School of Public Health

Alcohol Consumption and Cigarette Smoking by Australian Women: Changes with Pregnancy and Lactation

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Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

The work described in this thesis is the original work of the author and was undertaken solely by the author. The work of study design, ethics approval, writing of the thesis and published papers was undertaken with the primary supervision of Professor Colin W Binns. The data analysis was undertaken with supervision from Dr Helman Alfonso.

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Abstract

The consumption of alcohol and smoking of cigarettes are both common practices in Australian society. With continued public health efforts exposure to both alcohol and nicotine during pregnancy has diminished, however little is known about exposure to these toxins in the postnatal period and the effect on the breastfed infant.

To investigate the pattern of alcohol consumption and cigarette smoking in the postnatal period and the effect on breastfeeding outcomes, a longitudinal study was conducted in two public hospitals with maternity wards in Perth, Australia. Data for the Perth Infant Feeding Study (PIFSII) were collected from 587 mothers between mid-September 2002 and mid-July 2003. While in hospital participating mothers completed a self-administered baseline questionnaire. Follow-up telephone interviews were conducted at 4, 10, 16, 22, 32, 40 and 52 weeks. Data collected included sociodemographic, biomedical, hospital related and psychosocial factors. Further analysis of alcohol data was undertaken on the 1995 and 2001 National Health Survey (NHS) data sets to provide a national perspective.

Alcohol and smoking related data were analysed and described using frequency distributions, means and medians. Univariate logistic regression was used to screen for potentially significant variables for subsequent incorporation in the multivariate analysis. Multivariate logistic regression analysis was employed to determine the effect of alcohol consumption and cigarette smoking on breastfeeding outcomes prenatally, antenatally and postnatally, after adjusting for factors identified in the literature as being associated with breastfeeding initiation and duration. The relationship between smoking status and breastfeeding duration was determined using survival analysis. Analysis of the relationship between breastfeeding duration and the level of postpartum intake was investigated using a Cox hazards model with repeated measures for alcohol consumption.

Results showed that:

1. PIFSII. During pregnancy approximately 32% of women stopped drinking alcohol. Thirty five percent of pregnant women continued to consume alcohol during their pregnancy with 82.2% of these women consuming two or fewer standard drinks per week. At 4, 6 and 12 months postpartum, 46.7%, 47.4% and 42.3% of breastfeeding women were consuming alcohol, respectively.

2. NHS. Sixteen point four percent and 1.3% of pregnant women from the 1995 and 2001 NHS, respectively were consuming more than that recommended in 'Guideline 11' from the National Health and Medical Research Council of Australia (ie >7 standard drinks/week).

3. NHS. Thirteen percent of lactating mothers from the 1995 NHS and 16.8% from the 2001 NHS were consuming seven or more standard drinks of alcohol in the reference week, thus exceeding the NHMRC recommended level.

4. PIFSII. After 6 months of follow up, women who consumed alcohol at levels of more than two standard drinks per day were almost twice as likely to discontinue breastfeeding earlier than women who drank below these levels (HR 1.9, 95% CI 1.1, 3.0).

5. PIFSII. With regard to smoking, 226 (39%) of mothers reported smoking pre- pregnancy. Mothers who smoked were more likely to have a partner who smoked, to have consumed alcohol prior to pregnancy and less likely to attend antenatal classes. They were also less likely to know how they were going to feed their baby before conception and be more inclined to consider stopping breastfeeding before four months postpartum.

6. PIFSII. Women who smoked during pregnancy had a lower prevalence and shorter duration of breastfeeding than non-smoking mothers (28 weeks versus 11 weeks, 95% CI: 8.3-13.7). This effect remained even after adjustment for age, education, income, father's smoking status, mother's country of birth, intended duration of breastfeeding >6 months and birth weight (risk ratio HR 1.59, 95% CI 1.22 to 2.08).

7. PIFSII. Two hundred and twenty six (39%) mothers reported smoking prior to pregnancy and 77 (34%) of these stopped smoking during pregnancy. Quitting smoking during pregnancy was significantly associated with breastfeeding for longer than six months (OR = 3.70, 95% CI 1.55 to 8.83; $p<0.05$).

The results of the present study suggest a negative association between drinking alcohol in the postpartum period and breastfeeding outcomes. Similarly, smoking cigarettes before, during and after pregnancy negatively affects breastfeeding. There is a need for guidelines outlining the safe intake of alcohol during lactation and for the cessation of cigarette smoking in the prenatal and antenatal period.

Acknowledgments

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I dedicate this thesis to

Daniel

who is always unfailing in his

support

and

love.

List of included publications

Giglia R, Binns CW. 2006, Alcohol and lactation: a systematic review. *Nutrition & Dietetics* 2006, 63:103-116 (Impact Factor: *NA*)

This paper has been double-blind peer reviewed (see Appendix 7).

Giglia R, Binns CW. Patterns of alcohol intake of pregnant and lactating women in Perth, Australia. *Drug and Alcohol Review* 2007, 26:493-500.

(Impact Factor: *1.419/2006*)

Giglia R, Binns CW, Alfonso H, Scott J, Oddy W. The effect of alcohol intake on breastfeeding duration in Australian women. *Acta Paediatrica* 2008, 97:624-629.

(Impact Factor: *1.411/2008*)

Giglia R, Binns CW. Alcohol, pregnancy and breastfeeding; a comparison of the 1995 and 2001 National Health Survey data. *Breastfeeding Review* 2008, 16:17-24.

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All submissions are read by two or more reviewers (see Appendix 7).

Giglia R, Binns CW. Alcohol and breastfeeding: what do Australian mothers know? *Asia Pacific Journal of Clinical Nutrition*; 2007, 16 (Suppl 1): 473-477.

(Impact Factor: *1.483/2007*)

Giglia R, Binns CW, Alfonso H, Zhao Y. Which mothers smoke before, during and after pregnancy? *Public Health* 2007, 121:942-949.

(Impact Factor: *0.926/2007*)

Giglia R, Binns CW, Alfonso H. Maternal cigarette smoking and breastfeeding duration. *Acta Pædiatrica*; 2006, 95: 1370-1374.

(Impact Factor: *1.297/2007*)

Giglia R, Binns CW, Alfonso. Which women stop smoking during pregnancy and the effect on breastfeeding duration? *BMC Public Health;* 2006, 6:195

(Impact Factor: *1.603/2007*)

Conference Proceedings

Giglia R, Binns CW, Alfonso H, Zhao Y 2005, 'Which mothers smoke pre, during and post pregnancy?' The *Mark Liveris Health Sciences Research Student Seminar.* Division of Health Sciences, Curtin University of Technology. 10 November 2005, Perth, Western Australia.

Giglia R, Binns CW, Alfonso H 2006, 'Smoking during pregnancy and breastfeeding duration', *Dietitians Association of Australia, Western Australia Branch, Nutrition Symposium*. 8 September 2006, Perth, Western.[1ω]

Giglia R, Binns CW, Alfonso H 2006, 'Maternal alcohol intake: does it affect breastfeeding duration?' The Joint 8th IUNS International Symposium on Clinical Nutrition (8th ISCN) and 5th Asia-Pacific Clinical Nutrition Society (5th APCNS) Conference. 15 - 18 October 2006, Hangzhou, Zhejiang Province, China.

Giglia R, Binns CW, Alfonso H 2006, 'Maternal alcohol intake: does it affect breastfeeding duration?', The *Mark Liveris Health Sciences Research Student Seminar.* Division of Health Sciences, Curtin University of Technology. 6 November 2006, Perth, Western Australia.[ω]

Giglia R, Binns CW, 'Do Australian women drink during pregnancy and lactation?', The Joint 8th IUNS International Symposium on Clinical Nutrition (8th ISCN) and 5th Asia-Pacific Clinical Nutrition Society (5th APCNS) Conference. 15 - 18 October 2006, Hangzhou, Zhejiang Province, China.[2]

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[1] Winner, best oral presentation.
[ω] Oral presentation

[2] Winner, best poster.

Giglia R, Binns CW, ‘Alcohol and breastfeeding: what do Australian mothers know?’ The Joint 8th IUNS International Symposium on Clinical Nutrition (8th ISCN) and 5th Asia-Pacific Clinical Nutrition Society (5th APCNS) Conference. 15 – 18 October 2006, Hangzhou, Zhejiang Province, China.[ω]

Giglia R, Binns CW, Alfonso H. ‘What does smoking have to do with breastfeeding?’ Perth Epidemiology Group 4th Annual Scientific Meeting. 4 – 5 May 2007, Rottnest Island, Western Australia.[ω]

Giglia R, Binns CW, Alfonso, H, Scott JA, Oddy WH. ‘National Alcohol Guidelines; what direction for breastfeeding women?’ Public Health Association of Australia (WA Branch) State Conference. 31 October – 2 November 2007, Perth, Western Australia. [ω]

Giglia R, Binns CW. ‘Alcohol, pregnancy and breastfeeding;. What are Australian mothers doing?’ The 39th Conference of Asia-Pacific Academic Consortium for Public Health. 22 – 25 November 2007. Kagawa Nutrition University, Sakado-city, Saitama, Japan. [ω]

Giglia R, Binns CW. Alcohol intake during lactation. What are Australian women doing?’ 14th Conference of the International Society for Research in Human Milk and Lactation (ISRHML). 31 January-5 February 2008, The University of Western Australia, Perth, Australia. [ω]

[ω] Oral presentation

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Tables and Figures

Chapter 1 Introduction

1.1 Statement of the problem

1.1.1 Alcohol and breastfeeding

The benefit of breastfeeding for the infant and the mother are well known. For the infant these include nutritional, immunological and psychological benefits and exclusive breastfeeding for an extended period of time will provide the greatest gains for infant development, protection against childhood obesity and the prevention of chronic disease later in adult life (Arenz & von Kries 2005; Labbok, Clark & Goldman 2004; Leon-Cava 2002). Health benefits for the mother include lactation amenorrhea, maternal weight or fat loss, protection against premenopausal breast cancer and ovarian cancer, bone remineralisation to levels exceeding those present before lactation, and more optimal blood glucose profiles in women with gestational diabetes (Dobson & Murtaugh 2001; Labbok 2001).

The World Health Organization Expert Consultation recommends exclusive breastfeeding for 6 months before the introduction of complementary foods (World Health Organization 2001). It is recognised that it may not be possible for all mothers to maintain breastfeeding for this period however consuming an optimal diet during pregnancy and lactation will help support the desired outcomes of this recommendation for both the mother and the infant. Alcohol consumption by lactating mothers is not considered to be optimum nutrition as some of the alcohol consumed by a lactating woman is transferred to her milk and then consumed by her infant (Mennella 2001a). In addition alcohol also displaces valuable nutrients from the diet (National Health and Medical Research Council 2003a).

It is a long held belief across many countries and cultures that consuming alcohol during lactation may hold special virtues for the mother in that it can help the mother to relax, promote breastmilk production and aid in settling the infant (Mennella 2001a). To quote; “Tranquilizers help some mothers in letting down their milk despite disturbances in the hospital or at home; for most mothers, a mild alcoholic beverage will do the same trick" (Pryor 1973) (p32). Pryor then goes on to say that one famous obstetrician prescribes a small glass of wine for nursing mothers just before feeding time and that this has the double benefit of relaxing the mother and relieving discomfort (e.g. sore nipples, stitches, or cramps) which may hamper the let-down reflex (Pryor 1973). Contrary to these beliefs research shows that drinking alcohol during lactation can result in a decrease in breastmilk production (through its effect on oxytocin), disturbed sleep patterns and altered gross motor development (Little et al. 1989; Mennella & Garcia-Gomez 2001; Mennella, Pepino & Teff 2005).

Alcoholic beverages are widely consumed in Australia. The 2001 National Health Survey (Australian Bureau of Statistics 2003b) showed that 56.5% of women in the 18-44 year age group had consumed alcohol in the past week. Over 8% of women aged 18 years or more consumed alcohol at a level that created a health risk for them and many of these women were in the age group for pregnancy or for breastfeeding.

Overall alcohol provides 7% of energy in the Australian diet and as such is an important contributor to energy intake. If all other conditions of an individual remain relatively constant (e.g. energy intake, physical activity level) an increase in energy of 1-2% above requirements provides the basis for a gain in weight of 1-2kg per year. Given that alcohol is not considered a core food or essential to physiological functioning, consuming alcohol in addition to the everyday diet may contribute to incremental weight gain over time.

There have only been a limited number of studies on breastfeeding and alcohol consumption and none reported from Australia. Epidemiological studies in the United States of America (USA) have shown that breastfeeding mothers were less likely to smoke cigarettes or marijuana, but regular alcohol consumption at one month and three months postpartum did not differ from women who had never breastfed (Little, Lambert & Worthington-Roberts 1990b). Mennella (Mennella 1997) reports that lactating women who were either encouraged to drink or received no advice regarding alcohol intake drank significantly more than women who were advised not to drink. In a further study women were asked about the advice they received from health professionals on alcohol intake during lactation. Approximately 42% were advised to drink alcohol during lactation by a health professional (doctor, lactation consultant, midwife, nurse) to facilitate lactation and/or help their babies sleep better, 16.6% were discouraged from drinking, whereas the remaining were not given any advice at all about drinking (41.7%) (Mennella 2001b). This highlights the need for sound health education information to be provided by health professionals to women during lactation.

The provision of information and support to promote breastfeeding initiation and duration is well documented in the literature (Hector, King & Webb 2004). However the parallel promotion of safe alcohol consumption has not previously been included in health promotion programs promoting breastfeeding. This is most likely a result of the need for more directive and consistent national and international recommendations on alcohol intake during lactation.

The most recent Australian alcohol guidelines published by the National Health and Medical Research Council (National Health and Medical Research Council 2001) provide a guideline for alcohol consumption for pregnant, or soon to be pregnant women (Guideline 11). Added on to this guideline is some 'prudent' advice for lactating women not to exceed the levels of drinking recommended during pregnancy, and to consider not drinking at all. Guideline 11 states 'Women who are pregnant or might soon become pregnant (11.1) may consider not drinking at all; (11.2) most importantly, should never become intoxicated; (11.3) if they choose to drink, over a week, should have less than 7 standard drinks[3] (spread over at least two hours); should note that the risk is highest in the earlier stages of pregnancy, including the time from conception to the first missed period' (National Health and Medical Research Council 2001)(p. 16).

There is an additional comment to Guideline 11 that states; 'Alcohol in your bloodstream passes into the breast milk. There is little research evidence available

[3] 1 standard drink is equivalent to 10mg (12.5ml) of alcohol

about the effect of alcohol in breast milk on your baby. However, practitioners report that, even at relatively low levels of drinking, it may reduce the supply of milk and cause irritability, poor feeding and sleep disturbance in the infant.' (National Health and Medical Research Council 2001)(p.16).

The NHMRC Dietary Guidelines for Australian Adults do not address breastfeeding but refer to other international authorities who are more prescriptive for pregnant women and recommend 'total abstinence when pregnant or planning a pregnancy, as a precautionary principal' (Truswell 2003)(p163).

Internationally recommendations for alcohol intake during pregnancy and breastfeeding vary considerably and many countries only provide a recommendation for pregnancy. Among countries with policies on alcohol intake during pregnancy, those recommending complete abstinence include New Zealand, the Netherlands, Canada, and the United States (Health Canada October 1996; Health Council of the Netherlands 2005; Ministry of Health 2006; U.S. Department of Health and Human Services and U.S. Department of Agriculture 2005). Those countries whose recommendations allow for occasional drinking of low/moderate amounts during pregnancy include Denmark and the United Kingdom (UK) (Department of Health 2006; The Danish National Board of Health 2006).

There are few nations that provide a recommendation for alcohol intake during lactation. In New Zealand the Ministry of Health states "that during lactation alcohol be avoided during breastfeeding, particularly in the first month, when it is important for sound breastfeeding patterns to be established. However, if it is not possible for a woman to abstain from alcohol, they should be advised to limit themselves to one to two standard drinks[4] occasionally" (Ministry of Health 2006)(p77). Further to this is the recommendation to avoid exposing the baby to alcohol, by waiting until maternal blood alcohol level drops, allowing two to three hours to pass after drinking alcohol.

[4] 1 standard drink is equivalent to 10g alcohol

An infant needing to be fed during this time can be given expressed breast milk that is free from alcohol (Ministry of Health 2006).

The Health Council Netherlands explains that alcohol consumption may play a role after childbirth in an inability to properly stimulate or continue lactation and that mothers can avoid exposing the nursing child to ethanol by refraining from breastfeeding the infant or expressing milk for later feeding for a period of three hours immediately following the one standard measure of alcohol (one standard drink is equivalent to 10g alcohol). If a greater volume of alcohol is consumed then the period should be longer and can be calculated by multiplying the three-hour period by the number of standard measures of alcohol consumed (Health Council of the Netherlands 2005).

Similarly in Ontario, Canada, 'best start' advocate 'having an occasional alcoholic drink' as not harmful to a breastfed infant and scheduling occasional alcohol consumption around breastfeeding (best start Ontario's maternal newborn and early child development resource centre). This is not dissimilar from the UK Department of Health's advice which suggests keeping alcohol intake low, and avoiding drinking alcohol shortly before breastfeeding (Department of Health 2006).

The 2005 Dietary Guidelines for Americans are more simplistic in their approach and state that 'Alcoholic beverages should not be consumed by some individuals, including those who cannot restrict their alcohol intake, women of childbearing age who may become pregnant, pregnant and lactating women, children and adolescents, individuals taking medications that can interact with alcohol, and those with specific medical conditions' (U.S. Department of Health and Human Services and U.S. Department of Agriculture 2005)(p44).

Providing guidelines for safe drinking opportunities during lactation may prolong breastfeeding duration in some groups, however there is a dearth of information on safe levels of alcohol intake during breastfeeding. A literature search has not revealed any published papers on alcohol consumption during breastfeeding in Australia. By providing information on actual baseline levels of drinking and attitudes to drinking in this population it is possible to formulate relevant guidelines for consumption and develop health education materials based on this information.

1.1.2 Alcohol and pregnancy

Alcohol is a known teratogen responsible for fetal alcohol syndrome (FAS), a common cause of severe disability. Considerable research has been conducted into the effects of alcohol on the developing embryo and FAS has become recognised as the foremost preventable, nongenetic cause of intellectual impairment (New South Wales Department of Health (Ed.) 2006; O'Leary 2004). The literature regarding FAS will not be addressed in this thesis, but it is important to note that nationally and internationally there are already well documented recommendations to restrict or limit alcohol intake during pregnancy.

1.1.3 Smoking and breastfeeding

Nicotine is both water and lipid soluble, and distributes rapidly to and from breast milk. As maternal plasma nicotine concentration rises and falls, breast milk concentration rises and falls. The mean elimination half-life of nicotine in breastmilk is 95 minutes (Dempsey & Benowitz 2001).

Smoking during pregnancy is associated with an increased risk of adverse obstetric complications, including ectopic pregnancy, spontaneous abortion, pregnancy and labour complications, stillbirth, intrauterine growth retardation, low birth weight and sudden infant death syndrome (SIDS) (British Medical Association 2004; U.S. Department of Health and Human Services 2004).

Smoking in the postpartum period can impact on breastfeeding initiation and duration. Mothers who smoke are less likely to start breastfeeding their babies than non-smoking mothers, and tend to breastfeed for a shorter time (Antoniou et al.

2005; Clemens, Donath & Stockwell 2006; Dennis 2002; Giglia, Binns & Alfonso 2006; Haug et al. 1998; Horta, Kramer & Platt 2001; Lande et al. 2003; Scott & Binns 1998; Yang et al. 2004).

Research has found that in breastfeeding mothers who smoke, milk output is reduced and it is thought that nicotine inhibits breastmilk supply by suppressing prolactin levels (Vio, Salazar & Infante 1991). Despite a suggested physiological mechanism continued research fails to support this theory (Amir 2001; Amir & Donath 2002).

Exposure to environmental tobacco smoke (ETS) or passive smoking may also influence breastfeeding, with non-smoking women who are exposed to ETS stopping breastfeeding sooner than those who are not exposed (Horta et al. 1997).

1.1.4 Objectives of the study

1.1.4.1 Alcohol

- To determine levels of alcohol consumption of breastfeeding and non-breastfeeding mothers aged 18-44 years.
- To define the levels of ‘at risk’ drinking by non-breastfeeding, breastfeeding and pregnant mothers.
- To determine if alcohol intake during lactation affects breastfeeding duration.
- To determine if there is a difference in the breastfeeding practices of drinkers and non-drinkers of alcohol.
- To determine the attitudes of breastfeeding and non-breastfeeding mothers aged 18-44 years towards the consumption of alcohol during lactation.
- To determine if the introduction of solid foods to infants differs between breastfeeding and non-breastfeeding women who drink alcohol.
- To compare levels of alcohol consumption and attitudes towards the consumption of alcohol of mothers who are feeding infants using an infant formula with mothers who are breastfeeding.

- To document the level and type of information provided to lactating women by health professionals regarding alcohol intake and breastfeeding.

1.1.4.2 Smoking

- To investigate the predictive factors of maternal cigarette smoking.
- To examine cigarette smoking during pregnancy.
- To examine the relationship between cigarette smoking during lactation and breastfeeding duration.
- To investigate the factors influencing the ability to stop smoking during lactation.

1.1.5 Significance of the study

In this study a number of data sources will be brought together to document alcohol consumption and cigarette smoking in 18-44 year old women. This data will be related to pregnancy and breastfeeding and will include both cross-sectional and longitudinal data on alcohol intake, health behaviours (including smoking) and breastfeeding outcomes. This will enable alcohol intake and cigarette smoking over the period of lactation to be investigated with regard to breastfeeding outcomes. Additional investigations will then be undertaken to expand the available knowledge on alcohol consumption and the impact that consumption has on breastfeeding practice.

Concurrently, the investigation of cigarette smoking prenatally, antenatally and postnatally utilising the longitudinal data will enable health educators to tailor smoking cessation programs suitable for maternal uptake. In addition, this research will identify women least likely to quit smoking and the appropriate action for these women who also choose to breastfeed, as children of women who smoke have been found to be seven times more likely to develop respiratory illness if they are never breastfed compared to those who are breastfed (Woodward et al. 1990).

There is sound evidence that links breastfeeding and breastfeeding duration with improved health outcomes for infant health. In addition it is commonly recommended that alcohol should be avoided during pregnancy and breastfeeding. Despite this, a literature search to establish a sound basis for the latter recommendation has not revealed any published papers (on alcohol consumption during breastfeeding) in Australia. The need for research into alcohol and breastfeeding was highlighted in the NHMRC publication Australian Alcohol Guidelines: Health Risks and Benefits, where this topic was listed as a priority in Chapter 5 (NHMRC 2001). Through this research study a greater understanding of the levels of alcohol intake during lactation and its effect on this practice will be achieved, providing the basis for the development of alcohol consumption guidelines and supportive information and educational material for lactating women.

1.1.6 Limitations of the study

Alcohol intake will be recorded using standardised questions used for over a decade by the Australian Bureau of Statistics in previous National Health Surveys and National Nutrition Surveys (Australian Bureau of Statistics 1991).

A potential limitation with the data from the National Health Survey 2001 and the PIFSII is the possibility of underreporting alcohol consumption during lactation due to the stigma associated with this behaviour at such an important time in the lifecycle. It is acknowledged that this is a problem commonly associated with dietary surveys, and that on average, people underreport their consumption of food and beverages (Australian Bureau of Statistics 1998).

The questions used in the 2001 NHS and the PIFSII survey to elicit information on alcohol consumption are standard questions that have previously been used in the 1995 NHS and other Australian Bureau of Statistics surveys to report alcohol intake. Underreporting will be a limitation, however there is no other method available to use and these questions use standardised methodology that will indicate if women are drinking and the effects of alcohol on breastfeeding outcomes.

Questions used to illicit maternal smoking information were from the 1989/90 National Health Survey (Australian Bureau of Statistics 1991). Similar to matenal alcohol intake, it must be acknowledged that much of the data uses retrospective self-reporting of smoking. This method of data collection in the presence of an adverse outcome leads to underreporting of smoking during pregnancy and in the postpartum period, which in turn may lead to an under-estimation of the strength of association between maternal smoking during pregnancy and lactation, and the outcome under investigation, therefore the effects reported may be conservative (U.S. Department of Health and Human Services 2004).

1.2 Series of published papers

This thesis will be presented as a series of published papers. Each chapter is an original copy of the text from each published paper. An original reprint of each paper is provided in Appendix 1. The following outlines the list of papers and the objective/s of the study that the paper addresses.

1.2.1 Patterns of alcohol intake of pregnant and lactating women in Perth, Australia

Giglia RC and Binns CW. *Drug and Alcohol Review* 2007; 26: 493-500.

- To determine levels of alcohol consumption of breastfeeding and non-breastfeeding mothers aged 18-44 years.
- To define the levels of ‘at risk’ drinking by non-breastfeeding, breastfeeding and pregnant mothers.

1.2.2 The effect of alcohol intake on breastfeeding duration in Australian women

Giglia RC, Binns CW, Alfonso HS, Scott JA and Oddy WH. *Acta Paediatrica* 2008; 97:624-629

- To determine if alcohol intake during lactation affects breastfeeding duration.

- To determine if there is a difference in the breastfeeding practices of drinkers and non-drinkers of alcohol.

1.2.3 Alcohol, pregnancy and breastfeeding; a comparison of the 1995 and 2001 National Health Survey data

Giglia RC and Binns CW. *Breastfeeding Review* 2008, 16:17-24

- To determine levels of alcohol consumption of breastfeeding and non-breastfeeding mothers aged 18-44 years.
- To define the levels of 'at risk' drinking by non-breastfeeding, breastfeeding and pregnant mothers.

1.2.4 Alcohol and breastfeeding: what do Australian mothers know?

Giglia RC and Binns CW Alcohol and breastfeeding: what do Australian mothers know? *Asia Pacific Journal of Clinical Nutrition* 2007, 16 (Suppl 1):473-477

- To determine the attitudes of breastfeeding and non-breastfeeding mothers aged 18-44 years towards the consumption of alcohol during lactation.
- To document the level and type of information provided to lactating women by health professionals regarding alcohol intake and breastfeeding.

1.2.5 Which mothers smoke before, during and after pregnancy?

Giglia RC, Binns CW, Alfonso HS and Zao Y. *Public Health* 2007, 121:942-949.

- To investigate the predictive factors of maternal cigarette smoking.

1.2.6 Maternal cigarette smoking and breastfeeding duration

Giglia R, Binns CW and Alfonso H. *Acta Pædiatrica* 2006, 95: 1370-1374

- To examine the relationship between cigarette smoking during lactation and breastfeeding duration.

1.2.7 Which women stop smoking during pregnancy and the effect on breastfeeding duration?

Giglia RC, Binns CW and Alfonso HS. *BMC Public Health* 2006, 6:195

- To examine cigarette smoking during pregnancy.

References

Amir, LH 2001, 'Maternal smoking and reduced duration of breastfeeding: a review of possible mechanisms', *Early Hum Dev,* vol. 64, no. 1, pp. 45-67.

Amir, LH & Donath, SM 2002, 'Does maternal smoking have a negative physiological effect on breastfeeding? The epidemiological evidence', *Birth,* vol. 29, no. 2, pp. 112-23.

Antoniou, E, Daglas, M, Iatrakis, G, Kourounis, G & Greatsas, G 2005, 'Factors associated with initiation and duration of breastfeeding in Greece', *Clinical and Experimental Obstetrics and Gynecology,* vol. 32, no. 1, pp. 37-40.

Arenz, S & von Kries, R 2005, 'Protective effect of breastfeeding against obesity in childhood', *Advances in Experimental Medicine and Biology,* vol. 569, pp. 40-8.

Australian Bureau of Statistics 1991, *National Health Survey Questionnaire 1989-1990*, Canberra.

Australian Bureau of Statistics 1998, National Nutrition Survey: Nutrient intakes and physical measurements. Cat no. 4805.0., Commonwealth of Australia, Canberra.

Australian Bureau of Statistics 2003, *National Health Survey, Australia (2001), Basic Confidentialised Unit Record File*, Australian Bureau of Statistics, Canberra, Cat no. 4324.0.30.001.

best start Ontario's maternal newborn and early child development resource centre 2005, *Drinking alcohol while breastfeeding*, Motherisk. http://www.beststart.org/resources/alc_reduction/index.html

British Medical Association 2004, *Smoking and reproductive life: the impact of smoking on sexual, reproductive and child health*, BMA science and education department, British Medical Association and Tobacco Control Resource Centre, London.

Clemens, S, Donath, S & Stockwell, T 2006, *Alcohol consumption in Australia; national surveys from 1989 to 2001*, Curtin University of Technology, Perth.

Dempsey D & Benowitz N 2001, 'Risks and benefits of nicotine to aid smoking cessation in pregnancy', *Review Drug Safety,* vol. 24, pp. 277-322.

Dennis, CL 2002, 'Breastfeeding initiation and duration: a 1990-2000 literature review', *J Obstet Gynecol Neonatal Nurs,* vol. 31, no. 1, pp. 12-32.

Department of Health 2006, *The Pregnancy Book: 2006 Edition*, Department of Health, London.

http://www.dh.gov.uk/PublicationsAndStatistics/Publications/PublicationsPolicyAndGuidance/PublicationsPolicyAndGuidanceArticle/fs/en?CONTENT_ID=4136417&chk=saaOhH

Dobson, B & Murtaugh, M 2001, 'Position of the American Dietetic Association: Breaking the barriers to breastfeeding', *Journal of the American Dietetic Association,* vol. 101, no. 10, pp. 1213-20.

Giglia, R, Binns, C & Alfonso, H 2006, 'Maternal cigarette smoking and breastfeeding duration', *Acta Paediatrica,* vol. 95, pp. 1370-4.

Haug, K, Irgens, L, Baste, V, Markestad, T, Skjaerven, R & Schreuder, P 1998, 'Secular trends in breastfeeding and parental smoking', *Acta Paediatrica,* vol. 87, no. 1023-1027.

Health Canada October 1996, JOINT STATEMENT: Prevention of Fetal Alcohol Syndrome (FAS) Fetal Alcohol Effects (FAE) in Canada, Ottawa.

Health Council of the Netherlands 2005, *Risks of alcohol consumption related to conception, pregnancy and breastfeeding.*, Health Council of the Netherlands, The Hague.

Hector, D, King, L & Webb, K 2004, *Overview of recent reviews of interventions to promote and support breastfeeding*, NSW Centre for Public Health Nutrition and NSW Department of Health, Sydney. http://www.cphn.biochem.usyd.edu.au/resources/OverviewBreastfeeding.pdf.

Horta, BL, Kramer, MS & Platt, RW 2001, 'Maternal smoking and the risk of early weaning: a meta-analysis', *Am J Public Health,* vol. 91, no. 2, pp. 304-7.

Horta, BL, Victora, CG, Menezes, AM & Barros, FC 1997, 'Environmental tobacco smoke and breastfeeding duration.' *American Journal of Epidemiology,* vol. 146, pp. 128-33.

Labbok, M 2001, 'Effects of breastfeeding on the mother', *Pediatric Clinics of North America,* vol. 48, no. 1, pp. 143-58.

Labbok, M, Clark, D & Goldman, A 2004, 'Breastfeeding: maintaining an irreplaceable immunological resource', *Nature Reviews. Immunology,* vol. 4, pp. 565-72.

Lande, B, Andersen, L, Baeug, A, Trygg, K, Lund-Larsen, K, Veierød, M & Bjørneboe, G 2003, 'Infant feeding practices and associated factors in the first six months of life: The Norwegian Infant Nutrition Survey', *Acta Paediatrica,* vol. 92, pp. 152-61.

Leon-Cava, N 2002, *Quantifying the benefits of breastfeeding: A summary of the evidence*, Pan American Health Organisation, Washington D C. http://www.aed.org/ToolsandPublications/upload/quantifyingbenefits.pdf.

Little, R, Anderson, K, Ervin, C, Worthington-Roberts, B & Clarren, S 1989, 'Maternal alcohol use during breast-feeding and infant mental and motor development at one year', *N Engl J Med,* vol. 321, pp. 425-30.

Little, RE, Lambert, MD & Worthington-Roberts, B 1990, 'Drinking and smoking at 3 months postpartum by lactation history', *Paediatr Perinat Epidemiol,* vol. 4, no. 3, pp. 290-302.

Mennella, J 1997, 'Infant's suckling responses to the flavor of alcohol in mothers' milk', *Alcoholism: Clinical and Experimental Research,* vol. 21, no. 4, pp. 581-5.

Mennella, J 2001a, 'Alcohol's effect on lactation', *Alcohol Research and Health,* vol. 25, no. 3, pp. 230-4.

Mennella, J 2001b, 'Regulation of milk intake after exposure to alcohol in mother's milk', *Alcoholism: Clinical and Experimental Research,* vol. 25, no. 4, pp. 590-3.

Mennella, J & Garcia-Gomez, P 2001, 'Sleep disturbances after acute exposure to alcohol in mother's milk', *Alcohol,* vol. 25, pp. 153-8.

Mennella, J, Pepino, M & Teff, K 2005, 'Acute alcohol consumption disrupts the hormonal milieu of lactating women', *The Journal of Clinical Endocrinology and Metabolism,* vol. 90, no. 4, pp. 1979-85.

Ministry of Health 2006, *Food and Nutrition Guidelines for Healthy Pregnant and Breastfeeding Women: A background paper*, Ministry of Health, Wellington. http://www.moh.govt.nz/moh.nsf/by+unid/F4F10903136588EFCC25716200123030?Open.

National Health and Medical Research Council 2001, *Australian Alcohol Guidelines: Health Risks and Benefits*, National Health and Medical Research Council, Canberra.

National Health and Medical Research Council 2003, *Dietary Guidelines for Australian Adults*, Commonwealth of Australia, Canberra.

New South Wales Department of Health (Ed.) 2006, Background papers to the National clinical guidelines for the management of drug use during pregnancy, birth and the early development years of the newborn., NSW Department of Health, Sydney.

NHMRC 2001, Australian Alcohol Guidelines: Health Risks and Benefits, Canberra.

O'Leary, C 2004, 'Fetal alcohol syndrome: Diagnosis, epidemiology, and developmental outcomes', *Journal of Paediatrics and Child Health,* vol. 40, pp. 2-7.

Pryor, K 1973, *Nursing your baby*, Harper and Row, New York.

Scott, J & Binns, C 1998, 'Factors associated with the initiation and duration of breastfeeding: a review of the literature', *Australian Journal of Nutrition and Dietetics,* vol. 55, pp. 51-61.

The Danish National Board of Health 2006, *Public Health/ The National Centre for Health Promotion and Prevention*, Denmark. http://www.sst.dk

Truswell, AS 2003, 'Limit your alcohol intake if you choose to drink', in National Health and Medical Research Council (ed.), *Food for Health: Dietary Guidelines for Australian Adults*, NHMRC, Canberra.

U.S. Department of Health and Human Services 2004, *The Health Consequences of Smoking: A Report of the Surgeon General*, U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, Atlanta.

U.S. Department of Health and Human Services and U.S. Department of Agriculture 2005, *Dietary Guidelines for Americans, 2005,* 6th edn, U.S. Government Printing Office, Washington, DC.

Vio, F, Salazar, G & Infante, C 1991, 'Smoking during pregnancy and lactation and its effects on breast-milk volume', *The American Journal of Clinical Nutrition,* vol. 54, pp. 1011-6.

Woodward, A, Douglas, R, Graham, N & Miles, H 1990, 'Acute respiratory illness in Adelaide children: breast feeding modifies the effect of passive smoking', *Journal of Epidemiology and Community Health,* vol. 44, no. 224-230.

World Health Organization 2001, The optimal duration of exclusive breastfeeding. Report of an expert consultation, WHO, Geneva.

Yang, Q, Wen, S, Dubois, L, Chen, Y, Walker, M & Krewski, D 2004, 'Determinants of breast-feeding and weaning in Alberta, Canada', *Journal of Obstetrics and Gyanecology Canada,* vol. 26, no. 11, pp. 975-81.

Chapter 2 Literature Review

Alcohol and Lactation: A Comprehensive Review

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Abstract

The aim of this paper is to critically review the current literature on the effect of alcohol intake during lactation on the hormonal control of lactogenesis; breastmilk and infant blood alcohol concentration; and on the breastfeeding infant. The databases PubMed, CINAHL, Proquest Health and Medical Complete, ScienceDirect and ISI Web of Knowledge were searched for articles published between 1990–2005.

We found limited research investigating the effect of alcohol intake on the infants of lactating women, with most being conducted using animal models. Results consistently show a decrease in lactational performance in both animal and human studies of alcohol intake and breastfeeding. Alcohol intake by lactating mothers in amounts recommended as 'safe' for non-lactating women, may have a negative effect on infant development and behaviour.

Clear guidelines for alcohol consumption are required for lactating women and health professionals to guide breastfeeding mothers to make educated choices regarding alcohol intake during this critical period of infant development.

Keywords: Breastfeeding, lactation, alcohol

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2.1 Introduction

Breastfeeding is the safest and best method for nurturing and optimising infant growth and health. In 2001 the World Health Organisation (WHO) Expert Consultation recommended exclusive breastfeeding for six months, with continued breastfeeding until two years of age together with complementary foods, a position now adopted in Australia (National Health and Medical Research Council 2003a; World Health Organization 2001). Alcohol is an important part of most human societies and mothers need advice on its use during lactation. The term ‘alcohol’ describes a series of organic chemical compounds, however only one type, ethyl alcohol or ethanol, is found in significant quantities in drinks intended for human consumption.

Alcoholic beverages are a source of great enjoyment in many societies, but alcohol problems are an important public health concern (National Health and Medical Research Council 2001). Considerable research has been conducted into the effects of alcohol on the developing embryo and fetal alcohol syndrome (FAS) has become recognised as the foremost preventable, nongenetic cause of intellectual impairment (O'Leary 2004). The literature regarding FAS will not be addressed in this paper, but it is important to note that there are well documented recommendations to restrict or limit alcohol intake during pregnancy (National Academy of Sciences 1990; National Health and Medical Research Council 2001). Many studies report a reduced maternal alcohol intake during pregnancy and a return to prepregnancy levels, or at least higher intakes than during pregnancy, shortly following birth (Little, Lambert & Worthington-Roberts 1990a; Mennella & Gerrish 1998; O'Connor, Brill & Sigman 1986).

A report from the United States Institute of Medicine National Academy of Sciences (National Academy of Sciences 1991) concluded that alcohol consumption by lactating women in excess of 0.5 g/kg of maternal weight may be harmful to the infant, partly because of a potential reduction in milk volume. Without giving specific recommendations, the American Academy of Pediatrics, stated that alcohol intake is ‘compatible with breastfeeding’. However the following effects are noted on the infant; ‘with large amounts, drowsiness, diaphoresis, deep sleep, weakness, decrease in linear growth, abnormal weight gain; and maternal ingestion of 1g/kg daily decreases milk ejection reflex’ (p780) (American Academy of Pediatrics 2001).

The Health Council of the Netherlands states in their most recent report that alcohol use during breastfeeding has adverse effects on the infant. The Council recommends that mothers who have consumed a standard measure (10g ethanol) of an alcoholic beverage can avoid exposing the nursing child to ethanol by abstaining from breastfeeding for a period of three hours from when the alcohol was consumed or using expressed milk. If the mother has consumed a higher amount, the Council suggests the period until the next breastfeed should be longer, and can be calculated by multiplying the three hour period by the number of standard measures of alcohol consumed (Health Council of the Netherlands 2005).

The United States Department of Health and Human Services recommends that on the basis of alcohol being transferred into the breast milk, alcohol intake should be limited to protect the health of the mother and infant (U.S. Department of Health and Human Services 2000).

The most recent Australian alcohol guidelines published by the NHMRC (National Health and Medical Research Council 2001) provide a guideline for alcohol consumption for pregnant, or soon to be pregnant women (Guideline 11).

Guideline 11 states ‘Women who are pregnant or might soon become pregnant (11.1) may consider not drinking at all; (11.2) most importantly, should never become intoxicated; (11.3) if they choose to drink, over a week, should have less than 7 standard drinks (spread over at least two hours); should note that the risk is highest in the earlier stages of pregnancy, including the time from conception to the first missed period.’ (p 16).

An appendage to this guideline is some 'prudent' advice for lactating women not to exceed the levels of drinking recommended during pregnancy, and to consider not drinking at all.

The aim of this paper is to review the literature on the physiological process and hormonal control of lactogenesis, the milk ejection reflex ('let down'), and the effect of alcohol on these processes in both the short term and long term. These three questions will be addressed:

1. What is the effect of alcohol intake on the hormonal control of lactogenesis?

2. What effect do blood alcohol levels have on the breastmilk concentration of alcohol and subsequent infant blood alcohol levels?

3. What is the effect of alcohol intake on the breastfeeding infant?

2.2 Methods

A systematic literature review was conducted using the electronic databases PubMed, CINAHL, Proquest Health and Medical Complete, ScienceDirect and ISI Web of Knowledge from 1990–2005. The search terms 'breastfeeding', 'breast feeding', 'breastmilk', 'breast milk', 'lactation', 'alcohol', and 'ethanol'. The search was limited to English language journals.

The US Department of Health and Human Services (US Department of Health and Human Services, National Institutes of Health & National Institute of Alcohol Abuse and Alcoholism 2004) defines a standard drink as containing approximately 14 grams (about 0.6 fluid ounces) of pure alcohol. The Australian National Health and Medical Research Council (NHMRC) (National Health and Medical Research Council 2001) standard drink contains 10 grams (12.5 millilitres) of alcohol. All references to alcohol volumes in this paper have been converted to Australian standard drink equivalents (unless stated otherwise).

References used in this paper (at first use) have been classified using the NHMRC guide, ‘How to use the evidence: assessment and application of scientific evidence’ (National Health and Medical Research Council 2000) (see Table 2.2.1). While originally developed for clinical guidelines, the guidelines can be used in public health assessments recognising that in research on maternal and infant alcohol intakes, ethical restraints on human experimentation limit the types of research that can be undertaken. In this review paper expert consensus statements and evidence from experimental studies with animals and/or cells that may provide valuable adjunct information and are given a rating of Level V.

2.2.1 NHMRC levels of evidence

	NHMRC Level of evidence
I	Evidence obtained from a systematic review of all relevant randomised controlled trials.
II	Evidence obtained from at least one properly designed randomised controlled trial.
II-1	Evidence obtained from well-designed pseudo-randomised controlled trials (alternate allocation or some other method).
III-2	Evidence obtained from comparative studies (including systematic reviews of such studies) with concurrent controls and allocation not randomised, cohort studies, case-control studies, or interrupted time series with a control group.
III-3	Evidence obtained from comparative studies with historical control, two or more single arm studies, or interrupted time series without a parallel control group.
IV	Evidence obtained from case series, either post-test or pretest/post-test.
V	Evidence provided by expert consensus statements, experimental animal and cell studies.

Source (National Health and Medical Research Council 2000)

2.3 The physiology of lactation

2.3.1 Lactogenesis

Specialised glands that secrete breastmilk are already present at birth. However it is not until puberty that they develop further and during pregnancy they become fully functional. The development of these mammary glands and the initiation of milk secretion from the numerous alveoli containing the milk secreting cells within the gland are regulated by hormonal control. The commencement of this secretory differentiation during pregnancy is referred to as 'lactogenesis stage I'. However the gland will remain inactive until activated hormonally, initiating 'lactogenesis stage II,' the onset of milk secretion occurring during the first four days postpartum (Neville & Morton 2001).

The most important hormones for the initiation and maintenance of lactation are prolactin and oxytocin. Prolactin levels rise throughout pregnancy controlling the final development of the mammary gland secretory mechanism. At the same time high levels of placental progesterone prevent the prolactin from initiating lactation. It is not until the baby is born and the placenta delivered that levels of progesterone fall allowing prolactin to exert its effects on the mammary tissue and initiating stage II of lactogenesis (Neifert, McDonough & Neville 1981).

Once lactation has been established, prolactin is also essential for the maintenance of lactation. In response to the infant's suckling, prolactin is released from the anterior pituitary gland and enables the mammary gland to produce milk before the next feed. Oxytocin, also released in response to the suckling stimulus, promotes the milk ejection reflex and emptying of the breast, however it is the actual removal of milk from the breasts, in a constant favourable hormonal environment, which controls milk production (Akre 1989; Peaker & Wilde 1996). The lactating mammary gland exercises a local feedback inhibitory control over milk synthesis, autocrine control, based on a supply=demand feedback loop of control. The frequency or completeness of milk removal from the breast regulates the rate of milk secretion and there does not appear to be a direct relationship between prolactin and milk yield as the autocrine control ‘downregulates’ milk synthesis to match the mother’s supply of milk to the infant’s appetite (National Health and Medical Research Council 2003b).

2.3.2 Milk ejection reflex

The ‘milk ejection reflex’ or ‘milk let down’ is responsible for expelling the milk from the alveoli into small ducts leading to the nipple. It is under the hormonal control of oxytocin, which is secreted into the blood stream from the posterior pituitary gland (Clement, Glasier & McNeilly 1992). Like prolactin, oxytocin is released in response to suckling or other stimuli (e.g. hearing the baby cry) and ensures effective emptying of the breast by the infant (Mennella 2001a; Neville 2001). Ultrasound imaging of milk ejection indicates that infant milk intake is positively related to the number of milk ejections (Ramsay et al. 2004).

2.4 The effect of alcohol on the mother

2.4.1 Maternal blood alcohol concentration

Alcohol enters breastmilk by passive diffusion and reflects levels in maternal blood within 30 to 60 minutes after ingestion (Kesaniemi 1974; Lawton 1985; Mennella & Beauchamp 1993). (Evidence level Lawton; Kesaniemi – NHMRC IV; Evidence level Mennella & Beauchamp – NHMRC III-1) Factors that influence the blood alcohol concentration (BAC) of the mother include body weight, amount of adipose tissue, stomach contents at the time of alcohol ingestion, rate at which alcohol beverages are consumed, and the amount and strength of alcohol in the drink (National Institute on Alcohol Abuse and Alcoholism 1990). (Evidence level – NHMRC V, expert authority)

Ho and colleagues (Ho et al. 2001) (Evidence level – NHMRC V, experimental) developed a nomogram (Table 2.4.1) to guide lactating women who drink alcohol on how to avoid exposure of their infant to ethanol through breastmilk. Taking into account Total Body Water (TBW), BAC and body weight, the average maximal elimination rate of 15mg/dl/h (V_{max} x V_d) was used. Time is calculated from the beginning of drinking, alcohol metabolism is assumed constant at 15mg/dl, height of the woman is 162.56cm and one drink is a standard Australian drink serve of 10g of alcohol. At the end of each time period it is proposed that the alcohol content of the milk will be zero.

2.4.1. Alcohol and breastfeeding: time (h:min) until the zero level in milk is reached for women at different body weights

Maternal Weight	Number of standard drinks								
kg	1	2	3	4	5	6	7	8	9	10
45	1:54	3:50	5:45	7:40	9:36	11:31	13:27	15:22		
47	1:52	3:44	5:37	7:29	9:22	11:14	13:07	14:59		
50	1:51	3:43	5:35	7:27	9:18	11:11	13:03	14:54	16:52	
52	1:48	3:37	5:26	7:15	9:05	10:53	12:42	14:31	16:47	
54	1:46	3:32	5:19	7:05	8:52	10:38	12:25	14:11	16:21	
57	1:45	3:31	5:17	7:02	8:48	10:34	12:20	14:05	15:58	
59	1:42	3:26	5:09	6:52	8:36	10:19	12:02	13:45	15:52	
61	1:40	3:21	5:02	6:43	8:24	10:05	11:46	13:28	15:29	16:50
63	1:38	3:17	4:56	6:34	8:13	9:52	11:30	13:10	15:09	16:27
66	1:37	3:15	4:53	6:31	8:10	9:48	11:26	13:04	14:48	16:20
68	1:35	3:12	4:47	6:24	8:00	9:36	11:12	12:48	14:42	16:00
70	1:33	3:07	4:41	6:15	7:50	9:24	10:57	12:31	14:24	15:40

Adapted from (Ho et al. 2001)

2.4.2 Effect of alcohol on lactogenesis and lactational performance

2.4.2.1 Milk ejection reflex

In many parts of the world folklore suggests that women should drink alcohol (particularly beer) to enhance breastmilk supply and promote breastfeeding success. For example in Germany women drink malt beer. In Mexico women are encouraged to drink a local plant fermented juice called pulque daily during pregnancy and lactation, and Indochinese women in California drink wine steeped in herbs to promote successful lactation (Mennella 2001a). (Evidence level – NHMRC V, review) However it seems the evidence to support this enhanced effect of any source of alcohol on breastfeeding is limited and unsupported (Mennella & Beauchamp 1993).

The effect of alcohol in suppressing lactation through its effect on oxytocin was first identified in early studies in rats and later humans (Cobo 1973; Fuchs 1969). (Evidence level Fuchs – NHMRC V, animal study; Cobo - NHMRCII) In a study of 40 women Cobo found that ethanol blocks the release of oxytocin and that the degree of inhibition is dose dependent with ethanol doses between 0.5 to 2g/kg body weight (Cobo 1973). (NOTE 1g per kg is six standard drinks for a 60kg woman and results in a blood alcohol level of 0.15 if consumed in one hour).

Cobo postulates that it is possible that doses higher than 2g/kg (equivalent to approximately 12 standard drinks) in a 60kg woman could completely inhibit the suckling induced oxytocin release in humans. This is a central effect of ethanol as the mammary gland response to exogenous oxytocin was not changed by ethanol. On the basis of comparative studies both Fuchs and Subramanian suggest an inhibitory dose of 1.1 to 1.5g/kg ethanol for women (Cobo 1973; Fuchs 1969; Subramanian 1999). (Evidence level Fuchs; Subramanian – NHMRC V, animal study)

Beer in quantities ranging from 800ml to one litre, has been shown to increase serum prolactin secretion in normal men and nonlactating women as beer is reported to have different effects as a galactagogue, unlike ethanol alone (Carlson, Wasser & Reidelberger 1985; DeRosa et al. 1981). (Evidence level Carlson, Wasser and Reidelberger – NHMRC IV; DeRosa et al – NHMRC IV) However it has been demonstrated in both human and animal studies that the effect of alcohol regardless of the source (e.g. beer) is at the posterior pituitary, through the effect of oxytocin on milk ejection from the mammary gland in response to suckling, rather than prolactin levels, which are responsible for milk biosynthesis (Heil & Subramanian 2000; Mennella & Beauchamp 1993; Mennella, Pepino & Teff 2005; Subramanian 1999). (Evidence level Heil and Subramanian – NHMRC V, animal study; Mennella, Pepino and Teff – NHMRC II)

2.4.2.2 Lactational performance

Lactational performance has been shown to decrease in both animal and human studies of alcohol intake and breastfeeding. Animal model research demonstrates a graded inverse response between alcohol intake and milk yield in alcohol treated dams (Heil & Subramanian 2000; Murillo-Fuentes et al. 2001; Subramanian 1999; Tavares do Carmo et al. 1999). (Evidence level Tavares do Carmo et al – NHMRC V, animal study; Murillo-Fuentes et al. – NHMRC V, animal study)

Using a within-subjects study design where lactating women are tested with or without alcohol, on two days separated by one week, Mennella and colleagues have consistently shown a diminished milk yield in response to alcohol consumption in lactating mothers (Mennella 1998, 2001b; Mennella & Beauchamp 1991, 1993; Mennella, Pepino & Teff 2005). (Evidence level Mennella and Beauchamp 1991 – NHMRC III-1; Mennella 1998 – NHMRC III-1)

2.5 Effect of alcohol on breastfeeding initiation and duration

Howard and Lawrence (Howard & Lawrence 1998) present data on drug use during pregnancy and breastfeeding from the United States 1988 National Maternal and Infant Health Survey (NMIHS) (Evidence level – NHMRC V, review article)[5]. Drinking alcohol more than six times per week was equally associated with breast or formula feeding, whereas consuming less than six drinks per week doubled the likelihood of a mother breastfeeding. Early cessation of breastfeeding was most often reported by women with the highest frequency of all drinking patterns, including binge drinking, at three months postpartum than women who were still breastfeeding, even after preconception habits were taken into account.

A study by Little, Lambert and Worthington-Roberts (Little, Lambert & Worthington-Roberts 1990a) (Evidence level – NHMRC III-2) investigated the relationship between levels of maternal smoking and drinking of 463 women at preconception, during pregnancy, and in the postpartum period. Approximately 80% reported drinking some alcohol in the month before conception, with alcohol use dropping after conception, and only 40% of subjects reporting drinking in the last trimester. After delivery, drinking rose and by the end of the third month postpartum, 69% of the total sample reported some drinking however not to the level reported at preconception. Breastfeeding at three months postpartum was generally associated with less drinking, especially less binge drinking.

In this study (Little, Lambert & Worthington-Roberts 1990a) differences in smoking and drinking habits by lactation history cannot be attributed to differences in age, education, race, marital status, employment outside the home or parity, as these were accounted for in the analysis. These results provide support for a recommendation to reduce or eliminate alcohol intake during lactation, which would help foster the mindset of abstinence that appears to be so easily maintained during pregnancy. By

[5] The data analysis presented on the NMIHS is part of this review paper.

preparing women for a continued abstinence of alcohol following pregnancy women may be more inclined and mentally prepared to maintain this behaviour throughout lactation thus possibly promoting prolonged breastfeeding duration.

2.5.1 Key articles evidence table; the effect of alcohol on the mother

NHMRC Level	Reference	Key findings
Effect on blood alcohol		
IV	Kesaniemi (1974)	Ethanol reaches human milk in almost the same concentration as in the blood at 30 minutes after administration.
IV	Lawton (1985)	Alcohol appeared in both fore- and hind- breastmilk at a level equivalent to or higher than the corresponding blood samples within an hour.
Effect on lactational performance		
V Animal study (rat)	Fuchs (1969)	Lactating dams alcohol intake • 1.0g/kg body weight – no effect on milk removal. • 2.0g/kg body weight – significant reduction on milk removal. • >2.0g/kg/body weight further reductions in milk yield. • 5g/kg/body weight – complete inhibition of the milk ejection reflex. Ethanol inhibits oxytocin release in the rat.
II	Cobo (1973)	Maternal alcohol intake of • <0.5g/kg body weight - no effect on milk ejection reflex. • 0.5 – 1g/kg body weight – varying individual effect from no effect to complete block of milk ejection reflex. • 1.5 – 2g/kg body weight – decreased milk ejection reflex (average decrease 80%). • >2g/kg body weight – complete inhibition of the milk ejection reflex.
III-1	Mennella and Beauchamp (1991)	Maternal alcohol intake of 0.3g/kg body weight (in orange juice) decreases milk intake in infants and is proposed to be a result of a decrease in the milk ejection reflex.[6]

[6] This amount of alcohol approximates the ethanol content of approximately 1.5 standard drinks.

III-1	Mennella and Beauchamp (1993)	Maternal alcohol intake of 0.3g/kg body weight (in beer) decreases milk intake in infants and is proposed to be a result of a decrease in the milk ejection reflex.
III-1	Mennella (1998)	Maternal alcohol intake of 0.3g/kg body weight (in orange juice) resulted in decreased expressed breastmilk yield.
V Animal study (rat)	Subramanian (1999)	Alcohol administration in lactating dams (1.0g/kg body weight and 2.0g/kg body weight) inhibited the suckling induced oxytocin release. All pups from alcohol treated dams had reduced milk intakes.
V Animal study (rat)	Tavares Do Carmo et al. (1999)	Lactating dams alcohol intake. • alcohol treated, 20% ethanol diluted in drinking water and food ad lib – decreased milk yield lower than pair fed. • pair fed, nutritional control receiving a solid diet per day and per 100g body weight to give an equivalent daily caloric intake as the alcohol rats – decreased milk yield.
V Animal study (rat)	Heil and Subramanian (2000)	Alcohol administration in lactating dams (1.0g/kg body weight and 2.0g/kg body weight). Pups of the 2.0g/kg groups reduced milk intakes despite elevated suckling induced prolactin release suggesting alcohol's primary impact is through oxytocin.
V Animal study (rat)	Murillo-Fuentes et al. (2001)	Three experimental nutritional treatments with ethanol concentration increasing 5% each week over a four week period starting at 5% week one. Pups exposed to ethanol during gestation only 1. Pups exposed to ethanol during lactation only 2. Pups exposed to ethanol only during lactation All alcohol exposed pups had decreased milk intake compared to controls.
III-1	Mennella (2001b)	Maternal alcohol intake of 0.3g/kg body weight (in orange juice). Infants consumed approximately 20% less breastmilk compared with control conditions. Compensatory intake was observed during the period 8 to 16 hours after exposure when mothers refrained from drinking alcohol.

II	Mennella, Pepino and Teff (2005)	Maternal alcohol intake of 0.4g/kg body weight (in orange juice) decreased oxytocin levels and increased prolactin levels. The result was a decrease in milk yield and milk ejection.
Effect on breastfeeding initiation and duration		
Review article	Howard and Lawrence (1998)	US 1998 NMIHS. Women who drink less than six alcohol drinks per week almost twice as likely to choose breastfeeding (OR 1.9; $P<0.05$). Women who weaned early reported the highest frequency of all drinking patterns, and more likely to report binge drinking (RR = 4.1: 99%-CI 1.72, 9.62), at three months postpartum than women who were still nursing. Women who never breastfed tended to be intermediate or more like nursing women.
III-2	Little, Lambert and Worthington-Roberts (1990)	Investigated levels of maternal drinking and smoking (n=463) women pre, during and post pregnancy. Women breastfeeding at three months postpartum reported less drinking, and less binge drinking than women who never breastfed or breastfed for less than one month.

2.6 The effect of alcohol on the infant

2.6.1 Infant alcohol absorption

Ethanol is a water soluble nonpolar compound that easily passes through biological membranes to be distributed proportionally throughout the water compartments of the body. The average water content of breastmilk is 87.5% and that of blood is 85%. For this reason it is expected that the ethanol concentration at equilibrium would be slightly higher in breastmilk (Lawton 1985).

The rate of absorption and elimination of alcohol in the breastmilk, and level attained in the baby's blood through extrapolation from maternal blood alcohol levels, was investigated by Lawton (Lawton 1985). Eight mothers consumed amounts of alcohol between 0.56g/kg body weight and 1.5g/kg/body weight. With moderate to high intakes, alcohol levels were higher in breastmilk than in blood. At lower alcohol intakes, blood and milk alcohol levels were similar. The rate of elimination of alcohol from breastmilk and blood were similar. The level of alcohol in breastmilk falls as blood alcohol levels fall because retrograde diffusion of alcohol from the milk back to the blood stream occurs. Any alcohol present in milk stored in the breast returns to the blood supply to maintain equilibrium during elimination, regardless of emptying the breasts (Kesaniemi 1974; Lawton 1985).

Using the baby of 'subject one' from the Lawton study (Lawton 1985) as an example, the maximum blood alcohol value of the baby can be calculated. This baby was six months old and weighed 6.5kg. This is equivalent to the 5th percentile for boys and the 25th percentile for girls. During the experiment it consumed 180ml breastmilk while the mother was near her maximum blood alcohol level (119mg alcohol/dl blood). Thus the baby would have consumed 245mg of alcohol (37mg/kg body weight). However taking into consideration the body water content of approximately 0.60g/kg of body weight then the blood alcohol level would rise to approximately 6mg alcohol/dl blood (Lawton 1985).

2.6.2 *Maternal alcohol intake and infant development*

For ethical reasons there are limited human intervention studies on the effect of alcohol on the behavioural state of infants, however observational studies provide some information in this area. Most research has been done using small amounts of alcohol consumed by the mother and the subsequent behavioural effect on the infant is then evaluated.

A case report by Binkiewicz, Robinson and Senior (Binkiewicz, Robinson & Senior 1978) (Evidence level – NHMRC V, case report) documents the effect of chronic excessive alcohol intake by a breastfeeding mother on her four month old baby. A random sample of expressed breastmilk contained 100mg/dl of alcohol and her reported intake was approximately 10 Australian standard alcoholic drinks per day, over a one week period.

Symptoms evident in the infant at four months were an increased weight gain and a simultaneous slowing in rate of growth. Her length for age was below the third percentile, she was obese, and her facial appearance was ‘balloon shaped’. Alcohol increases cortisol levels in the blood and can give rise to a clinical pattern that closely resembles Cushing syndrome. Confirmation of the condition was established by impaired suppressibility of cortisol secretion by dexamethasone and increased excretion of cortisol in the urine. With no other problems she was eventually diagnosed with Pseudo-Cushing Syndrome, subsequently reversed with the removal of alcohol from the mother’s diet.

In a landmark epidemiological study by Little et al (Little et al. 1989) (Evidence level – NHMRC III-2) 400 infants were investigated to determine the relationship between mother’s use of alcohol during breastfeeding and the infant’s development at one year of age. The Bayley Mental Development Index (MDI) was used to measure mental development and the Psychomotor Development Index (PDI) measured motor development. There was a strong inverse linear relationship between chronic exposure to ethanol in breastmilk and the PDI. At a clinical level the motor effect was small (4-5% decrease in test scores) with moderate alcohol intake of 1.4 to

2.8 standard Australian drinks per day. In the small number of infants whose mothers were heavy drinkers (≥8.4 standard Australian drinks) there was a 15% decrease in PDI test scores. At a population level these effects could have a considerable impact on community vitality and development. The association persisted even after controlling for over 100 potentially confounding variables (including maternal tobacco, marijuana, and heavy caffeine use). No relation was apparent between the infant's exposure to ethanol and the MDI.

With the intake of six Australian standard drinks by a 60kg lactating mother, in one sitting, the ingestion of ethanol through the breastmilk is estimated (using the Kesaniemi method) (Kesaniemi 1974) to be 232mg in a 5 kg infant and can be harmful (Little et al. 1989). Little et al (Little et al. 1989) propose that the ethanol is detrimental possibly because the developing brain is extremely sensitive to ethanol even in very small quantities; or the small quantities ingested during lactation are accumulated in the infant because it is metabolised or excreted more slowly than in adults. The authors suggest that serial doses of ethanol accumulate in the infant as supported by the association between an 'absolute alcohol' score (representing the average daily exposure that could accumulate in the infant) and the PDI found in this study. There was no significant association between the infant's exposure to maternal binges during lactation (which would be less likely to result in an accumulation of ethanol in the infant) and the PDI.

Lawton suggests that occasional exposure of a six month, 6.5kg infant to 245mg of alcohol (119 mg/dl in mother's blood resulting 37mg/kg body weight in the infant) is unlikely to have an affect even after taking into account the body water content and low alcohol dehydrogenase activity of the infant (Lawton 1985).

Kesaniemi (Kesaniemi 1974) concurs with Lawton (Lawton 1985) as to the level of maternal alcohol intake suggested not to cause harm to the infant. Kesaniemi states that mothers receiving approximately 0.6g/kg body weight ethanol orally would result in maternal blood and milk ethanol levels of 18.2 +/- 2.5umol/ml (83.7mg/dl blood) and 16.9 +/- 2.5umol/ml, respectively. At these levels a 5kg infant receiving 200ml of milk would receive about 180mg ethanol or about 36mg/kg body weight, which Kesaniemi states is 'unlikely to have harmful effects on the infant' (p.84) (Kesaniemi 1974). However both studies used small numbers of women and the alcohol was given very rapidly after fasting conditions.

Despite Lawton and Kesaniemi stating that these levels would not effect the infant, it should be noted that these levels are higher than in many of the studies found to inhibit the milk ejection reflex (Cobo 1973; Mennella 1998, 2001b; Mennella & Beauchamp 1991, 1993) (Evidence level Mennella 2001b – NHMRC III-1), higher than the level at which motor development in the infant was affected (Little et al. 1989), and higher than that recommended by the Institute of Medicine (National Academy of Sciences 1991). (Evidence level – NHMRC V, expert authority)

2.6.3 Maternal alcohol intake and infant (feeding and sleeping) behaviour

The effect of alcohol flavoured expressed breastmilk and unaltered breastmilk on the suckling response of infants was tested. The milk was bottle fed to infants on demand and the pattern of suckling, the amount of milk consumed, and the suckling responses were recorded (Mennella 1997). (Evidence level – NHMRC IV) The alcohol flavoured breastmilk contained 32mg ethanol/100ml, the average concentration detected in human milk approximately one hour after lactating women drank an acute dose of 0.3g/kg alcohol

Results showed that infants consumed significantly more and sucked more frequently when drinking the alcohol flavoured milk. This is inconsistent with the diminished intake by infants of breastmilk immediately following mother's exposure to alcohol as reported previously (Mennella 2001b; Mennella & Beauchamp 1991, 1993), however in this study infants were able to bottle feed on demand and may have been stimulated by the sweet flavour of the ethanol in the milk to consume and suck more. This study indicates that infants can readily detect flavours in breastmilk and show a distinct preference for the alcohol flavoured milk over and above the unaltered milk.

Using a within-subject study design described previously(Mennella & Beauchamp 1991), Mennella (Mennella 2001b) demonstrated a compensatory increase in the number of demand breastfeedings by infants that occurred post exposure to alcohol. Consistent with previous findings (Mennella & Beauchamp 1991, 1993) the infants consumed approximately 20% less breastmilk during the first four hours after exposure to alcohol in mother's milk and then compensated for this diminished intake during the eight to 12 hours by increasing the number of breastfeedings that occurred in this time.

Mennella and Beauchamp (Mennella & Beauchamp 1991) tested the effect of alcohol ingestion by lactating women, on the odour of breastmilk and the subsequent behaviour of the infant. The ingestion of alcohol (0.3g/kg body weight; equivalent to 1.5 Australian standard drinks) significantly altered the odour of breastmilk as perceived by a panel of adults. Results demonstrated that the infants sucked significantly more frequently during the first few minutes of an alcohol-exposed breastfeed, and slept for shorter periods and more often, on the day when their mothers consumed alcohol.

Because of the common folklore belief that maternal alcohol consumption can promote sleep in breastfeeding infants Mennella and Gerrish (Mennella & Gerrish 1998) (Evidence level – NHMRC III-1) further tested the effect of exposure to alcohol in breastmilk on infants' sleep and activity levels in the short term. Exposure to alcohol through expressed breastmilk (32mg/100ml) resulted in definite changes in infant's sleep-wake patterning. All infants slept for the same number of times during each test session however there was a significant reduction in the length of time spent sleeping after they consumed the alcohol flavoured milk compared with the breastmilk alone. The reduction in sleep was attributable to a shortening in the longest sleeping bout and the amount of time spent in active sleep. There was no significant difference in the amount of time spent in active sleep during the first half of the 3.5 hour testing session, however infants spent significantly less time in active sleep during the second half of the testing session (i.e. 1.75 to 3.5 hours) following alcohol exposure. There was no significant difference in the number of times the infants breastfed or the amount of milk consumed during these breastfeeds after alcohol exposure.

These results build on previous findings (Mennella & Beauchamp 1991) in which exposure to alcohol in breastmilk altered the infants' sleep-wake patterning such that the infants slept for shorter periods but more often during the day when exposed to alcohol.

To determine if these effects on infant sleep behaviour were a result of the experience to the flavour of the breastmilk the authors repeated the study on another group of breastfed infants using non-alcohol based vanilla in place of alcohol (Mennella & Gerrish 1998). However results show there was no significant difference in the amount of time the infants spent in active sleep during the 3.5 hours testing session in which they ingested their mothers breastmilk flavoured with vanilla compared with breastmilk alone. Nor were there significant differences in the number of sleeping bouts, amount of time spent in quiet or total sleep, latency to sleep, longest sleep bout, or activity levels during wakefulness after exposure to the vanilla flavoured milk. This suggests that it is not the flavour per se that is responsible for the disruptions in the sleep-wake patterning exhibited after alcohol exposure in breastmilk.

Mennella and Garcia-Gomez (Mennella & Garcia-Gomez 2001) (Evidence level – NHMRC III-1) repeated the alcohol and sleep patterning study by Mennell and Gerrish (1998), with the exception of extending the monitoring period to 24 hours.

During the first half of the centre 3.5 hour testing session there was no significant difference in the amount of time spent in active sleep. However during the second half of this session (1.75 – 3.5 hours) infants exposed to alcohol in mother's milk spent less time in active sleep, compared to the control condition. Infants then compensated for such decreases in the following 20.5 hours when mothers refrained from drinking alcohol, by exhibiting an increase in active sleep.

Mothers were unaware of changes in their infants' behaviour following exposure to alcohol and it is likely that the decrease in active sleep would go unnoticed as infants tended to fall asleep immediately following alcohol exposure but then woke up shortly afterwards resulting in a decrease in the amount of time spent in active sleep in the hours immediately following exposure to alcohol in mother's milk.

Together these studies (Mennella & Beauchamp 1991; Mennella & Garcia-Gomez 2001; Mennella & Gerrish 1998) demonstrate that exposure to small amounts of alcohol in the mothers' milk has a direct, although subtle effect, on infant sleep patterning and the infants' ability to modulate behaviours in response to acute ethanol exposure. The mechanism for this effect on sleep patterning (Mennella & Beauchamp 1991; Mennella & Garcia-Gomez 2001; Mennella & Gerrish 1998) remains to be explained, however Mennella and Gerrish (Mennella & Gerrish 1998) propose based on their results and that of others (Ioffe & Chernick 1990; Little et al. 1989) that the slight deficit identified in the motor development of the children exposed to chronic alcohol intake may be a result of continued disruption of active sleep subsequent to regular alcohol intake. (Evidence level Ioffe and Chernick – NHMRC III-2)

Animal model studies and experimental studies in humans suggest that pre- and postnatal experiences with the smell and taste of ethanol can affect later responsiveness to ethanol. Breastfed infants (six to 13 months old) exposed to ethanol (determined from questionnaires about maternal and paternal alcoholism and alcohol intake) exhibited different behaviours in the presence of ethanol scented toys compared with less exposed infants. Exposed infants demonstrated increased 'mouthing' of the scented toy (Mennella & Beauchamp 1998). (Evidence level – NHMRC IV) Whether mouthing the flavour scented toy indicates familiarity with the flavour of ethanol, which in turn leads to a greater willingness to accept ethanol-flavoured substances remains to be investigated.

2.6.4 Growth indices

For ethical reasons animal studies are the only way to determine the long term effect of alcohol intake on infant development, body weight and metabolism.

The effects of maternal alcohol intake in lactating dams on the development of their offspring were studied using a rat model by Detering et al (Detering et al. 1979). (Evidence level – NHMRC V, animal study) Results from the study conclusively show that those pups whose dams received ethanol during either the pre- and postnatal period or only in the postnatal period had retarded physical growth that was more severe than that observed as a result of simple malnutrition.

These results are supported in a study by Vilaro et al (Vilaro et al. 1987) (Evidence level – NHMRC V, animal study) in which the pups of alcohol treated dams demonstrate a significant reduction in combined weight compared to control pups. This decrease is associated with reduced milk production in the alcohol fed dams despite their milk having a higher energy content due to a greater lipid concentration.

In a later study the physical activities, physical growth and the histological appearance of the cerebellum control pups nursed by non-alcohol consuming dams were compared with pups nursed by alcohol-consuming dams (Hekmatpanah, Haghighat & Adams 1994). (Evidence level – NHMRC V, animal study) Pups exposed to alcohol opened their eyes several days after pups in the control groups and had a lower average litter weight and brain weight that was evident until alcohol was removed from the diet. These degenerative changes were independent of the pups' weight. This study highlights the considerable growth and developmental problems occurring in pups as a result of alcohol intake in the lactating dams and the potential similar harm that could take place in humans with continued alcohol intake during lactation.

Lactational performance, brain and liver composition, circulating metabolites, plasma nutrients and metabolites were investigated in pups fed by ethanol treated lactating dams (Tavares do Carmo et al. 1999). The dams in the alcohol treated group had a decreased milk yield that was associated with a decreased collective weight gain of their pups. These pups also exhibited a decreased brain weight and brain protein.

The amount of DNA indirectly reflects the number of cells and when expressed as DNA per total brain weight the alcohol exposed pups had reduced values, possibly indicating a lower number of brain cells. This was also apparent in the liver of the alcohol exposed pups, who also experienced a lower liver weight, lower liver protein and liver glycogen concentration than the control pups.

It is proposed that these lower levels of protein and glycogen are metabolic adaptations in response to the malnutrition being experienced by the alcohol exposed pups. It is known that the lipid content increases in the milk of alcohol treated rats (Vilaro et al. 1987). This high lipid content partially compensates for the alcohol induced malnutrition occurring in the alcohol exposed pups and allows the proper metabolic adaptations to prevent severe hypoglycaemia and maintain minimum liver stores of glycogen. However these adaptations are not enough to protect against impaired brain development, evident in the alcohol exposed pups (Tavares do Carmo et al. 1999).

These results are supported in a later study by Oyama et al (Oyama et al. 2000) (Evidence level – NHMRC V, animal study) who found that pups suckled by alcohol lactating dams (5%, 10% and 20% ethanol) had significantly lower body weights compared to controls. However only pups of lactating dams exposed to higher alcohol levels experienced a significant decrease in brain weight suggesting a preservation of the pups' brain or a profound reduction in overall body growth as possible hypotheses for the difference between alcohol groups.

Liver weight of the 5% and 10% alcohol exposed pups was significantly decreased. ATP-citrate lyase activity is indicative of liver lipogenesis and affected by the composition of the diet. Similar to previous results (Tavares do Carmo et al. 1999) all alcohol exposed pups experienced a decrease in liver weight, and there was a decrease in ATP-citrate lyase activity which could be related to an increased milk lipid content in the alcohol treated rats (Vilaro et al. 1987).

Results from this study indicate that the effects of maternal alcohol intake on pups' development and metabolism are dose-dependent and although the low intake of ethanol (5%) did not have an effect on brain or liver weight it did have an effect on brain metabolism.

The phenomenon of insulin resistance has more recently been an area of investigation with regard to alcohol intake during lactation. In a study by Chen and Nyomba (Chen & Nyomba 2004) (Evidence level – NHMRC V, animal study) maternal alcohol consumption during lactation and its effect on glucose homeostasis in rat pups was investigated. Results demonstrate that the offspring of rats exposed to alcohol during lactation exhibit insulin resistance regardless of having normal birth weight and growth pattern. Despite a lack of clarity in determining the mechanism for this effect, the study highlights the importance of lactation as a vulnerable period for the future metabolic homeostasis of the infant.

2.6.1 Key articles evidence table; the effect of alcohol on the infant

NHMRC Level	Reference	Key findings
Effect on infant alcohol absorption		
III-1	Mennella and Beauchamp (1993)	Estimated by multiplying the milk intake by the concentration of ethanol detected in breastmilk and taking into account infant body weight. Estimated dose ranged from 2.3 to 8.4mg/kg which is approximately 0.8 to 2.8% of the maternal dose (0.3g/kg body weight).
Effect on infant development		
Case Study	Binkiewicz et al (1978)	Long term high level alcohol intake causes Pseudo-Cushing syndrome in an infant, subsequently reversed with alcohol withdrawal.
III-2	Little et al. (1989)	Maternal alcohol intake of approx. 0.8g/kg body weight has detrimental effect on infant motor development.
Effect on infant (feeding and sleeping) behaviour		
III-1	Mennella and Beauchamp (1991)	Maternal alcohol intake of 0.3g/kg body weight (in orange juice). Infants initially sucked more frequently when mothers had consumed alcohol ($P<0.008$). No significant difference between the total number of sucks on the two days of testing (control vs. alcohol: 856.7 +/- 103.4 vs. 877.2 +/- 102.3). The number of times the infants slept increased on the days when the mother consumed alcohol (6.6 +/-0.7 vs. 7.8 +/- 0.9, paired t (11df) = 2.31, $P<0.05$).
IV	Mennella (1997)	Infants consumed significantly more and sucked more frequently when drinking alcohol flavoured breastmilk compared with unaltered breastmilk.
III-1	Mennella and Gerrish (1998)	Infants bottle fed mother's milk alone (control condition) on one test day and mother's milk containing 32mg of ethanol per 100ml on the other and sleep and activity patterning monitored for next 3.5 hours using an actigraph. Alcohol ingested by the infants was estimated to range from 4.0 to 6.41mg/kg (mean 5.24 +/- 0.2), which is similar to what would be experienced at the breast after the consumption of 0.3g/kg dose by the mother. All infants slept for the same number of times during each test session however there was a significant reduction in the length of time spent sleeping after they consumed the alcohol flavoured milk compared with

		the breastmilk alone (on average a 25% reduction; 78.2 minutes compared with 56.8minutes after feeding with alcohol in breastmilk). There was no significant difference in the amount of time spent in active sleep during the first half of the 3.5 hour testing session (control vs. alcohol 18.2 +/- 3.8 vs. 17.0 +/- 4.2 minutes; *P* =0.84), however infants spent significantly less time in active sleep during the second half of the testing session (i.e. 1.75 to 3.5 hours) following alcohol exposure (control vs. alcohol, 25.2 +/- 5.5 vs. 8.6 +/- 2.6 minutes; *P* = 0.09).
III-1	Mennella and Garcia-Gomez (2001)	Study design as previous (Mennella & Gerrish 1998) with testing time extended to 24 hours. During the first half of the centre 3.5 hour testing session there was no significant difference in the amount of time spent in active sleep. During the second half of this session (1.75 – 3.5 hours) infants exposed to alcohol in mother's milk spent less time in active sleep, compared to the control condition. Infants exposed to alcohol then compensated for such decreases in the following 20.5 hours when mothers refrained from drinking alcohol, by exhibiting a 22.4 +/- 7.0% increase in active sleep.
III-1	Mennella (2001b)	Maternal alcohol intake of 0.3g/kg body weight (in orange juice). For the following four hours infants were videotaped during breastfeeding and were weighed immediately before and after each feeding. Infants demonstrated a compensatory increase in the number of demand breastfeedings.
Effect of alcohol on growth indices		
V Animal study (rat)	Deterring et al (1979)	Dams were fed a regular stock diet (control), liquid diet containing 35% of the energy as ethanol (50g/L resulting in a blood alcohol level of 61±6mg%), or a liquid diet containing dextrin substituted for the calories supplied by ethanol (isoenergetic=IE). Pups whose dams received ethanol during either the pre- and postnatal period or only in the postnatal period had retarded physical growth that was more severe than that observed as a result of simple malnutrition (the IE diet alone).
V Animal study (rat)	Hekmatpanah, Haghighat and Adams (1994)	Four groups of lactating dams. (I) control with limited food, (II) receiving 5% alcohol and limited food, (III) receiving 10% alcohol and limited food, (IV) control with unlimited food. Pups exposed to alcohol opened their eyes several days after pups in control groups and had a

		lower average litter weight and brain weight independent of malnutrition. Myelin formation and the appearance of the Purkinje cells[7] was delayed and failed to be as prolific as that of the controls at day 30.
V Animal study (rat)	Tavares do Carmo et al (1999)	Three groups of lactating dams (I) alcohol treated, received 20% ethanol and food ad lib (AL); (II) pair fed, as a nutritional control received an equivalent daily caloric intake as group I (PF); (III) control rats received a solid diet and tap water ad lib (C). The AL pups had a decreased collective weight gain. The brain weight was significantly reduced in the AL and PF animals (P<0.05) compared to the C group and the brain protein content was decreased in AL pups compared to the other two groups (P<0.05). When corrected for body weight (g/100g body weight), the brain was heavier in the AL and PF litters than in the controls. The amount of DNA indirectly reflects the number of cells and when expressed as DNA per total brain weight the AL pups had lower values than those of the C or PF pups (P<0.05), possibly indicating a lower number of brain cells. This was also apparent in the liver of the AL pups with the total amount of DNA per liver being significantly (P<0.05) lower in the pups of both the AL and PF dams, suggesting that the liver of these animals had less cells than the C group despite the cell size being the same. The AL and PF pups had a lower liver weight (P<0.05), a lower liver protein (P<0.05) and liver glycogen (P<0.05) concentration than the control pups.
V Animal study (rat)	Vilaro et al (1987)	Ethanol treated dams received ethanol diluted in drinking water with ethanol concentration increasing 5% each week over a four week period starting at 10% week one. Pups of alcohol treated dams demonstrate a significant reduction in combined weight compared to control pups.
V Animal study (rat)	Heil and Subramanian (2000)	Lactating dams alcohol intake of 1.0kg/kg body weight and 2.0kg/kg body weight. Pups of the 2.0g/kg groups exhibit lower body weights.

[7] A specific type of nerve cell that carries each and every piece of information outputted by the cerebellum. These cells possess a great deal of control over the refinement of motor activities.

V Animal Study (rat)	Oyama et al (2000)	Pups suckled by alcohol treated lactating dams (5%, 10%, 20% ethanol solution groups) had significantly lower body weights compared to controls (*P*<0.05). Only pups of lactating dams exposed to higher alcohol levels (10% and 20%) experienced a significant decrease in brain weight (*P*<0.05). Liver weight of the 5% and 10% alcohol exposed pups was significantly decreased (*P*<0.05). The ingestion of the 5% ethanol solution by the dams decreased pups' brain lipogenesis rate from glucose.
V Animal Study (rat)	Chen Nyomba (2004)	Offspring of rats exposed to alcohol (36%) during lactation exhibit insulin resistance regardless of having normal birth weight and growth pattern.

2.7 Conclusion

Alcohol is almost ubiquitous in Australian society and is commonly consumed, even during lactation. The evidence available to give advice to lactating mothers is less than ideal and must rely on a combination of experiments, observational studies and animal data. The evidence supporting severe limitations on the consumption of alcohol during pregnancy is abundant (O'Leary 2004) and robust guidelines outlining recommendations for alcohol intake during this time are well documented (National Health and Medical Research Council 2001). However there is a paucity of scientific information about the effect during lactation making it harder to give definitive recommendations.

In animal and human studies alcohol has been shown to disrupt the hormonal control of lactation by decreasing the milk ejection reflex through the inhibition of oxytocin. Doses as low as 0.3g/kg/body weight (equivalent to 1.5 standard Australian drinks) have been reported to have an inhibitory effect with a subsequent decrease in milk intake by infants. Most often undetected, this decrease in intake with regular low level alcohol consumption over an extended period of time will contribute to a significant decrease in milk intake and a resulting decline in infant body weight, growth and other vital developmental indices.

Ethanol is water soluble and enters the breastmilk by passive diffusion, reflecting maternal blood levels (or higher) within 30 – 60 minutes. Further evidence suggests this dose may be rendered more potent due to the limited activity of alcohol dehydrogenase in infants. There is an absence of information reporting the effect of breastmilk alcohol concentrations on infant blood alcohol levels.

Despite the popular folklore belief that consuming alcohol when breastfeeding (Mennella 2002) will promote lactation, and relax the infant and mother, the available research provides evidence to the contrary. Exposure to small amounts of alcohol in the mothers' milk has a direct effect on infant sleep patterning resulting in significantly less time spent in active sleep immediately after exposure to alcohol in breastmilk. It is important for mothers to establish sound breastfeeding patterns in the first month and if a mother has a restless baby (as most are in the first few weeks) the introduction of alcohol may exacerbate this restlessness, prompting her to discontinue breastfeeding at this critical time. The authors advise nursing mothers to restrict all alcohol intake during this first month in an effort to provide the most optimal environment to support continued breastfeeding.

Based on the available evidence the authors suggest the prudent use of alcohol and strongly recommend lactating mothers consume only one to two standard drinks after breastfeeding. Advice restricting alcohol consumption during the first month of breastfeeding and providing direction on levels of consumption and timing of intake will enable lactating women to consume alcohol in quantities and conditions conducive to the optimal development of their young infant while supporting successful breastfeeding.

Box 1. Suggested Advice for Alcohol Intake of Breastfeeding Mothers

1. No alcohol in the first month.
2. After that – limit alcohol intake.
    a. Preferable 1 – 2 standard drinks per day
    b. Drinking just after a breastfeeding
3. If wanting to drink more than (2) then expressing milk in advance and skipping one feed may be an option to consider.

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References

Akre, J 1989, 'Infant feeding: the physiological basis', *Bulletin of the World Health Organization,* vol. 67, no. Suppl, pp. 1-108.

American Academy of Pediatrics 2001, 'The transfer of drugs and other chemicals into human milk', *Pediatrics,* vol. 108, no. 3, pp. 776-89.

Binkiewicz, A, Robinson, M & Senior, B 1978, 'Pseudo-Cushing syndrome caused by alcohol in breast milk', *Journal of Pediatrics,* vol. 93, pp. 965-7.

Carlson, HE, Wasser, HL & Reidelberger, RD 1985, 'Beer-induced prolactin secretion: A clinical and laboratory study of the role of salsolinol', *Journal of Clinical Endocrinology and Metabolism,* vol. 60, no. 4, pp. 673-7.

Chen, L & Nyomba, B 2004, 'Whole body insulin resistance in rat offspring of mothers consuming alcohol during pregnancy or lactation: comparing prenatal and postnatal exposure', *Journal of Applied Physiology,* vol. 96, pp. 167-72.

Clement, C, Glasier, A & McNeilly, A 1992, 'Endocrine control of lactation', in MF Picciano & B Lonnerdal (eds), *Mechanisms regulating lactation and infant nutrient utilization*, vol. 15, Wiley-Liss, New York, pp. 34-42.

Cobo, E 1973, 'Effect of different doses of ethanol on the milk-ejecting reflex in lactating women', *American Journal of Obstetrics and Gynecololgy,* vol. 115, no. 6, pp. 817-21.

DeRosa, G, Corsello, SM, Ruffilli, MP, Della Casa, S & Pasargiklian, E 1981, 'Prolactin secretion after beer', *The Lancet,* vol. 2, p. 934.

Detering, N, Reed, W, Ozand, P & Karahasan, A 1979, 'The effects of maternal ethanol consumption in the rat on the development of their offspring', *Journal of Nutrition,* vol. 109, pp. 999-1009.

Fuchs, A 1969, 'Ethanol and the inhibition of oxytocin release in lactating rats', *Acta Endocrinologica,* vol. 62, pp. 546-54.

Health Council of the Netherlands 2005, *Risks of alcohol consumption related to conception, pregnancy and breastfeeding.*, Health Council of the Netherlands, The Hague.

Heil, S & Subramanian, M 2000, 'Chronic alcohol exposure and lactation. Extended observations', *Alcohol,* vol. 21, pp. 127-32.

Hekmatpanah, J, Haghighat, N & Adams, C 1994, 'Alcohol consumption by nursing rats and its effect on the cerebellum of the offspring', *Alcohol an Alcoholism,* vol. 29, no. 5, pp. 535-47.

Ho, E, Collantes, A, Kapur, B, Moretti, M & G, K 2001, 'Alcohol and breast feeding: calculation of time to zero level in milk', *Biology of the Neonate,* vol. 80, pp. 219-22.

Howard, C & Lawrence, R 1998, 'Breast-feeding and drug exposure', *Obstetrics and Gynecology Clinics of North America,* vol. 25, no. 1, pp. 195-217.

Ioffe, S & Chernick, V 1990, 'Prediction of subsequent motor and mental retardation in newborn infants exposed to alcohol in utero by computerized EEG analysis', *Neuropediatrics,* vol. 21, pp. 11-7.

Kesaniemi, YA 1974, 'Ethanol and acetaledhyde in the milk and peripheral blood of lactating women after ethanol administration', *The Journal of Obstetrics and Gynaecology,* vol. 81, no. January, pp. 84-6.

Lawton, M 1985, 'Alcohol in breastmilk', Australian and New Zealand Journal of Obstetrics and Gynaecology, vol. 25, pp. 71-3.

Little, R, Anderson, K, Ervin, C, Worthington-Roberts, B & Clarren, S 1989, 'Maternal alcohol use during breast-feeding and infant mental and motor development at one year', *N Engl J Med,* vol. 321, pp. 425-30.

Little, R, Lambert, M & Worthington-Roberts, B 1990, 'Drinking and smoking at 3 months postpartum by lactation history', *Paediatric and Perinatal Epidemiology,* vol. 4, pp. 290-302.

Mennella, J 1997, 'Infant's suckling responses to the flavor of alcohol in mothers' milk', *Alcoholism: Clinical and Experimental Research,* vol. 21, no. 4, pp. 581-5.

Mennella, J 1998, 'Short-term effects of maternal alcohol consumption on lactational performance', *Alcoholism: Clinical and Experimental Research,* vol. 22, no. 7, pp. 1389-92.

Mennella, J 2001a, 'Alcohol's effect on lactation', *Alcohol Research and Health,* vol. 25, no. 3, pp. 230-4.

Mennella, J 2001b, 'Regulation of milk intake after exposure to alcohol in mother's milk', *Alcoholism: Clinical and Experimental Research,* vol. 25, no. 4, pp. 590-3.

Mennella, J 2002, 'Alcohol use during lactation: The folklore versus the science', in K Auerbach (ed.), *Current issues in clinical lactation.*, Jones and Bartlett, Boston, pp. 3 - 10.

Mennella, J & Beauchamp, G 1991, 'The transfer of alcohol to human milk', *New England Journal of Medicine,* vol. 325, pp. 981-5.

Mennella, J & Beauchamp, G 1993, 'Beer, breast feeding and folklore', *Developmental Psychobiology,* vol. 26, no. 8, pp. 459-66.

Mennella, J & Beauchamp, G 1998, 'Infant's exploration of scented toys: effects of prior experiences', *Chemical Senses,* vol. 23, no. 11, pp. 11-7.

Mennella, J & Garcia-Gomez, P 2001, 'Sleep disturbances after acute exposure to alcohol in mother's milk', *Alcohol,* vol. 25, pp. 153-8.

Mennella, J & Gerrish, C 1998, 'Effects of exposure to alcohol in mother's milk on infant sleep', *Pediatrics,* vol. 101, no. 2 March 2004, pp. e21-e5 .

Mennella, J, Pepino, M & Teff, K 2005, 'Acute alcohol consumption disrupts the hormonal milieu of lactating women', *The Journal of Clinical Endocrinology and Metabolism,* vol. 90, no. 4, pp. 1979-85.

Murillo-Fuentes, L, Artillo, R, Carreras, O & Murillo, L 2001, 'Effects of maternal chronic alcohol administration in the rat: lactation performance and pup's growth', *European Journal of Nutrition,* vol. 40, pp. 147-54.

National Academy of Sciences 1990, Nutrition during pregnancy. Part I: Weight Gain, Part II: Nutrient Supplements, National Academy Press, Washington, D.C.

National Academy of Sciences 1991, Nutrition During Lactation. Report of the Subcommittee on Nutrition During Lactation of the Committee on Nutritional Status during Pregnancy and Lactation, National Academy Press, Washington, D.C.

National Health and Medical Research Council 2000, *How to use the evidence: assessment and application of scientific evidence*, National Health and Medical Research Council, Canberra.

National Health and Medical Research Council 2001, *Australian Alcohol Guidelines: Health Risks and Benefits*, National Health and Medical Research Council, Canberra.

National Health and Medical Research Council 2003a, *Dietary Guidelines for Australian Adults*, Commonwealth of Australia, Canberra.

National Health and Medical Research Council 2003b, *Dietary Guidelines for Children and Adolescents in Australia*, Commonwealth of Australia, Canberra.

National Institute on Alcohol Abuse and Alcoholism 1990, *Alcohol and women*, National Institute on Alcohol Abuse and Alcoholism (NIAAA), Bethesda. http://pubs.niaaa.nih.gov/publications/aa10.htm

Neifert, MR, McDonough, SL & Neville, MC 1981, 'Failure of lactogenesis associated with placental retention', *American Journal of Obstetrics and Gynecology,* vol. 15, pp. 477-8.

Neville, MC 2001, 'Anatomy and physiology of lactation', *Pediatr Clin North Am,* vol. 48, no. 1, pp. 13-34.

Neville, MC & Morton, J 2001, 'Physiology and endocrine changes underlying human lactogenesis II', *Journal of Nutrition,* vol. 131, pp. 3005S-8S.

O'Connor, M, Brill, N & Sigman, M 1986, 'Alcohol use in primiparous women older than 30 years of age: relation to infant development', *Pediatrics,* vol. 78, no. 3, pp. 444-50.

O'Leary, C 2004, 'Fetal alcohol syndrome: Diagnosis, epidemiology, and developmental outcomes', *Journal of Paediatrics and Child Health,* vol. 40, pp. 2-7.

Oyama, L, Couto, R, Damaso, A & Oller do Nascimento, C 2000, 'Ethanol intake during lactation II. Effects on pups' liver and brain metabolism', *Alcohol,* vol. 21, pp. 201-6.

Peaker, M & Wilde, CJ 1996, 'Feedback control of milk secretion from milk', *Journal of Mammary Gland Biology and Neoplasia,* vol. 1, no. 3, pp. 307-15.

Ramsay, DT, Kent, JC, Owens, RA & Hartmann, PE 2004, 'Ultrasound imaging of milk ejection in the breast of lactating women', *Pedatrics,* vol. 113, no. 2, pp. 361- 7.

Subramanian, M 1999, 'Alcohol inhibits suckling-induced oxytocin release in the lactating rat', *Alcohol,* vol. 19, no. 1, pp. 51-5.

Tavares do Carmo, M, Oller do Nascimento, C, Martin, A & Herrera, E 1999, 'Ethanol intake during lactation impairs milk production in rats and affects growth and metabolism of suckling pups', *Alcohol,* vol. 18, no. 1, pp. 71-6.

U.S. Department of Health and Human Services 2000, *HHS Blueprint for Action on Breastfeeding*, U.S. Department of Health and Human Services, Office on Women's Health, Washington, D.C.

US Department of Health and Human Services, National Institutes of Health & National Institute of Alcohol Abuse and Alcoholism 2004, *Helping Patients with Alcohol Problems. A Health Practitioner's Guide*, National Institute of Alcohol Abuse and Alcoholism, Bethesda, February 2004. http://www.niaaa.nih.gov/publications/Practitioner/HelpingPatients.htm#introduction

Vilaro, S, Vinas, O, Remesar, X & Herrera, E 1987, 'Effects of chronic ethanol consumption on lactational performance in rat: mammary gland and milk composition and pups' growth and metabolism', *Pharmacology Biochemistry and Behaviour,* vol. 27, pp. 333-9.

World Health Organization 2001, The optimal duration of exclusive breastfeeding. Report of an expert consultation, WHO, Geneva.

Chapter 3 Methodology

This research project used a number of different data sources to achieve its objectives. In effect there were three parts to this project: the Perth Infant Feeding study, the 1995 and 2001 National Health Surveys, and the focus group discussions.

3.1 Perth Infant Feeding Study

3.1.1 Overview

The Perth Infant Feeding Study Mark II (PIFSII) was a longitudinal study conducted on a cohort of consecutive unselected mothers who delivered babies in two Perth (Western Australia) hospitals with maternity wards between September 2002 and July 2003. The partners of mothers recruited to the study were also invited to participate. Both were asked to sign a consent form (see Appendix 2) while in hospital. This was the second Perth Infant Feeding Study following on a decade later from PIFS Mark I, which was conducted in 1993-1995 to document factors that determine breastfeeding initiation and duration. PIFSII was undertaken with similar objectives to the first and to document secular trends. The same two hospitals that were used in the PIFSI in 1992 were used in the PIFSII. The catchment area for the hospitals have remained the same, as has the socio-economic category of the areas.

There were two notable differences between the first infant feeding study and the PIFSII conducted in 2002. In the earlier study, a six month cohort study, mothers not breastfeeding in hospital were not followed-up post-discharge and mothers who stopped breastfeeding during the first six months postpartum were dropped from the study once they had stopped breastfeeding. In the 2002 study however, all mothers were followed for 12 months postpartum regardless of the infant feeding method chosen in hospital and whether or not they had stopped breastfeeding before 12 months. The second difference was the inclusion of the baby’s father in the 2002 study. Fathers were not participants in the PIFSI.

3.1.2 Survey Instruments

There were three survey questionnaires used to elicit information in the PIFSII. Mothers completed an 'in-hospital' baseline questionnaire and 'follow-up' questionnaires at 4, 10, 16, 22, 32, 40 and 52 weeks postpartum. These tools were the same as those validated and previously utilised in the Perth Infant Feeding Study Mark I. There were some minor modifications and additions. In the PIFSII fathers were asked to participate for the first time and completed a baseline questionnaire at the time of the mother's recruitment.

3.1.2.1 Baseline Questionnaire

The 'in-hospital' baseline questionnaire was designed to identify feeding method while in hospital and to collect information on variables known, or suspected, to be associated with breastfeeding duration:

- socio-demographic factors (e.g. maternal age, education, occupation, ethnicity, marital status, family income, partner's occupation)
- psychosocial factors (e.g. maternal attitudes and beliefs, influence of significant others, social support)
- bio-medical factors (e.g. method of delivery, use of pain relief)
- health and lifestyle behaviours prenatally and antenatally (e.g. smoking status, alcohol intake, level of physical activity)
- hospital practices (e.g. early mother-infant contact, demand feeding, rooming-in, antenatal and postnatal education) (see Appendix 3).

The Iowa Infant Feeding Attitude Scale ('the Iowa scale') was an addition to the 2002 mother's 'in-hospital' questionnaire and father's questionnaire. The maternal Iowa Infant Feeding Attitude Scale (IIFAS) is a 17 item scale which measures attitudes towards both breast and formula feeding with regards to the health and nutritional benefits, and the cost and convenience of each method. It has been shown previously to be a valid and reliable measure of infant feeding attitudes amongst women in the USA (De la Mora et al. 1999) and Scotland (Scott, Shaker & Reid

2004). Each item is measured on a five point scale and total scores could range from 17 (reflecting positive formula feeding attitudes) to a high of 85 (indicating attitudes that favour breastfeeding).

3.1.2.2 Father's Baseline Questionnaire

A selection of questions from the mother's 'in-hospital' questionnaire were used as the basis for the father's questionnaire (see Appendix 4). Questions were designed to determine fathers' attitude towards breastfeeding as well as elicit socio-demographic details.

3.1.2.3 Follow up Questionnaire

Questions included in the follow-up questionnaire were designed to elicit information on current feeding practices, the types of problems experienced by women during the course of lactation, health and lifestyle behaviours undertaken postpartum, and to identify the time of weaning and reasons for the cessation of breastfeeding (see Appendix 5).

3.1.3 Data Collection

3.1.3.1 Recruitment of sample

The study sample was recruited between September 2002 and July 2003, from two metropolitan regional hospitals that drew their patients from areas of primarily high socio-economic disadvantage (Australian Bureau of Statistics 2002b).

During peak birth periods the project officer visited the hospital daily from Monday to Friday and occasionally on one weekend day. During quieter periods the project officer would contact the maternity wards to determine if it was necessary to visit the hospitals on a daily basis. Mothers, who were on the ward at the time of the visit, were invited to participate in the study. Attempts were made to contact all eligible mothers within the first three days after the birth, with consideration being given to mothers who had recently given birth or with many visitors present.

Women were considered eligible if they had delivered a live infant with no serious health conditions requiring transfer to Perth's major maternity hospital or neonatal intensive care. Mothers whose infants were admitted for less serious health problems to the special care nurseries of the participating hospitals were eligible for recruitment.

Father's of the newborn infants were also asked to participate in the survey. At the time of recruitment of the mothers, fathers were asked to complete the 'in-hospital' baseline questionnaire.

3.1.3.2 Administration of the baseline questionnaires

Upon contact with the mother in both hospitals the purpose and the methodology of the study were explained to each mother and they were asked to sign a consent form. Mothers who declined to participate in the 12 month cohort study were asked to provide some basic demographic details to allow for an assessment of how representative the final sample was. Some baseline data were collected at initial contact from all mothers and provided consent was given, an 'in-hospital' questionnaire was left for mothers to complete. The completed mother's questionnaire was collected either from the mother prior to her discharge from hospital or alternatively from a sealed box on the ward or posted back directly to the university within a week.

Mothers who were recruited by the research officer were left a self-administered questionnaire for the baby's father to complete and return either while the mother was in hospital or shortly afterwards by post. Some basic socio-demographic information was also sought from all fathers or alternatively through the baby's mother.

3.1.3.3 Follow-up interviews

Attempts were made to follow-up all recruited mothers by telephone seven times during the 12 month period post discharge: at 4 weeks, 10 weeks, 16 weeks, 22 weeks, 32 weeks, 40 weeks and 52 weeks. All ‘in-hospital’ questionnaires were checked soon after collection for missing or unclear responses. This information was then clarified during the first follow-up call.

Attempts were made to contact the mothers repeatedly during the due week of follow up, and in the following week if unsuccessful. If mothers were unable to be contacted during this two week period then they were withdrawn from the study.

3.1.3.4 Sample criteria

All mothers that delivered at either of the two Perth hospitals were eligible to participate in the study excluding: mothers with poor levels of English language literacy; mothers that delivered babies needing to be transferred to another hospital for neonatal intensive care; and those deemed unfit, for medical or other reasons, by nursing staff on the ward. Recruitment of mothers continued until 600 or close to 600 mothers were enrolled in the study. All partners of participating mothers were eligible to participate if the participating mother was in contact with them and they were able to return a completed questionnaire shortly after the birth of their infant.

3.1.3.5 Sample size

It was estimated that it would take six months to recruit enough mothers (600 women) from the same hospitals as previously used in the 1992 Perth Infant Feeding Study. The sample size required was estimated to be 600, similar to that of the earlier study. After allowing for a loss to follow-up of up to 20% over the duration of the study this would enable the breastfeeding rates to be estimated within approximately five percentage points with 95% confidence.

3.2 The 1995 and 2001 National Health Surveys

National Health Surveys were conducted in 1989-90 and 1995, and prior to that as Australian Health Surveys in 1977-78 and 1983. Previous National Health Surveys were conducted five yearly; however since 2001 the surveys have been conducted every three years.

3.2.1 1995 National Health Survey

The 1995 National Health Survey (1995 NHS) was conducted by the Australian Bureau of Statistics (ABS) from January 1995 to January 1996. After sample loss, approximately 23 800 households, representing about 1 in 310 of the non-institutionalised population throughout Australia were included in the survey. The final sample size was 21 787 households, giving a total unweighted response rate for households of 91.5%

The survey was conducted on a multi-stage area sample in both urban and rural areas across all States and Territories of Australia, and included both private (e.g. houses, flats) and non-private dwellings (e.g. hotels, motels). All households within sampled private dwellings were included in the survey along with a random sample of individuals residing in non-private dwellings.

The area-based selection of the private dwelling sample ensured that all segments of the population were represented in the sample. The sample of non-private dwellings was selected separately from the sample of private dwellings to ensure they were adequately represented in the sample. Overall, all persons within selected dwellings/units were included in the survey, subject to scope and coverage provisions. The selection methods ensured a known and equal chance of selection for each person within each State and, an equal chance of selection within each State (except in Victoria where a proportionately higher sample of dwellings in the metropolitan area of Melbourne was drawn, in the Northern Territory where a higher sample was drawn in Darwin and Alice Springs, and the Australian Capital Territory). A sample of 2 000 Indigenous people were included in the 1995 NHS, however for the purposes of this research the Indigenous population were not included in the data analysis.

Greater detail on sample selection can be found in Australian Bureau of Statistics. National Health Survey: User's Guide 1995 (Australian Bureau of Statistics 1996).

Data for the 1995 NHS was obtained by trained ABS interviewers, through personal interview with each adult member of the selected households. There were four questionnaires used in the 1995 NHS: the Household Form, Personal Interview Questionnaire, the General Health and Well-Being Form (SF-36) and the Women's Health Supplementary Form.

The Household Form was used to collect demographic data from private dwellings. This information was obtained from any responsible adult within the household. A similar form (the special dwellings form) was used for the non-private dwellings. The Personal Interview Questionnaire collected information from individuals about recent and long term illness conditions, health related actions (e.g. seeking health advice) and selected lifestyle behaviours. There was no separate children's questionnaire and only those questions that were sample or age group appropriate were delivered.

The SF-36 form was given to adults (aged 18 years and over) in selected households for self-completion prior to the administration of the main questionnaire. The Women's Health Supplementary form was given to adult female respondents who were not selected in the SF-36 sample. This questionnaire contained 30 questions on specific aspects of women's health, which included information on pregnancies and breastfeeding. It was completed by the respondent in writing and returned to the interviewer in a sealed envelope. This approach was adopted in recognition of the potential sensitivity of the topics covered.

3.2.1.1 1995 NHS Sub-sampling

In order to maximise the capacity of the survey within acceptable interview time and cost limits, some sections (e.g. General Health and Well-Being {SF-36} questionnaire, Women's Health Supplementary Form, Alcohol consumption) of the survey were administered to half the sample only, while core sections were administered to all age appropriate respondents. Sub-sample selections were made on a block basis, and were undertaken prior to initial interviewer contact with households, to ensure the selection process was unbiased.

3.2.2 2001 National Health Survey

The 2001 National Health Survey (2001 NHS) was conducted by the ABS using a stratified multistage area sample of private dwellings from February to November 2001.

The 2001 NHS was conducted in 17 918 private dwellings selected throughout non-sparsely settled areas of Australia. Non-private dwellings including hotels and motels, hostels and boarding houses were excluded. In total a sample of approximately 26 960 households was selected which, taking account of an expected rate of sample loss (e.g. vacant dwellings, dwellings under construction etc.) of 13% and non-response of 15%, was designed to achieve the desired sample of about 20 000 fully responding households.

A total of 3 198 Aboriginal and Torres Strait Islander adults and children were included in the 2001 NHS, however for the purpose of this research the Indigenous population were not included in the data analysis.

To ensure a minimal seasonal effect on health characteristics, the sample was initially allocated equally to each quarter of the calendar year 2001. Selected Population Census Collection Districts (CDs) were randomly allocated in such a way as to ensure an even spread of sample throughout the year. The sample design ensured that within each State or Territory each person had an equal chance of selection. Information was obtained about one adult, all children aged 0 to 6 years, and one child aged 7 to 17 years in each selected household.

Owing to higher than expected survey enumeration costs a decision was taken in August 2001 to deselect sample from the 4th quarter of enumeration. After sample deselection, a total of 21 891 private dwellings were selected in the sample for the 2001 NHS. This reduced to an active sample of 19 408 dwellings after sample loss in the field stage. A total of 26 863 persons fully responded to the survey.

Greater detail on sample selection can be found in: Australian Bureau of Statistics. National Health Survey: User's Guide 2001, (Australian Bureau of Statistics 2001).

Trained ABS interviewers personally interviewed the selected adult member of the household. A parent or guardian was asked to answer questions on behalf of their children aged less than 18 years. This person was referred to as the child proxy. Responses were provided on behalf of the child by an adult, generally a parent, and the mother in almost 80% of cases.

The 2001 NHS interviews sought information on long-term medical conditions experienced by respondents, recent injury events, consultations with health professionals, other actions people had recently taken in regard to their health (e.g. taken days away from work), aspects of their lifestyle and other factors which may affect their health such as smoking, alcohol consumption, diet, exercise and immunisation.

Four questionnaires were developed for and used in the 2001 NHS: the Household Form, the Personal Interview Adult Questionnaire, the Personal Interview Child Questionnaire and the Women’s Health Supplementary Form.

The Household Form was used to collect basic demographic data about usual residents of the household and details of the relationship between individuals in each household. This information was obtained from any responsible adult within the household. The form was also used to identify the selected adult respondent for the dwelling, and the child proxy where applicable.

The Personal Interview Adult Questionnaire was used to collect information from adults about their demographic and socio-economic characteristics and health characteristics such as health-related actions they had taken, long-term illness conditions experienced, selected lifestyle behaviours and similar.

The Personal Interview Child Questionnaire was used to collect information about each child; this included their demographic and (for older children) their socio-economic characteristics and various health characteristics. This questionnaire was also used to collect some demographic and socio-economic information about the child proxy.

The Women's Health Supplementary Form was given to female respondents aged 18 years and over at the completion of their interview. It contained questions relating to specific women's health issues and was completed by the respondent in writing and returned to the interviewer in a sealed envelope. This approach was adopted in recognition of the potential sensitivity of the topics covered.

3.2.3 Sample Selection (breastfeeding and alcohol/smoking)

For the purposes of this research the 1995 National Health Survey (NHS) Confidentialised Unit Record File (CURF) and 2001 National Health Survey CURF were used to select the sample population (Australian Bureau of Statistics 1995, 2003b). The CURF contains unit (person) record data. The use of this data is made possible under the *Census and Statistics Act 1905,* which allows for the release of data in the form of unit records where the information is not likely to enable the identification of a particular person or organisation. Therefore the unit record data file contains detailed information on each person in the sample, but identifying data has been removed to preserve confidentiality.

In the unit record data, the ABS provides a weighting for each person to be used when estimating parameters for the Australian population. There are 53 828 person records on the 1995 NHS CURF which, when weighted by expansion factors on each record, gives a population estimate of 18 061 076. The 2001 NHS CURFs contains 26 862 confidentialised respondent records.

Data relating to mothers and fathers in the 1995 and 2001 NHS is not linked to their children and vice versa in the CURF, therefore several methods were used to select the sub-samples for further study. Initially two sub-samples were selected from the 1995 NHS and three samples from the 2001 NHS. These were as follows:

1995 Lactating Mothers 1: were women from a household where there is a child aged four years or less.

1995 Lactating Mothers 2: were women who stated they have ever breastfed and live in a household where there is a child aged four years or less in the same household.

2001 Lactating Mothers 1: were women from a household where there is a child aged four years or less.

2001 Lactating Mothers 2: were women who stated they have ever breastfed and live in a household where there is a child aged four years or less in the same household.

2001 Lactating mothers 3: were women who stated they have had a baby (babies) and there is a child aged four years or less living in the same household.

Lactation is defined as, "1. the secretion of milk by the mammary glands. 2. the suckling of young" (Moore 1997)(p749). Upon further consideration of the definition of lactation and the similarity in numbers between the sub-samples for each NHS, only the second definition for both the 1995 and 2001 NHS (Lactating Mothers 2) were retained for the purpose of this research project.

Table 3.2.1 Sample of women selected from the 1995 National Health Survey

	Lactating Mothers Definition 1	Lactating Mothers Definition 2	Pregnant Women	Non-mothers
Unweighted sample	3086	3086	84	1489
Missing values	1603	1603	0	0
Weighted sample	960 246	461 125	260 28	142 159
Missing values	0	0	0	0

Table 3.2.2 Sample of women selected from the 1995 National Health Survey

	Lactating Mothers Definition 1	Lactating Mothers Definition 2	Lactating Mothers Definition 3	Pregnant Women	Non-mothers
Unweighted sample	1382	1 263	1 264	137	2764
Missing values	983	1102	1101	0	0
Weighted sample	998574	906094	906606	107983	1924414
Missing values	0	0	0	0	0

For both surveys, non-mothers were aged between 18-44 years and reported not having any children. Pregnant women were those women who reported that they were currently pregnant at the time of the survey interview. For the purpose of the published papers the final definitions of Lactating Mothers (i.e. only definition 2) were limited to women aged 50 years or less.

3.2.3 Lactating Mothers aged 50 years or less from the 1995 and 2001 National Health Survey

	Lactating Mothers 1995	Lactating Mothers 2001
Unweighted sample	1461	1248
Weighted sample	452895	882974

3.3 Alcohol consumption measures

3.3.1 Perth Infant Feeding Study II

In the baseline questionnaire women were asked if they consumed alcohol before pregnancy. If they responded in the affirmative they were asked how often (days/week) they usually drank alcohol and how many standard drinks they usually consumed at each drinking occasion. Participants were asked the type of alcohol they consumed most frequently and were provided with a list of standard drink sizes. As part of the baseline questionnaire these same questions were asked for the period of their pregnancy.

At each postpartum follow-up telephone interview participants were asked if they were drinking alcohol at present, how many days they had consumed alcohol in the previous two weeks, and how many standard drinks and the type of alcoholic beverage they had each time (drinking occasion). In addition respondents were asked at what time they consumed alcohol in relation to feeding the baby or time of day. Questions were modelled on the 1989/90 National Health Survey (NHS) (Australian Bureau of Statistics 1991) (see Appendix 6).

One standard drink unit was defined as 10g of alcohol in accordance with the NHMRC Australian alcohol guidelines (National Health and Medical Research Council 2001). Two methods of categorising alcohol intake were used. Firstly, standard drinks consumed per week were calculated by multiplying the usual frequency of consumption with the usual volume of alcohol consumed per occasion (each time).

3.3.1 Examples of common standard drinks

Alcohol type	% alcohol/volume	Volume/measure	No. standard drink
Full strength beer	4.9%	375ml (1 can)	1.5
Mid strength beer	3.5%	375ml (1 can)	1
Light beer	2.7%	375 ml (1 can)	0.8
Wine	12%	100ml (small glass)	1
Spirit	40%	30ml (1 Nip)	1
Pre-mix spirits	5%	375ml (1 can)	1.5

Source: (National Health and Medical Research Council 2001)

Secondly, the number of standard drinks per day consumed in the previous two week period were categorised into the NHMRC guidelines for risk of harm in the long term for the general population. For this categorisation it was assumed that ‘per occasion’ or ‘each time’ of alcohol consumption corresponded to ‘per day’ consumption of alcohol. The number of drinks were categorised for ‘low risk’ (up to two standard drinks per day); ‘risky’ (three to four standard drinks per day); and ‘high risk’ (five or more standard drinks per day). The NHMRC does not recommend these levels of consumption for pregnant women. Missing values were not recoded as zero as this would falsely elevate the number of women who reported not drinking. Results were then compared to Guideline 11 (National Health and Medical Research Council 2001).

Guideline 11 states 'Women who are pregnant or might soon become pregnant (11.1) may consider not drinking at all; (11.2) most importantly, should never become intoxicated; (11.3) if they choose to drink, over a week, should have less than 7 standard drinks (spread over at least two hours); should note that the risk is highest in the earlier stages of pregnancy, including the time from conception to the first missed period' (National Health and Medical Research Council 2001)(p. 16).

Only the alcohol data of women reporting 'any breastfeeding' were analysed. Any breastfeeding includes those infants who receive both breastmilk and other milk feeds or solid foods (World Health Organization 1991). This level of breastfeeding was chosen in order to capture the majority of breastfeeding women throughout the study period.

3.3.2 1995 and 2001 National Health Survey

The methodology used to collect information regarding alcohol intake was essentially the same in both the 1995 and 2001 NHS and is considered by the Australian Bureau of Statistics (ABS) to be directly comparable (Australian Bureau of Statistics 2001). Adult respondents were asked how long ago they last had an alcoholic drink. Those who reported they had a drink within the previous week were asked the days in that week on which they had consumed alcohol (excluding the day on which the interview was conducted), and for each of the last 3 days on which they drank, the types and quantities of drinks they had consumed.

Reported quantities of drinks were converted to millilitres of alcohol present in those drinks, which respondents reported they had consumed. This system used information about the type of alcoholic drinks consumed, and the size and number of drinks consumed; a conversion factor was applied to this information to obtain the amount of pure alcohol consumed. Conversion factors tailored to specific drinks/drink types were included in the system. The system used to derive alcohol content in the 2001 survey catered for more specific drink information (e.g. down to individual brand level) and as a result the accuracy of the derivation of alcohol consumed is expected to be marginally higher than that in 1995. At the population level however this is expected to have minimal impact on the comparability of the 2001 and 1995 data sets (Australian Bureau of Statistics 2001).

The criteria for classifying alcohol consumption were similar for both the 1995 and 2001 NHS with the exception of the beer category. The 2001 NHS alcohol categories are as follows: low alcohol beer, medium strength beer, full-strength beer, wine, spirits, fortified wine and other alcoholic beverages. The categories of beer changed between surveys, and reflect a change in product availability between the surveys. In the 1995 survey the beer categories extra/special light beer and low alcohol beer were essentially replaced with light beer and mid-strength beer in the 2001 NHS.

Alcohol risk was not calculated in the 1995 NHS, however it has been determined in this analysis using the 'estimated total daily consumption of alcohol (in millilitres) for the reference week' and 'period since last drank alcohol' (including never drank) to develop the NHMRC guidelines for drinking at risk of harm in the long term (National Health and Medical Research Council 2001). The guidelines are recommended for the general population and for females these are as follows. On an average day; Low Risk - up to two standard drinks; Risky – three to four standard drinks; High Risk – five or more standard drinks. Overall weekly level; Low Risk – up to 14 standard drinks per week; Risky – 15 to 28 standard drinks per week; and High Risk – 29 or more standard drinks per week. One Australian standard drink contains 10g of alcohol (equivalent to 12.5ml of ethanol) (National Health and Medical Research Council 2001).

Alcohol intakes of all women were compared with the NHMRC guidelines for drinking at risk of harm in the long term, however it should be noted that the NHMRC does not recommend these levels of consumption for pregnant women (National Health and Medical Research Council 2001). In addition, the alcohol intakes of the pregnant and lactating women were compared with Guideline 11 from the NHMRC Australian Alcohol Guidelines (National Health and Medical Research Council 2001).

3.3.3 Cigarette smoking measurements

Only smoking data from the PIFSII was analysed in this research project. Mothers were asked if they had smoked before pregnancy and if they had smoked during pregnancy as part of the baseline questionnaire. Smoking status was again established at each follow up telephone interview.

Questions relating to smoking status were modelled on the 1989/90 NHS (Australian Bureau of Statistics 1991) (see Appendix 6).

3.4 Data Analysis

3.4.1 Perth Infant Feeding Study

All data were coded, entered and analysed using SPSS version 11.0 (SPSS 2002). Several analyses of the data distribution were first undertaken to identify any coding and data entry errors. Plausibility checks were conducted to assist in identifying any out of range responses and inconsistent data with the original questionnaire. Data were cleaned and corrected appropriately.

3.4.1.1 Alcohol

Alcohol related data were analysed and described using frequency distributions, means and medians.

Univariate logistic regression was used to screen out potentially significant variables for subsequent incorporation in the multivariate analysis. Multivariate logistic regression analysis was employed to determine which individual variables best predicted breastfeeding initiation and the effect of consuming alcohol before and during pregnancy on the model.

All variables reported in the literature to be associated with the breastfeeding initiation were included in the full model together with related alcohol measures. The full model was reduced manually and the fitness of the model was assessed at every step to avoid dropping non-significant variables that affected the model fitness. Consuming alcohol before and during pregnancy were not removed from the model and their effect on breastfeeding initiation observed.

A Cox proportional hazards model with repeated measures for alcohol consumption was used to determine the effect of alcohol intake in the postpartum period up to six months on breastfeeding duration. Variables reported in the literature to affect breastfeeding duration were also included in the model.

Greater detail of data processing and analysis for the results will be presented in subsequent chapters.

3.4.1.2 Smoking

Factors influencing smoking in women before, during and after pregnancy were initially examined using a univariate analysis. Findings from the literature and univariate analysis were used to determine which variables would remain in the final multivariate logistic model. In the final model all variables were entered simultaneously. All variables were kept in the final model, even those not statistically significant, to illustrate their diminished effect of these factors, which are often considered to be correlated with cigarette smoking (e.g. education and income level).

The effect of smoking during pregnancy on breastfeeding duration of specific time points (<2wk, 2 wk–6 mo and >6 mo) was initially examined in a univariate analysis.

Findings from the literature and univariate analyses were used to decide which variables should be entered into the final multivariate logistic model. In the final model variables were entered stepwise and all variables were kept in the final model.

The relationship between smoking status and breastfeeding duration was determined using Kaplan Meier survival analysis. This was adjusted by using a Cox regression model with smoking status as the time-dependent covariate. This extension of the standard Cox model allows changes over time to be taken into account, and it does not assume proportionality of risks

Risk factors associated with stopping smoking during pregnancy were initially analysed using univariate analysis. All variables were then entered into the model for the multivariate analysis of predicting stopping smoking during pregnancy. The model was reduced manually by excluding those variables with a less significant value. Variables identified in the literature as being associated with breastfeeding initiation and duration were examined and included in the development of each statistical model.

The difference between duration of breastfeeding in those who stopped smoking during pregnancy and those who did not was initially explored using Kaplan Meier survival analysis. This relationship was further examined using logistic regression to examine breastfeeding duration less than and greater than six months using a variety of sociodemographic, biomedical and psychosocial factors reported to have an effect on breastfeeding duration in the literature. Variables were entered into the model to determine the effect on breastfeeding duration for more than or less than six months. Non-significant variables were manually excluded from the final model.

Greater details of data processing and analysis for the results will be presented in subsequent chapters.

3.5 Qualitative Research

A descriptive study using qualitative methods was conducted in the Perth metropolitan area of Western Australia between February 2004 and December 2005 (Sandelowski 2000). Data was gathered through focus group discussions. Women eligible to participate were currently breastfeeding or had been breastfeeding within the previous 12 months.

3.5.1 Data Analysis

All focus group and interview data were transcribed verbatim immediately following the discussions. Qualitative content analysis was applied to systematically summarise recurring themes (Morgan 1993). Greater detail on the qualitative data analyses are presented in Chapter 7.

3.6 Ethical Considerations

3.6.1 Perth Infant Feeding Study

Prior to the commencement of the study, ethical approval was obtained from each of the hospital's ethics committee and the Human Research Ethics Committee of Curtin University of Technology.

Women were informed that participation in the study was on a voluntary basis and that they could withdraw at any time without prejudice. Informed consent was obtained from all study participants after the study was fully explained by the research officer. A duplicate copy of the signed consent form incorporating information on the study was also provided to study participants (see Appendix 2).

Anonymity and confidentiality of results was assured and maintained throughout the course of the study. Participants were assigned and ID number which was printed on their baseline and follow-up questionnaires. They were also asked to provide their name and address which was linked to their ID number for tracking purposes only.

All information and questionnaires were stored in locked filing cabinets. Results are presented as grouped data.

3.6.2 1995 and 2001 National Health Surveys

Access to the 1995 National Health Survey (NHS) Confidentialised Unit Record File (CURF) and 2001 National Health Survey CURF is made possible under the *Census and Statistics Act 1905*. Legislation allows the Australian Statistician to release unit data provided that this is done: "in a manner that is not likely to enable identification of a particular person or organisation to which it relates".

Utilisation of the 1995 and 2001 Basic Confidentialised Unit Record Files (CD-ROM) was undertaken in accordance with the conditions of access outlined by the Australian Bureau of Statistics.

References

Australian Bureau of Statistics 1991, *National Health Survey Questionnaire 1989-1990*, Canberra.

Australian Bureau of Statistics 1995, *National Health Survey, Australia 1995, Basic Confidentialised Unit Record File*, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics 1996, *National Health Survey: User's Guide 1995, Cat no. 4363.0*, Australia Bureau of Statistics, Canberra.

Australian Bureau of Statistics 2001, *National Health Survey: Users' Guide, 2001*, Australian Bureau of Statistics, Canberra, from http://www.abs.gov.au/Ausstats/abs@.nsf/66f306f503e529a5ca25697e0017661f/777CA8D289E66729CA256D32001B5324?opendocument

Australian Bureau of Statistics 2002, Socio-economic indexes for areas 2001 : a comprehensive profile of the Australian people, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics 2003, *National Health Survey, Australia (2001), Basic Confidentialised Unit Record File*, Australian Bureau of Statistics, Canberra, Cat no. 4324.0.30.001.

De la Mora, A, Russell, D, Dungy, C, Losch, M & Dusdieker, L 1999, 'The Iowa Infant Feeding Attitude Scale: analysis of reliability and validity', *Journal of Applied Social Psychology,* vol. 29, no. 11, pp. 2362-80.

Moore B (Ed) 1997, *The Australian concise Oxford dictionary of current English,* 3rd edn, Oxford University Press, Melbourne.

Morgan, DL 1993, 'Qualitative Content Analysis: A guide to paths not taken', *Qualitative Health Research,* vol. 3, pp. 112-21.

National Health and Medical Research Council 2001, *Australian Alcohol Guidelines: Health Risks and Benefits*, National Health and Medical Research Council, Canberra.

Sandelowski, M 2000, 'Focus on Research Methods. Whatever happened to qualitative description?' *Research in Nursing and Health,* vol. 23, pp. 334-40.

Scott, JA, Shaker, I & Reid, M 2004, 'Parental attidtudes toward breastfeeding: Their association with feeding outcome at hospital discharge', *Birth,* vol. 31, no. 2, pp. 125-31.

SPSS 2002, *SPSS-for Windows, Version 11.*, SPSS Inc., Chicago, Illinois.

World Health Organization 1991, Indicators for assessing breastfeeding practices., WHO, Geneva.

Chapter 4 Patterns of alcohol intake of pregnant and lactating women in Perth, Australia

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Abstract

Introduction and Aims

Australian alcohol consumption data for women during the period of pregnancy and lactation is limited. The purpose of this paper is to provide current alcohol consumption data for pregnant and lactating women in Perth, Western Australia (WA). Data were collected from 587 women between mid-September 2002 and mid-July 2003.

Design and Methods

Women from two public hospitals with maternity wards in the Perth metropolitan area completed a self-administered baseline questionnaire while in hospital or shortly after discharge. All women regardless of their chosen infant feeding method were followed up by telephone interview at four, 10, 16, 22, 32, 40 and 52 weeks postpartum.

Data were analysed to determine alcohol use patterns of the women during the period of pregnancy and lactation and results were compared to national guidelines for alcohol consumption.

Results

Approximately 32% of women stopped drinking alcohol during pregnancy. A remaining 35% of pregnant women consumed alcohol during pregnancy with 82.2% of these women consuming up to two standard drinks per week. At four, six and 12 months postpartum, 46.7%, 47.4% and 42.3% of breastfeeding women were consuming alcohol, respectively.

Discussion and Conclusions

The majority of breastfeeding women consumed up to two standard drinks per week, which is within levels recommended by national authorities. There is however a small proportion of women consuming alcohol at levels above national recommendations for pregnancy and lactation. The development of 'safe' alcohol intake practices, within national recommendations, during the postnatal period would remove any potential health risks to the infant from alcohol exposure at this vulnerable growth stage.

Keywords: alcohol, breastfeeding, lactation, pregnancy

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4.1 Introduction

Alcohol is a teratogen, which in pregnant women may affect the developing fetus. Alcohol passes through the placenta to the fetus and can reach concentrations as high as those in the mother. The ability of the fetus to metabolise alcohol is minimal. Alcohol and its metabolite, acetaldehyde can damage developing fetal cells (Hard, Einarson & Koren 2001). Fetal Alcohol Syndrome Disorder (FASD) describes the range of effects that can occur in an individual whose mother drank alcohol during pregnancy. These effects may include physical, mental, behavioral, and/or learning disabilities with possible lifelong implications. FASD refers to conditions such as fetal alcohol syndrome (FAS), fetal alcohol effects (FAE), alcohol-related neurodevelopmental disorder (ARND), and alcohol-related birth defects (ARBD) (U.S. Department of Health and Human Services 2006)

The adverse effects of alcohol consumption during pregnancy are well documented however there is limited information available on the postpartum effect of alcohol in the breastmilk on the developing human infant. In a review of the literature by Giglia and Binns (Giglia & Binns 2006b), alcohol consumption at a level of two standard drinks per day during lactation resulted in a deficit in motor development (Little et al. 1989). However results of this study failed to be replicated with a different but comparable population (Little, Northstone & Golding 2002). The review also concluded that consuming this amount of alcohol shortly before the beginning of a breastfeed can inhibit lactational performance and negatively disrupt an infant's sleep-wake behavioural patterns (Mennella & Garcia-Gomez 2001; Mennella, Pepino & Teff 2005). In addition women who consume alcohol during lactation have been shown to have a shorter duration of breastfeeding (Giglia & Binns 2006b; Little, Lambert & Worthington-Roberts 1990a). One Australian standard drink is equivalent to 10g [12.5ml] alcohol) (National Health and Medical Research Council 2001).

Because of the high level of public interest in fetal alcohol syndrome (FAS), alcohol intake during pregnancy is often recorded as part of the antenatal care whereas intake in the postpartum period is not. Numerous international studies have documented alcohol consumption of pregnant women (Counsell, Smale & Geddis 1994; Ebrahim et al. 1998). However there is a paucity of information in the literature on alcohol consumption in women during lactation.

In Australia it is recommended for lactating women 'not to exceed the levels of drinking recommended during pregnancy, and to consider not drinking at all'. That is 'if they choose to drink, over a week, should have less than 7 standard drinks (spread over at least two hours)' (Guideline 11, p16) (National Health and Medical Research Council 2001).

Despite the existence of this guideline there is little or no detailed contemporary Australian data on alcohol use during pregnancy or lactation with which to evaluate the risk level of maternal alcohol consumption. The most recent studies of drinking patterns of Australian women in the pre- and postnatal period include:

(i) an investigation into the incidence of smoking and alcohol consumption during pregnancy in Tasmania (Kwok et al. 1983);

(ii) the change in alcohol and nicotine usage during pregnancy in a two year longitudinal study of pregnant women in South Australia (Condon & Hilton 1988);

(iii) the use of the 1985 Victorian Perinatal Morbidity Statistics to document cigarette smoking and alcohol consumption during pregnancy (Bell & Lumley 1989); and

(iv) the 'traditional' population-based Australian health surveys (Adhikari & Summerill 2000; Australian Bureau of Statistics 1995, 2002a; Australian Institute of Health and Welfare 2003, 2005c) which have been designed for men and women of all ages and are limited in scope with regard to the pre- or postnatal period.

This study documents the alcohol use patterns of women living in Perth, Australia during the period of pregnancy and lactation. In particular, the time of alcohol intake with regard to breastfeeding and number of drinks consumed on a typical drinking occasion is reported. Alcohol intake levels are compared with national guidelines for pregnant and lactating women.

4.2 Methods

4.2.1 Sample

The second Perth Infant Feeding Study (PIFSII) was conducted between September 2002 and July 2003. The study used the same methodology (and sites) as the first PIFS study, details of which can be found in Scott et al (Scott et al. 1999). Initial results from the PIFSII have been reported elsewhere (Graham et al. 2005; Scott et al. 2006a; Scott et al. 2006b).

Mothers were contacted within the first three days following the birth of their infant. Women were considered eligible for the study if they had delivered a live infant free of any serious health conditions requiring transfer to the neonatal intensive care unit at Perth's major maternity hospital.

Those women agreeing to participate in the study completed the self-administered baseline questionnaire while in hospital or shortly after discharge. Women declining to participate were asked to provide some basic socio-demographic data in order to determine the representativeness of the sample. All women regardless of their chosen infant feeding method were followed up by telephone interview at four, 10, 16, 22, 32, 40 and 52 weeks postpartum.

In the baseline questionnaire women were asked if they consumed alcohol before pregnancy. If they responded in the affirmative they were asked how often (days/week) they usually drank alcohol and how many standard drinks they usually consumed at each drinking occasion. Participants were asked the type of alcohol they consumed most frequently and were prompted with standard drink sizes. As part of the baseline questionnaire these same questions were asked for the period of their pregnancy.

At each postpartum follow up telephone interview participants were asked if they were drinking alcohol at present, how many days they had consumed alcohol in the previous two weeks, and how many standard drinks and the type of alcoholic beverage they had each time (drinking occasion). In addition respondents were asked at what time they consumed alcohol in relation to feeding the baby or time of day. Questions were modelled on the 1989 National Health Survey (NHS) (Australian Bureau of Statistics 1991).

One standard drink unit was defined as 10g of alcohol in accordance with the NHMRC Australian alcohol guidelines (National Health and Medical Research Council 2001). Two methods of categorising alcohol intake were used. Firstly, standard drinks consumed per week were calculated by multiplying the usual frequency of consumption with the usual volume of alcohol consumed per occasion (each time). Results were then compared to Guideline 11 (National Health and Medical Research Council 2001).

Secondly, the number of standard drinks per day consumed in the previous two week period were categorised into the NHMRC guidelines for risk of harm in the long term for the general population. For this categorisation it was assumed that ‘per occasion’ or ‘each time’ of alcohol consumption corresponded to ‘per day’ consumption of alcohol. The number of drinks were categorised for ‘low risk’ (up to two standard drinks per day); ‘risky’ (three to four standard drinks per day); and ‘high risk’ (five or more standard drinks per day). The NHMRC does not recommend these levels of consumption for pregnant women. Missing values were not recoded as zero as this would falsely elevate the number of women who reported not drinking.

Only the alcohol data of women reporting ‘any breastfeeding’ were analysed. Any breastfeeding includes those infants who receive both breastmilk and other milk feeds or solid foods (World Health Organization 1991). This level of breastfeeding was chosen in order to capture the majority of breastfeeding women throughout the study period.

4.2.2 Statistical analysis

Statistical analyses were performed using the Statistical Package for Social Sciences, Version 11.0 (SPSS for Windows, SPSS Inc., Chicago, IL, USA). Data were analysed and described using frequency distributions, means and medians. Where confidence intervals are presented these have been calculated by estimating the difference between two proportions by assuming the samples are independent and have been taken from a binomial distribution (success and failure).

4.2.3 Ethical considerations

The PIFSII was approved by the Human Ethics Committee of Curtin University and the Research Ethics Committees of the two participating hospitals. Signed informed consent was obtained from participants.

4.3 Results

Overall, in the PIFSII 870 women of the 1068 contacted were eligible to participate and 587 completed baseline questionnaires, representing 68% of women contacted. No significant differences were found in the age or level of education of participants compared with non-participants.

Table 4.3.1 outlines the characteristics of the women who drank alcohol during pregnancy. Comparison with Western Australian (WA) perinatal demographic statistics (Laws & Sullivan 2005) suggests that the PIFS II sample was representative of new mothers in WA, with the exception of those who smoke during pregnancy. In 2003 in WA the average age of mothers was 29.3 years compared to 28.4 years in this study. Thirty seven percent of mothers in the PIFS II study were primiparous, compared to 41% for the whole state. Caesarean section births were 30.9% for WA compared to 29.3% in this study.

Table 4.3.1 shows that women who consumed alcohol in pregnancy were more likely to be aged 30 years and over and from a higher income family (54.3%, p=0.001). A greater proportion of Caucasian women drank during pregnancy (92.3%, p<0.001). Alcohol consumption was also associated with attendance at antenatal classes (72.9%, p=0.003).

Table 4.3.1 Characteristics of drinking and non-drinking women during pregnancy (n=587) Figures are percentages if not otherwise stated

	n=	Percentage drinking	Women who did not drink in pregnancy (n=377)	Women who did drink during pregnancy (n=208)	p[a]
Maternal age (yr)					
<20	32	15.6	7.2	2.4	0.001
20 – 24	122	24.6	24.4	14.4	
25 – 29	169	35.5	28.9	28.8	
30 – 35	177	44.1	26.3	37.5	
35+	85	41.2	13.3	16.8	
Family income level (AUD)					<0.001
<$15000	133	19.5	29.0	12.8	
$15000 - $25000	181	30.4	34.1	27.1	
$25 000 - $40000	102	44.1	15.4	22.2	
>$40000	156	49.4	21.4	37.9	
Marital status					0.045
never married	39	20.5	8.2	3.8	
married/defacto	538	37.0	89.8	95.7	
divorced/separated/married	8	12.5	1.9	0.5	
Education level					0.760
did not complete highschool	210	34.3	36.6	34.6	
completed highschool or trade	306	36.9	51.2	54.3	
bachelor degree or higher	69	33.3	12.2	11.1	
Mother's occupation					<0.001
admin/mgr/professional /paraprofessional	113	44.2	16.7	24.0	
clerical/sales/personal services	327	37.6	54.1	59.1	
trades/labourer/plant operator	71	33.8	12.5	11.5	
other[b]	74	14.9	16.7	5.3	
Parity					0.661
Primiparous	215	34.4	37.4	35.6	
Multiparous	370	36.2	62.6	64.4	

Country of birth					<0.001
Aust/New Zealand	427	38.2	71.2	78.4	
UK/Ireland	53	54.7	6.5	13.9	
Asia	59	11.9	14.0	3.4	
Other[c]	40	22.5	8.4	4.3	
Smoking in pregnancy					0.824
Non-smoker	427	35.6	73.9	26.1	
Smoker	153	36.6	73.1	26.9	
Timing of pregnancy					0.341
Planned	279	38.7	47.5	52.7	
Mistimed	181	32.0	34.2	28.3	
Unplanned	105	37.1	18.3	19.0	
Mother attend antenatal classes for this or previous pregnancy					0.003
No	203	27.5	39.1	27.1	
Yes	380	39.7	60.9	72.9	

[a]Chi-square test
[b]Includes self-employed, disabled/invalid pension, student, home duties, unemployed, other pensions.
[c]Includes women from Europe, Africa, South America, North America and small island nations.

Table 4.3.2 presents the amount of alcohol consumed before pregnancy, during pregnancy and during the postpartum period. Three hundred and ninety five women (67.3%) reported drinking alcohol before pregnancy. This decreased to 208 women (35.4%) during pregnancy with almost a third of women (31.9%) discontinuing drinking at this time.

Table 4.3.2 Alcohol use before and during pregnancy; and in lactating women reporting 'any breastfeeding' at 4, 6 and 12 months postpartum (%)

	Before pregnancy (n=587)	During pregnancy (n=587)	4 mo postpartum n=587		6 mo postpartum		12 mo postpartum	
Any Breastfeeding			Yes (n=287)	No (n=199)	Yes (n=251)	No (n=232)	Yes (n=111)	No (n=344)
Any alcohol	395 (67.3)	208 (35.4)	134 (46.7)	86 (43.2)	119 (47.4)	120 (51.7)	47 (42.3)	174 (50.6)
Standard drinks/week								
0 – 2.0	189 (47.8)	171 (82.2)	80 (59.7)	42 (48.8)	68 (57.1)	59 (49.2)	30 (63.8)	74 (42.5)
2.1 – 6.9	109 (18.6)	29 (13.9)	40 (29.9)	26 (30.2)	32 (26.9)	37 (30.8)	13 (27.7)	61 (35.1)
7.0 or more	97 (24.6)	8 (3.8)	14 (10.4)	18 (20.9)	19 (16.0)	24 (20.0)	4 (8.5)	39 (22.4)
NHMRC Risk levels[a]								
Up to 2 std drinks	233 (59.0)	192 (92.3)	104 (77.6)	52 (60.5)	88 (73.9)	66 (55.0)	36 (76.6)	88 (50.6)
3 to 4 std drinks	99 (25.1)	13 (6.3)	24 (17.9)	26 (13.1)	24 (20.2)	39 (16.8)	11 (23.4)	73 (21.2)
More than 5 std drinks	63 (15.9)	3 (0.2)	6 (4.5)	8 (9.3)	7 (5.9)	15 (6.5)	0	13 (3.8)

[a]NHMRC risk levels: Low risk: up to 2 standard drinks/day, Risky: 3 to 4 standard drinks/day, High risk: more than 5 standard drinks/day

Before pregnancy median alcohol intake was two standard drinks on each occasion (mean=2.9 standard drinks/occasion). After recognition of pregnancy the median alcohol intake was one standard drink per occasion (mean=1.5 standard drinks/occasion). Alcohol intake before pregnancy ranged from half a standard drink to 19.5 standard drinks. This range decreased to half a standard drink to 9.5 standard drinks during pregnancy. The number of days that women consumed alcohol also decreased from a mean of 1.7 days per week before pregnancy (median=1.0 day/week) to a mean of one day per week (median=1.0 day/week) during pregnancy.

Prior to pregnancy 47.8% of women consumed less than two standard drinks per week however this increased to 82.2% during pregnancy. Prior to pregnancy approximately 25% of women were drinking above national recommendations for pregnancy however this decreased to approximately 4% during pregnancy. Less than 7% of pregnant women were drinking at levels considered 'risky' and/or 'high risk' for harm in the long term for the general population.

The majority of breastfeeding women who consumed alcohol at four, six and twelve months postpartum reported consuming up to two standard drinks per week. At four and six months postpartum more than 10% of the sample of breastfeeding women were consuming more than the recommended seven standard drinks per week. At all postpartum time points a greater proportion of non-breastfeeding women were consuming more than two standard drinks compared to women reporting any breastfeeding.

Using the NHMRC alcohol guidelines for risk in the long-term, a small proportion of breastfeeding women were drinking at levels considered risky at four (17.9%), six (20.2%) and twelve (23.4%) months postpartum. Very few women were drinking at high risk levels at four (4.5%), six (5.9%) and twelve (0%) months postpartum.

Of those women who consumed alcohol throughout the study most women reported drinking alcohol before or with the evening meal (46.2%). Two women (1.3%) ever reported drinking alcohol just before a breastfeed (see Table 4.3.3). Wine and champagne were the main alcohol types consumed by breastfeeding mothers followed by regular beer or cider (see Table 4.3.4).

Table 4.3.3 Time of alcohol consumption of breastfeeding mothers (%)

Time	1 month (n=158)	4 months (n=134)	6 months (n=119)	12 months (n=47)
Just before or with evening meal	73 (46.2)	82 (61.2)	86 (72.3)	36 (76.6)
Just after breastfeeding	39 (24.7)	28 (20.9)	9 (7.6)	4 (8.5)
In between breastfeeds	26 (16.5)	10 (7.5)	11 (9.2)	4 (8.5)
No particular time	15 (.5)	10 (7.5)	8 (6.7)	-
Just before breastfeeding	2 (1.3)	-	-	-
Various	3 (1.9)	4 (3.0)	5 (4.2)	3 (6.4)

Table 4.3.4 Main alcohol type of breastfeeding mothers (%)

	1 month	4 months	6 months	12 months
Wine/champagne	76 (48.1)	59 (44.0)	61 (51.3)	22 (46.8)
Beer/cider reg	24 (15.2)	23 (17.2)	12 (10.1)	2 (4.3)
Beer/cider light	13 (8.2)	15 (11.2)	11 (9.2)	6 (12.8)
Spirits	19 (12)	22 (16.4)	20 (16.8)	13 (27.7)
Premix/Alcopops[b]	13 (8.2)	8 (6.0)	10 (8.4)	3 (6.4)
Others[a]	13 (8.2)	7 (5.2)	5 (4.2)	1 (2.1)
Total	158 (100)	134 (100)	119 (100)	47 (100)

4.4 Discussion

This prospective study provides information about the alcohol consumption patterns of a cohort of women during pregnancy and after giving birth. A total of 35.4% of women reported drinking alcohol during pregnancy in this study, with 3.8% drinking above national recommendations for pregnancy (National Health and Medical Research Council 2001). The proportion of women consuming alcohol is lower than reported in earlier Australian research (Bell & Lumley 1989; Condon & Hilton 1988; Kwok et al. 1983) and this decrease is most likely due to a greater public health awareness of consuming alcohol during pregnancy (National Health and Medical Research Council 1992).

The National Drug Strategy Household Surveys (NDSHS) asks respondents about their alcohol consumption in the previous twelve months. Results from our study differ considerably from the NDSHS in which 64% and 62% of pregnant women reported drinking in the 2001 and 2004 NDSHS, respectively (Australian Institute of Health and Welfare 2003, 2005c). The difference in results is most likely due to the difference in methodology between the NDSHS survey and the PIFSII questions. The quantity frequency (QF) method used in the NDSHS involves asking respondents the volume of alcohol they usually consume and how frequently they consume alcohol (with responses ranging from daily, several times a week, weekly, monthly, and less often). Whereas the questions in the PIFSII were based on the NHS which uses a Diary method and involves asking respondents to recall the quantities of alcohol they consumed over a specific time period, typically the last seven days (Clemens, Donath & Stockwell 2006)

Internationally figures range from 41.6% in New Zealand (Counsell, Smale & Geddis 1994) to 62% in the United Kingdom (Waterson & Murray-Lyon 1989) of women drinking during pregnancy. In America, the Centers for Disease Control and Prevention (CDC) Behavioral Risk Factor Surveillance System (BRFSS) have reported figures of any alcohol use by pregnant women in the previous 30 days of 12.4% in1991, 16.3% in1995 and 10.1% in 2002 (Centers for Disease Control and Prevention 2002).

However comparisons of alcohol consumption levels between studies should be interpreted with caution due to differences in research methodology and reporting of alcohol intake (Stockwell et al. 2004).

Wine was the most popular beverage choice for pregnant women in this study which is not dissimilar to previous research from England and America (Streissguth et al. 1983; Waterson & Murray-Lyon 1989). Prior to pregnancy wine and spirits were equally as popular however spirit consumption decreased dramatically during pregnancy. It is likely that spirits are perceived as being a stronger drink and are therefore avoided during pregnancy.

As in other studies (Bell & Lumley 1989; Counsell, Smale & Geddis 1994; Kesmodel et al. 2003; Kwok et al. 1983) our study also showed a predominance of drinkers in the older age groups, higher income and employment levels, in married women, and in those of Caucasian origin. These women do not fit the stereotype of women at risk of adverse pregnancy outcomes and consequently practitioners need to bear this in mind when developing and targeting screening and intervention programs.

It is possible that drinking may be more acceptable among women from higher socio-economic groups and that these women attend more social occasions where alcohol is available. Alternatively, these women may have a greater amount of disposable income to spend on alcohol (Counsell, Smale & Geddis 1994).

The proportion of lactating women consuming alcohol was 46.7% at four months postpartum, 47.4% at six months postpartum and 42.3% at twelve months postpartum. Although there were slightly less women drinking and breastfeeding at 12 months postpartum; than at four months (95% CI: -0.154 to 0.066); and six months postpartum (95% CI: -0.165 to 0.063), this difference in intake was not significant. In contrast the 2001 and 2004 NDSHS report 72% and 70% of lactating women consuming alcohol during lactation, respectively (Australian Institute of Health and Welfare 2003, 2005b). A figure of 80% of women breastfeeding at six months postpartum and consuming alcohol has been reported internationally (Avlik, Haldorsen & Lindemann 2006).

The majority of breastfeeding women were consuming alcohol within levels recommended by the NHMRC for lactating women, however there remained a small proportion that drank above this level. Almost a quarter of the lactating women drank at levels considered 'risky' and/or 'high risk' for harm in the long term throughout the period of lactation whereas less than 7% drank at this level during pregnancy (National Health and Medical Research Council 2001). However it is a limitation of the study questionnaire that lactating mothers were not specifically asked how many standard drinks they consumed each day as opposed to 'each time' or 'drinking occasion', and future research should endeavour to align more closely with relevant alcohol consumption guidelines for ease of analysis and comparison.

Depending on the timing of consumption both breastfeeding and non-breastfeeding women may be putting their infant at risk through not being able to exhibit the level of concern or responsiveness required to care for a young infant. More specifically breastfeeding women may have a lower tolerance to alcohol if they have abstained or reduced their alcohol use during pregnancy. Further to this, the potentially harmful effects of high levels of alcohol conveyed through the breastmilk to the infant are also of concern.

Most women consumed alcohol before or with the evening meal however the authors were unable to determine this time in relation to breastfeeding with only two women ever reported drinking alcohol just before a breastfeed. It appears therefore that women in this study maybe conscious of not breastfeeding when the alcohol content of their milk is at its peak. In previous research from Canada, 38% of women reported drinking before or during a breastfeed as advised by health professionals to relax the mother and aid the letdown reflex (Davidson, Alden & Davidson 1981). Given that most of the women were not exclusively breastfeeding it is possible that the women were timing their alcohol intake with formula feeds. Future research should include more detailed data on alcohol intake, and feeding timing and type to overcome this limitation.

A further limitation of the study is having less than 60% of eligible women participate. Nevertheless, the sample size is still relatively large (>500), and there was no significant difference in maternal age and level of education between participant and non-participants, suggesting that the sample was representative of the population from which it was drawn. This study excluded those women with serious health conditions, which may have biased the sample, however, this represented only 5% of the eligible population and hence may be negligible.

This study presents data detailing alcohol consumption during the period of lactation not previously reported in the research literature. In addition, it provides the latest detailed data on alcohol intake during pregnancy on Australian women in almost two decades.

As in most studies of alcohol consumption, all intakes were self-reported during a telephone interview, and actual intake may have been underreported particularly during the antenatal period when there is an increased stigma associated with drinking. In addition, given the close proximity of the baseline survey to the infant delivery, there may be the potential for recall bias regarding pre-natal and antenatal alcohol intake of the mothers. Nevertheless, self-reported alcohol consumption using a telephone interview is considered to be reasonably accurate compared with self-administered questionnaires (Kesmodel & Frydenberg 2004).

4.5 Conclusions

The majority of pregnant and breastfeeding women consume alcohol at levels recommended by national authorities, however there is a small proportion of women who consume alcohol at higher levels. Considerable education opportunities still exist antenatally for promoting ‘safe’ alcohol consumption, particularly aimed at those with characteristics identified here. The potential health and developmental risks to the infant and mother of drinking alcohol during lactation is a relatively unfamiliar area for lactating women and the development of guidelines for 'safe' alcohol consumption at this time is an area for further public health education.

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References

Adhikari, P & Summerill, A 2000, *1998 National Drug Strategy Household Survey: Detailed findings.*, Australian Institute of Health and Welfare, Canberra, AIHW Cat no. PHE 27 (Drug Statistics Series No. 6). http://www.aihw.gov.au/publications/health/ndshs98d/index.html.

Australian Bureau of Statistics 1991, *National Health Survey Questionnaire 1989-1990*, Canberra.

Australian Bureau of Statistics 1995, *National Health Survey, Australia 1995, Basic Confidentialised Unit Record File*, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics 2002, *National Health Survey 2001: Summary of results*, Australia Bureau of Statistics, Canberra, ABS 4364.0.

Australian Institute of Health and Welfare 2003, *Statistics on drug use in Australia 2002*, AIHW, Canberra., (Drug Statistics Series No. 12.). http://www.aihw.gov.au/publications/index.cfm/title/8390.

Australian Institute of Health and Welfare 2005a, *2004 National Drug Strategy Household Survey: First Results. AIHW Cat no. PHE 57*, AIHW (Drug Statistics Series No. 13), Canberra.

Australian Institute of Health and Welfare 2005b, *Statistics on drug use in Australia 2004*, AIHW, Canberra, (Drug Statistics Series No. 15). http://www.aihw.gov.au/publications/index.cfm/title/10143.

Avlik, A, Haldorsen, T & Lindemann, R 2006, 'Alcohol consumption, smoking and breastfeeding in the first six months after delivery', *Acta Paediatrica,* vol. 95, pp. 686-93.

Bell, R & Lumley, J 1989, 'Alcohol consumption, cigarette smoking and fetal outcome in Victoria, 1985', *Community Health Studies,* vol. 8, no. 4, pp. 484-91.

Centers for Disease Control and Prevention 2002, *Alcohol use among women of childbearing age - United States, 1991-1999*, Centers for Disease Control and Prevention, Atlanta. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5113a2.htm#fig1

Clemens, S, Donath, S & Stockwell, T 2006, *Alcohol consumption in Australia; national surveys from 1989 to 2001*, Curtin University of Technology, Perth.

Condon, J & Hilton, C 1988, 'A comparison of smoking and drinking behaviours in pregnant women: who abstains and why', *The Medical Journal of Australia,* vol. 148, pp. 381-5.

Counsell, A, Smale, P & Geddis, D 1994, 'Alcohol consumption by New Zealand women during pregnancy', *The New Zealand Medical Journal,* vol. 107, no. 982, pp. 278-81.

Davidson, S, Alden, L & Davidson, P 1981, 'Changes in alcohol consumption after childbirth', *Journal of Advanced Nursing,* vol. 6, pp. 195-8.

Ebrahim, S, Luman, E, Floyd, R, Murphy, C, Bennett, E & Boyle, C 1998, 'Alcohol consumption by pregnant women in the United States during 1988-1995', *Obstetrics and Gynecology,* vol. 92, pp. 187-92.

Giglia, RC & Binns, CW 2006, 'Alcohol and lactation: a systematic review', *Nutrition and Dietetics,* vol. 63, pp. 103-16.

Graham, KI, Scott, JA, Binns, CW & Oddy, WH 2005, 'National targets for breastfeeding at hospital discharge have been achieved in Perth', *Acta Paediatrica,* vol. 94, pp. 352-6.

Hard, M, Einarson, T & Koren, G 2001, 'The role of acetaldehyde in pregnancy outcome after prenatal alcohol exposure', *Theraputic Drug Monitoring,* vol. 23, pp. 286-92.

Kesmodel, U & Frydenberg, M 2004, 'Binge drinking during pregnancy - Is it possible to obtain valid information on a weekly basis?' *American Journal of Epidemiology,* vol. 159, no. 8, pp. 803-8.

Kesmodel, U, Kesmodel, P, Larsen, A & Secher, N 2003, 'Use of alcohol and illicit drugs among pregnant Danish women, 1998', *Scandinavian Journal of Public Health,* vol. 31, pp. 5-11.

Kwok, P, Correy, J, Newman, N & Curran, J 1983, 'Smoking and alcohol consumption during pregnancy: an epidemiological study in Tasmania', *Medical Journal of Australia,* vol. 1, no. March 5, pp. 220-3.

Laws, PJ & Sullivan, EA 2005, *Australia's mothers and babies 2003. AIHW Cat. No. PER 29*, AIHW National Perinatal Statistics Unit (Perinatal Statistics Series No. 16), Sydney.

Little, R, Anderson, K, Ervin, C, Worthington-Roberts, B & Clarren, S 1989, 'Maternal alcohol use during breast-feeding and infant mental and motor development at one year', *N Engl J Med,* vol. 321, pp. 425-30.

Little, R, Lambert, M & Worthington-Roberts, B 1990, 'Drinking and smoking at 3 months postpartum by lactation history', *Paediatric and Perinatal Epidemiology,* vol. 4, pp. 290-302.

Little, R, Northstone, K & Golding, G 2002, 'Alcohol, breastfeeding, and development at 18 months', *Pediatrics,* vol. 109, no. 5, p. e72.

Mennella, J & Garcia-Gomez, P 2001, 'Sleep disturbances after acute exposure to alcohol in mother's milk', *Alcohol,* vol. 25, pp. 153-8.

Mennella, J, Pepino, M & Teff, K 2005, 'Acute alcohol consumption disrupts the hormonal milieu of lactating women', *The Journal of Clinical Endocrinology and Metabolism,* vol. 90, no. 4, pp. 1979-85.

National Health and Medical Research Council 1992, *Dietary Guidelines for Australians*, Commonwealth of Australia, Canberra.

National Health and Medical Research Council 2001, *Australian Alcohol Guidelines: Health Risks and Benefits*, National Health and Medical Research Council, Canberra.

Scott, J, Binns, C, Graham, K & Oddy, W 2006a, 'Temporal changes in the determinants of breastfeeding initiation', *Birth,* vol. 33, no. 1, pp. 37-45.

Scott, J, Binns, C, Oddy, W & Graham, K 2006b, 'Predictors of breastfeeding duration: evidence from a cohort study', *Pedatrics,* vol. 117, no. 4, pp. e646-e55.

Scott, JA, Aitkin, I, Binns, CW & Aroni, RA 1999, 'Factors associated with the duration of breastfeeding amongst women in Perth, Australia', *Acta Paediatr,* vol. 88, no. 4, pp. 416-21.

Stockwell, T, Donath, S, Cooper-Standbury, M, Chikritzhs, T, Catalano, P & Mateo, C 2004, 'Under-reporting of alcohol consumption in household surveys: a comparison of quantity-frequency, graduated frequency and recent recall', *Addiction,* vol. 99, pp. 1024-33.

Streissguth, A, Darby, B, Barr, H, Smith, J & Martin, D 1983, 'Comparison of drinking and smoking patterns during pregnancy over a six-year interval', *American Journal of Obstetrics and Gynecology,* vol. 145, pp. 716-24.

U.S. Department of Health and Human Services, SAaMHSA 2006, *SAMHSA Fetal Alcohol Spectrum Disorders Centre for Excellence*, Rockville. http://www.fascenter.samhsa.gov/

Waterson, EJ & Murray-Lyon, IM 1989, 'Drinking and smoking patterns amongst women attending an antenatal clinic - II. During pregnancy', *Alcohol and Alcoholism,* vol. 24, no. 2, pp. 163-73.

World Health Organization 1991, Indicators for assessing breastfeeding practices., WHO, Geneva.

Chapter 5 The effect of alcohol intake on breastfeeding duration in Australian women

Abstract

Introduction and Aims

Breastfeeding is the normal way to feed infants and it is recommended that mothers continue to breastfeed exclusively for up to six months of age. Many physiological and psychological factors affect a mother's ability and willingness to reach this breastfeeding milestone. Alcohol use is widespread throughout many cultures and there is limited information in the research literature on the effects of alcohol intake on lactation. More specifically the effect that alcohol has on breastfeeding initiation and duration has not been reported for almost a decade. The objective of this study was to evaluate the relationships between alcohol consumption and breastfeeding initiation and duration.

Design and Methods

A 12 month longitudinal study was conducted in two public hospitals with maternity wards in Perth, Australia between mid-September 2002 and mid-July 2003. While in hospital, participating mothers completed a self-administered baseline questionnaire. Follow up telephone interviews were conducted at 4, 10, 16, 22, 32, 40 and 52 weeks.

Results

After 6 months of follow up, women who consumed alcohol at levels of more than two standard drinks per day were almost twice as likely to discontinue breastfeeding earlier than women who drank below these levels (HR 1.9, 95% CI 1.1 to 3.0).

Discussion and Conclusions

Consuming alcohol in excess of two standard drinks per day during lactation was found to be independently associated with shorter breastfeeding duration, even after consideration of previously identified predictors of breastfeeding duration. Guidelines that provide direction on safe alcohol consumption for lactating mothers may help support extended breastfeeding duration.

Key words: alcohol, lactation, breastfeeding, duration

(Final publication accepted after thesis submission. See Appendix 7 for final text.)

5.1 Background

Breastfeeding initiation and duration are influenced by a myriad of factors, both modifiable and non-modifiable. Maternal age, ethnicity, social class, marital status, educational attainment and parity are all non-modifiable factors shown to influence breastfeeding initiation and duration (Peat et al. 2004). Deciding to breastfeed prior to pregnancy, family and partner support for breastfeeding, early return to work and smoking are modifiable factors shown to be associated with breastfeeding initiation and duration (Giglia & Binns 2006a; Scott et al. 2006b; Scott et al. 2001).

In Australia, alcohol is an accepted part of Australian culture and is widely consumed. On a daily basis approximately 6% of Australian females, and on a weekly basis 35%, of Australian females consume alcohol (Australian Institute of Health and Welfare 2005b). Many of these women are of childbearing age. Drinking alcohol during pregnancy is clearly implicated in the development of Foetal Alcohol Syndrome (FAS) and adverse pregnancy outcomes (New South Wales Department of Health (Ed.) 2006; O'Leary 2004). A review of the literature found that alcohol in the breastmilk can result in a deficit in motor development, reduced lactational performance and disrupted sleep-wake behavioural patterning of the infant (Giglia & Binns 2006a). However research on the relationship between alcohol consumption and breastfeeding initiation and duration is limited.

The objective of this paper was to evaluate the relationships between alcohol consumption and breastfeeding initiation and duration.

5.2 Methods

5.2.1 Sample

The second Perth Infant Feeding Study (PIFSII) was conducted between September 2002 and July 2003. The study was conducted in the same hospitals using the same methodology as the first PIF Study (PIFSI)(Scott et al. 1999) and results from the PIFSII have been reported (Graham et al. 2005; Scott et al. 2006a; Scott et al. 2006b).

Mothers were contacted within the first three days following the birth of their infant. Women were considered eligible for the study if they had delivered a live infant free of any serious health conditions requiring transfer to the neonatal intensive care unit at Perth's major maternity hospital.

Those women agreeing to participate in the study completed the self-administered baseline questionnaire while in hospital or shortly after discharge. The completed mother's questionnaire was collected either from the mother prior to her discharge from hospital or alternatively from a sealed box on the ward or posted back directly to the university within a week. Women declining to participate were asked to provide some basic socio-demographic data in order to determine the representativeness of the sample.

In the baseline questionnaire women were asked if they consumed alcohol before and during pregnancy. If they responded in the affirmative they were asked how often (days/week) they usually drank alcohol and how many standard drinks they usually consumed at each drinking occasion. Participants were asked the type of alcohol they consumed most frequently and were provided with a list of standard drink sizes.

All women regardless of their chosen infant feeding method were followed up by trained telephone interviewer at 4, 10, 16, 22, 32, 40 and 52 weeks postpartum.

At each postpartum follow up telephone interview participants were asked if they were drinking alcohol at present, how often they had consumed alcohol in the previous two weeks, and how many standard drinks and the type of alcoholic beverage they had on these drinking occasions. Participants were prompted with standard drink serve sizes (volumes and measures) by the interviewer for different alcoholic beverages. Unusual responses (e.g. very high alcohol intake) were noted and followed up at a subsequent interview.

One Australian standard drink is equivalent to 10g (12.5ml) alcohol (National Health and Medical Research Council 2001). Questions relating to alcohol intake were modelled on the 1989/1990 National Health Survey (NHS) (Australian Bureau of Statistics 1991).

5.2.2 Statistical analysis

Data were entered and analysed using the Statistical Package for Social Sciences, Version 11.0 (SPSS for Windows, SPSS Inc., Chicago, IL, USA). Estimation of odds ratios was performed by univariate analysis to examine the crude association between sociodemographic, biomedical and psychosocial characteristics of the mother and drinking alcohol at 4, 16, 22 and 40 weeks postpartum.

The relationship between drinking alcohol before and during pregnancy with breastfeeding initiation was initially investigated using univariate analysis. Variables previously identified by the research team as being associated with breastfeeding initiation for this sample population were included in the development of the multivariate statistical models (Scott et al. 2006a). These included; mother's education level, when the feeding method was decided, maternal Iowa Infant Feeding Attitude Scale (IIFAS) score, parity and father's feeding method preference. These factors were controlled for in the multivariate logistic regression models developed to evaluate the relationship between alcohol intake before, and during pregnancy with breastfeeding initiation.

Alcohol intake in the postpartum period was defined using the NHMRC guidelines for risk of harm in the long term for the general population. For this categorisation it was assumed that 'per occasion' consumption of alcohol corresponded to 'per day' consumption of alcohol. The number of drinks were categorised as 'low risk' (up to two standard drinks per day); 'risky' (three to four standard drinks per day); and 'high risk' (five or more standard drinks per day). The categories of risky and high risk consumption were combined for ease of comparison with Guideline 11 which is recommended for 'women who are pregnant or might soon become pregnant' as well as breastfeeding women (National Health and Medical Research Council 2001) (see Box 1). It should be noted that the NHMRC does not recommend these levels of consumption for pregnant women. Missing values were not recoded as zero as this would falsely elevate the number of women who reported not drinking.

Analysis of the relationship between breastfeeding duration and the level of postpartum alcohol intake, using follow-up data to six months, was investigated in a regression analysis using a Cox hazards model with repeated measures for alcohol consumption. In order to allow that participants may change their alcohol consumption over time, this variable was introduced in the model as a time-dependent variable in the analysis. Additional variables included in the final model were level of alcohol intake, breasfeeding problems at or before four weeks, age of the infant at which a pacifier was introduced, smoking during pregnancy and maternal Iowa Infant Feeding Attitude Scale (IIFAS) score. These have previously been found to be significant by the research team (Scott et al. 2006b) when investigating fully breastfeeding to six months and any breastfeeding to twelve months. Intended duration was not in the multivariate model as it has been argued that as intended duration of breastfeeding lies directly on the causal decision-making pathway and should not be included in any multivariate model investigating the duration of breastfeeding (Peat et al. 2004).

The six month time period was chosen for analysis in an effort to capture the majority of breastfeeding women as previous research and national monitoring has shown that the majority of women will have ceased breastfeeding by this time (Donath & Amir 2005; Scott et al. 2006b). The Iowa Infant Feeding Attitude Scale

(IIFAS) is a 17 item scale which measures attitudes towards both breast and formula feeding with regards to the health and nutritional benefits, and the cost and convenience of each method. It has been shown previously to be a valid and reliable measure of infant feeding attitudes amongst women in the USA (De la Mora et al. 1999) and Scotland (Scott, Shaker & Reid 2004). Each item is measured on a 5-point scale and total scores could range from 17 (reflecting positive formula feeding attitudes) to a high of 85 (indicating attitudes that favour breastfeeding).

Only women reporting 'any breastfeeding' were included in the univariate and multivariate analysis. Any breastfeeding included those infants who received both breastmilk and other milk feeds or solid foods (World Health Organization 1991). This level of breastfeeding was chosen in order to capture the majority of breastfeeding women throughout the study period.

5.2.3 Ethical considerations

The PIFSII was approved by the Human Ethics Committee of Curtin University and the Research Ethics Committees of the two participating hospitals. Signed informed consent was obtained from participants.

5.3 Results

Overall, of the 1068 women eligible to participate 870 were contacted and 587 completed baseline questionnaires and were followed-up, representing 68% of women contacted. No significant differences were found in the age or level of education of participants compared with non-participants.

A total of 551 women reported any breastfeeding at discharge. This represents 94% of the 587 women who participated in the PIFSII. Throughout the study period the number of women reporting any breastfeeding decreased. The proportion of women reporting 'any breastfeeding' at various time points throughout the study are presented in Table 5.3.1.

Table 5.3.1 Women reporting any breastfeeding[8] at 4, 16, 22 and 40 weeks (n=587)

	Number of women breastfeeding	% of subjects (95% confidence interval)
At discharge	551	93.8% (91.9-95.7)
4 weeks	431	78.2% (74.8-81.6)
16 weeks	325	58.9% (54.8-63.0)
22 weeks	284	51.5% (47.3-51.9)
40 weeks	182	33.0% (30.0-37.0)

The association between drinking alcohol before and during pregnancy, and initiating breastfeeding was explored using multivariate logistic analysis. Drinking during pregnancy was significantly associated with initiating breastfeeding, however this was no longer significant after adjusting for potential confounding covariates (crude OR 3.6, 95% CI 1.4, 9.5, adjusted OR 2.3, 95% CI 0.8, 6.4).

Tables 5.3.2 and 5.3.3 present the characteristics of the women who drank alcohol and reported any breastfeeding throughout the postpartum period. Women who consumed alcohol during pregnancy were significantly more likely to consume alcohol during lactation. A greater proportion of women who drank alcohol and breastfed were from a higher income family. Alcohol consumption was also associated with attendance at antenatal classes. Women least likely to consume alcohol in the postpartum period were of Asian origin, and more likely to be self employed, unemployed, receiving a pension, studying or carrying out home duties.

[8] Any breastfeeding included those infants who received both breastmilk and other milk feeds or solid foods

Table 5.3.2 Percentage and univariate odds ratios (95% confidence intervals) for drinking at 4 and 16 weeks postpartum among breastfeeding women

	Week 4				Week 16			
	n	Drinking		OR	n	Drinking		OR
		Yes	No			Yes	No	
Maternal age (yr)								
<25	104	22.5	29.2	1	68	21.3	26.4	1
>25	289	77.5	70.8	1.4 (0.9-2.3)	216	78.7	73.6	1.3 (0.8-2.3)
Maternal education level								
did not complete high school	120	30.6	30.5	1	85	30.9	29.1	1
completed high school or trade	216	56.3	54.1	1.0 (0.7-1.6)	150	50.7	54.7	0.9 (0.5-1.5)
bachelor degree or higher	57	13.1	15.5	0.8 (0.4-1.6)	49	18.4	16.2	1.1 (0.5-2.2)
Family income level (AUD)								
<$15000	82	13.9	26.1	1	50	11.2	24.0	1
$15000 - $25000	116	25.9	32.6	1.5 (0.8-2.8)	87	28.4	33.6	1.8 (0.9-3.8)
$25 000 - $40000	74	18.4	19.6	1.8 (0.9-3.5)	56	20.1	19.9	2.2 (1.0-4.8)
>$40000	116	41.8	21.7	3.6 (2.0-6.6)	87	40.3	22.6	3.8 (1.8-8.0)
Mother's occupation								
admin/manager/ professional/ paraprofess	84	25	18.9	1	70	26.5	23.0	1
clerical/sales/personal services	230	59.4	57.9	0.8 (0.5-1.3)	146	57.4	45.9	1.1 (0.6-1.9)
trades/labourer/plant operator	43	9.4	12.0	0.6 (0.3-1.3)	37	9.6	16.2	0.5 (0.2-1.2)
other[b]	36	6.3	11.2	0.4 (0.2-1.0)	31	6.6	14.9	0.4 (0.2-1.0)
Marital status								
single/divorced/separated/widow	23	3.1	7.7	1	12	4.4	6.8	1
married/defacto	370	96.9	92.3	2.6 (0.9-7.1)	268	95.6	93.2	1.6 (0.6-4.4)
Mother's country of birth								
Aust/New Zealand	276	73.8	69.0	1	203	77.9	67.4	1

UK/Ireland	36	12.5	7.0	1.7 (0.8-3.4)	24	9.6	7.6	1.1 (0.5-2.5)
Asia	45	3.1	17.5	0.2 (0.06-0.4)	28	2.9	16.7	0.2 (0.05-0.5)
Other[c]	32	10.6	6.6	1.5 (0.7-3.2)	25	9.6	8.3	1.0 (0.4-2.3)
Maternal alcohol intake during pregnancy								
Non-drinker	237	17.2	82.8	1	158	79.1	34.1	1
Drinker	160	72.5	27.5	12.7 (7.8-20.7)	126	20.9	65.9	8.7 (5.1-15.0)
Attend antenatal classes for this or a previous pregnancy								
No, never	115	21.4	34.9	1	80	21.6	34.5	1
Yes	276	78.6	65.1	2.0 (1.2-3.1)	202	78.4	65.5	1.9 (1.1-3.2)

[†]Significant at $p \leq 0.05$. Significant figures in bold
[a]Includes self-employed, disabled/invalid pension, student, home duties, unemployed, other pensions.
[b]Includes women from Europe, Africa, South America, North America and small island nations.

Table 5.3.3 Percentage and univariate odds ratios (95% confidence intervals) for drinking at 22 and 40 weeks postpartum among breastfeeding women

	Week 22				Week 40			
	n	Drinking		OR	n	Drinking		OR
		Yes	No			Yes	No	
Maternal age (yr)								
<25	60	20.3	27.6	1	34	11.9	28.6	1
>25	190	79.7	72.4	1.5 (0.8-2.7)	124	88.1	71.4	3.0 (1.2-7.0)
Maternal education level								
did not complete high school	73	29.3	29.1	1	52	31.3	34.1	1
completed high school or trade	130	52.8	51.2	1.0 (0.6-1.8)	72	41.8	48.4	0.9 (0.5-1.9)
bachelor degree or higher	47	17.9	19.7	0.9 (0.4-1.9)	34	26.9	17.6	1.7 (0.7-4.0)
Family income level (AUD)								
<$15000	45	10.7	25.2	1	31	6.2	29.7	1
$15000 - $25000	77	30.3	31.5	2.3 (1.0-5.0)	41	23.1	28.6	3.9 (1.1-13.3)
$25 000 - $40000	50	22.1	18.1	2.9 (1.2-6.8)	30	21.5	17.6	5.9 (1.7-21.1)
>$40000	77	36.9	25.2	3.5 (1.6-7.6)	54	49.2	24.2	9.8 (3.0-32.0)
Mother's occupation								
admin/manager/ professional/ paraprofess	62	26.8	22.8	1	38	28.4	20.9	1
clerical/sales/personal services	132	57.7	48.0	1.0 (0.6-1.9)	85	61.2	48.4	0.9 (0.4-2.0)
trades/labourer/plant operator	30	11.4	12.6	0.8 (0.3-1.8)	17	9.0	12.1	0.5 (0.2-1.8)
Other[a]	26	4.1	16.5	0.2 (0.07-0.6)	18	1.5	18.7	0.06 (0.007-0.5)
Marital status								
single/divorced/separated/widow	12	2.4	9.4	1	9	0	9.9	[c]
married/defacto	235	97.6	90.6	4.2 (1.1-15.2)	149	100	90.1	[c]
Mother's country of birth								

Aust/New Zealand	170	70.7	67.5	1	107	74.6	64.0	1
UK/Ireland	24	12.2	7.3	1.6 (0.7-3.8)	16	14.9	6.7	1.9 (0.6-5.6)
Asia	29	5.7	17.9	0.3 (0.1-0.7)	20	7.5	16.9	0.4 (0.1-1.1)
other[b]	23	11.4	7.3	1.5 (0.6-3.6)	13	3.0	12.4	0.2 (0.04-1.0)
Maternal alcohol intake during pregnancy								
Non-drinker	144	34.1	80.3	1	90	29.9	76.9	1
Drinker	106	65.9	19.7	7.9 (4.4-14.0)	68	70.1	23.1	7.8 (3.8-16.0)
Attend antenatal classes for this or a previous pregnancy								
No, never	63	15.7	34.6	1	39	13.4	33.0	1
Yes	185	84.3	65.4	2.8 (1.5-5.2)	119	86.6	67.0	3.2 (1.4-7.2)

[a]Includes self-employed, disabled/invalid pension, student, home duties, unemployed, other pensions.
[b]Includes women from Europe, Africa, South America, North America and small island nations.
[c]Insufficient sample size to calculate OR or CI

Table 5.3.4 shows the regression analysis of breastfeeding duration as a continuous variable in the Cox Hazards model. Women who consumed alcohol at risky to high risk levels were almost twice as likely to discontinue breastfeeding earlier (HR 1.9, 95% CI 1.1 to 3.0) than women who drink at low risk levels, even after adjustment for potential confounders (Figure 5.5.1). Cross tabulation show that a greater proportion of mothers who drank at low risk levels intended to breastfeed for more than six months (59.7%), compared to mothers who drank at risky (38.5%) and high risk levels (37.5%) (χ^2=6.64, df=2, p =0.034).

Table 5.3.4 Breastfeeding duration of at least six months and drinking alcohol during lactation

	Breastfeeding >6 months HR; 95% CI	*p*-value
Drinking alcohol[b] (unadjusted)	2.2 (1.4-3.5)	<0.001
Drinking alcohol[b, c] (adjusted)	1.8 (1.1-2.9)	0.015

HR: hazard ratios were calculated using Cox's regression model with time-dependent covariates
[a]drinking at risky to high risk levels (greater than 2 standard drinks/day)
[b]reference group is 'drinking at low risk levels' (up to 2 standard drinks/day) versus 'drinking at risky/high risk levels'
[c]adjusted for breastfeeding problems at four weeks, age at which a pacifier was introduced, maternal smoking during pregnancy and maternal IIFAS score

5.4 Discussion

This study shows that alcohol intake above levels recommended by the NHMRC during lactation is associated with a shorter duration of breastfeeding in accordance with previous research (Howard & Lawrence 1998; Little, Lambert & Worthington-Roberts 1990a).

The shortened duration of breastfeeding with intakes above two standard drinks per day may potentially be explained by a number of factors. Firstly, exposure to small amounts of alcohol in the mother's milk has been shown to disrupt infant sleeping patterns (Mennella & Garcia-Gomez 2001; Mennella & Gerrish 1998). This in turn may prompt the mother to commence formula feeding and discontinue breastfeeding at this critical time in an effort to placate the infant. Secondly, alcohol is known to decrease the milk ejection reflex through the inhibition of oxytocin. This results in a diminished milk yield in lactating mothers and a decrease in the volume of milk received by the infant, which may further exacerbate their unsettled behaviour (Mennella 1998, 2001b; Mennella, Pepino & Teff 2005). Thirdly, mothers may be wary of the health risks associated with drinking alcohol and breastfeeding. In an effort to reduce these risks and continue to consume alcohol they may voluntarily stop breastfeeding.

Finally is the possibility that mothers who drink at high levels are generally more likely to make poorer health and lifestyle choices. A mother's intention to breastfeed has previously been shown to predict breastfeeding initiation and duration (Donath, Amir & The ALSPAC Study Team 2003; Forster, McLachlan & Lumley 2006). Therefore mother's intention to breastfeed may be considered as an indicator of her own health enhancing behaviours, and a mother who is concerned with her own health is more likely to be concerned with the health of her infant, (Pesa & Shelton 1999) and intend to breastfeed for an extended duration and adhere to recommended or safer alcohol drinking practices. This final theory was tested using a simple cross-tab analysis in which mothers' level of drinking at four weeks postpartum was correlated with mothers' intention to breastfeed (baseline questionnaire). A greater proportion of mothers who intended to breastfeed for more than six months drank at low risk levels compared to mothers who drank at risky and high risk levels.

Internationally recommendations for alcohol intake during pregnancy differ between countries and even between professional groups within a country. For instance, the United States Institute of Medicine National Academy of Sciences (National Academy of Sciences 1991) maintains their outdated advice of over 15 years for lactating women not to exceed 0.5 g of alcohol /kg of maternal weight[9] due to the possible harmful effects on the infant, and partly because of a potential reduction in

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[9] Equivalent to approximately three Australian standard drinks in a 60kg woman.

milk volume. The policy statement from the American Academy of Pediatrics (AAP) recommends, 'Breastfeeding mothers should avoid the use of alcohol beverages, because alcohol is concentrated in breast milk and its use can inhibit milk production. An occasional celebratory, single, small alcoholic drink is acceptable, but breastfeeding should be avoided for 2 hours after the drink' (American Academy of Pediatrics 2005) (p497). The Dietary Guidelines for Americans recommend complete abstinence, stating that 'alcoholic beverages should not be consumed by pregnant and lactating women' (U.S. Department of Health and Human Services and U.S. Department of Agriculture 2005) (p44).

The Health Council of the Netherlands states in their most recent report that alcohol use during breastfeeding has adverse effects on the infant. The Council recommends that mothers who have consumed a standard measure (10g ethanol) of an alcoholic beverage can avoid exposing the nursing child to ethanol by abstaining from breastfeeding for a period of three hours from when the alcohol was consumed or using expressed milk not affected by alcohol. If the mother has consumed a higher amount, the Council suggests the period until the next breastfeed should be longer, and can be calculated by multiplying the three hour period by the number of standard measures of alcohol consumed (Health Council of the Netherlands 2005).

The government of the United Kingdom (UK) Department of Health recommends keeping alcohol intake low, and avoiding drinking alcohol shortly before breastfeeding (Department of Health 2006).

The Health Council of the Netherlands, the AAP and the UK Department of Health are the only institutions providing a guide to the timing of alcohol intake, which supports breastfeeding in women who want to drink alcohol. Interestingly, the amount of alcohol recommended by the United States Institute of Medicine National Academy of Sciences, is an amount that in this study has been implicated with the early cessation of breastfeeding.

The literature is limited with regard to the characteristics of women consuming alcohol during lactation. However, evidence from previous studies on alcohol intake during pregnancy and lactation support our finding that alcohol intake was more common in women from higher income and employment levels (Counsell, Smale & Geddis 1994; Kwok et al. 1983; McLeod et al. 2002; Parackal, Ferguson & Harraway 2007). There was also a predominance of drinkers who had attended antenatal classes. Together, the characteristics of these women do not fit the stereotype of women at risk of high alcohol intake and consequently providing information on alcohol intake and optimum breastfeeding outcomes during antenatal classes would be an excellent opportunity for educating women on alcohol intake during lactation.

This study is the first Australian study to assess the relationship between drinking alcohol before, during and after pregnancy and the associated effect on breastfeeding initiation and duration. However, it needs to be replicated to verify our results, as several limitations of this study exist.

A limitation of this study, as in any study investigating drinking habits, is the method used to collect data on alcohol intake during pregnancy and lactation. Collection of alcohol intake data is problematical and there is no ‘gold standard’ with limitations associated with all of the main methodologies commonly employed.

All alcohol intake data were self-reported during a telephone interview and drinking alcohol may have been underreported particularly during the antenatal period when there is an increased stigma associated with drinking. In addition, research shows reported alcohol intake declines with increasing recall period (Ekholm 2004). As women in this study were asked about antenatal alcohol intake following the birth of their infant it is likely that alcohol intake in this study is underreported and a limitation of this study.

Furthermore alcohol volume may be underestimated and true risk levels of alcohol consumption may be higher than presented here as under-reporting of alcohol consumption is common, both in terms of persons identifying as having drank alcohol in the defined time period, and in the quantities reported (Carruthers & Binns 1992; Kaskutas & Graves 2001). Future prospective studies should include more detailed and descriptive questions to ascertain more comprehensive data on alcohol intake at this time, particularly time of alcohol intake in relation to time of breastfeeding.

Although we have statistically adjusted for known confounders, the possibility of residual confounding is still present, either because some unknown or important predictors were not considered, or because some of the adjusted variables have not been measured with sufficient precision. For example, consideration of factors contributing to residual confounding, such as mothers' knowledge of transfer of alcohol to the breastmilk and the effect on the breastfed infant, were not measured in this research. Future research should examine these additional potential factors that may help further explain the relationship between alcohol consumption during lactation and breastfeeding duration. Nevertheless, despite this limitation the results reported are consistent with the limited data previously reported(Howard & Lawrence 1998) (Little, Lambert & Worthington-Roberts 1990a) which suggests that alcohol consumption at risky levels is negatively associated with breastfeeding duration. This finding is supported also by a number of biologically plausible arguments.

The small number of women reporting any breastfeeding towards the end of the 12 month follow-up period made it difficult to compare the characteristics of drinking and non-drinking women during week 40. Exclusive breastfeeding rates of 80% at six months of age has been set as an objective for Australia and would help foster future research in this area (Binns & Davidson 2003).

Overall, alcohol intake in the postnatal period of more than two standard drinks per day was significantly associated with a shorter breastfeeding duration. Many

Australian women are unaware of the appendage to the NHMRC's Guideline 11 (see Box 1), which urges lactating women to drink at the same levels of pregnant women (up to 2 standard drinks/day) or to consider not drinking at all (Giglia & Binns 2007). Furthermore they may not be aware of the health risks to their infant or the long-term consequence of shortened breastfeeding duration associated with drinking above this level.

5.5 Conclusions

Breastfeeding women who continue to consume alcohol at levels above those recommended are potentially at risk of not meeting their optimal breastfeeding outcomes and of compromising their own health and the growth and development of their infant. Considerable public health gains can be achieved by developing alcohol intake guidelines specific to lactating women, which support safe alcohol intake that in turn promote extended breastfeeding.

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Box 1. Australian Alcohol Guidelines

Guideline 11 Women who are pregnant or might soon become pregnant

11.1 may consider not drinking at all;

11.2 most importantly, should never become intoxicated;

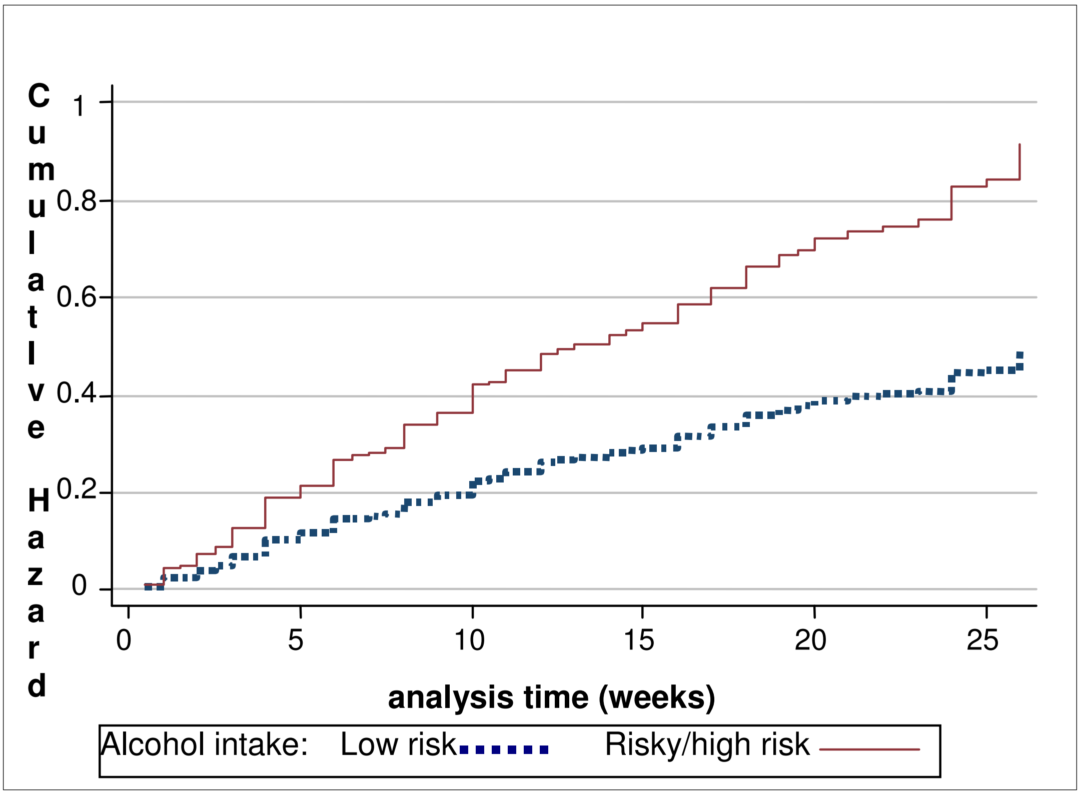
11.3 if they choose to drink, over a week, should have less than 7 standard drinks, AND, on any one day, no more than 2 standard drinks (spread over at least two hours);

11.4 should note that the risk is highest in the early stages of pregnancy, including the time from conception to the first missed period.

Women who are breastfeeding are advised not to exceed the levels of drinking

(National Health and Medical Research Council 2001).

Figure 5.5.1 Adjusted incidence of stopping breastfeeding by alcohol risk



References

American Academy of Pediatrics 2005, 'Breastfeeding and the use of human milk', *Pedatrics,* vol. 115, no. 2, pp. 496-506.

Australian Bureau of Statistics 1991, *National Health Survey Questionnaire 1989-1990*, Canberra.

Australian Institute of Health and Welfare 2005, *2004 National Drug Strategy Household Survey: First Results. AIHW Cat no. PHE 57*, AIHW (Drug Statistics Series No. 13), Canberra.

Binns, CW & Davidson, GP 2003, 'Infant Feeding Guidelines for Health Workers', in NHMRC (ed.), *Food for Health: Dietary Guidelines for Children and Adolescents in Australia*, ISBN 1864961538 edn, NHMRC, Canberra, p. 452.

Carruthers, S & Binns, CW 1992, 'The standard drink and alcohol consumption', *Drug and Alcohol Review,* vol. 11, pp. 363-70.

Counsell, A, Smale, P & Geddis, D 1994, 'Alcohol consumption by New Zealand women during pregnancy', *The New Zealand Medical Journal,* vol. 107, no. 982, pp. 278-81.

De la Mora, A, Russell, D, Dungy, C, Losch, M & Dusdieker, L 1999, 'The Iowa Infant Feeding Attitude Scale: analysis of reliability and validity', *Journal of Applied Social Psychology,* vol. 29, no. 11, pp. 2362-80.

Department of Health 2006, *The Pregnancy Book: 2006 Edition*, Department of Health, London.

http://www.dh.gov.uk/PublicationsAndStatistics/Publications/PublicationsPolicyAndGuidance/PublicationsPolicyAndGuidanceArticle/fs/en?CONTENT_ID=4136417&chk=saaOhH

Donath, S, Amir, L & The ALSPAC Study Team 2003, 'Relationship between prenatal infant feeding intention and initiation and duration of breastfeeding: a cohort study', *Acta Paediatrica,* vol. 92, pp. 352-6.

Donath, S, M & Amir, L, H 2005, 'Breastfeeding and the introduction of solids in Australian infants: data from the 2001 National Health Survey', *Australian and New Zealand Journal of Public Health,* vol. 29, pp. 171-5.

Ekholm, O 2004, 'Influence of the recall period on self-reported alcohol intake', *European Journal of Clinical Nutrition,* vol. 58, pp. 60-3.

Forster, D, McLachlan, H & Lumley, J 2006, 'Factors associated with breastfeeding at six months postpartum in a group of Australian women', *International Breastfeeding Journal,* vol. 1, no. 18.

Giglia, R & Binns, C 2006, 'Patterns of alcohol intake of pregnant and lactating women in Perth, Australia', *in press*.

Giglia, RC & Binns, CW 2007, 'Alcohol and breastfeeding: what do Australian mothers know?' *Asia Pacific Journal of Clinical Nutrition,* vol. 16 (Suppl 1), pp. 473-7.

Graham, KI, Scott, JA, Binns, CW & Oddy, WH 2005, 'National targets for breastfeeding at hospital discharge have been achieved in Perth', *Acta Paediatrica,* vol. 94, pp. 352-6.

Health Council of the Netherlands 2005, *Risks of alcohol consumption related to conception, pregnancy and breastfeeding.*, Health Council of the Netherlands, The Hague.

Howard, C & Lawrence, R 1998, 'Breast-feeding and drug exposure', *Obstetrics and Gynecology Clinics of North America,* vol. 25, no. 1, pp. 195-217.

Kaskutas, LA & Graves, K 2001, 'Pre-pregnancy drinking: how drink size affects risk assessment', *Addiction,* vol. 96, pp. 1199–209.

Kwok, P, Correy, J, Newman, N & Curran, J 1983, 'Smoking and alcohol consumption during pregnancy: an epidemiological study in Tasmania', *Medical Journal of Australia,* vol. 1, no. March 5, pp. 220-3.

Little, R, Lambert, M & Worthington-Roberts, B 1990, 'Drinking and smoking at 3 months postpartum by lactation history', *Paediatric and Perinatal Epidemiology,* vol. 4, pp. 290-302.

McLeod, D, Pullon, S, Cookson, T & Cornford, E 2002, 'Factors influencing alcohol consumption during pregnancy and after giving birth', *New Zealand Medical Journal,* vol. 115, no. 1157, p. U29.

Mennella, J 1998, 'Short-term effects of maternal alcohol consumption on lactational performance', *Alcoholism: Clinical and Experimental Research,* vol. 22, no. 7, pp. 1389-92.

Mennella, J 2001, 'Regulation of milk intake after exposure to alcohol in mother's milk', *Alcoholism: Clinical and Experimental Research,* vol. 25, no. 4, pp. 590-3.

Mennella, J & Garcia-Gomez, P 2001, 'Sleep disturbances after acute exposure to alcohol in mother's milk', *Alcohol,* vol. 25, pp. 153-8.

Mennella, J & Gerrish, C 1998, 'Effects of exposure to alcohol in mother's milk on infant sleep', *Pediatrics,* vol. 101, no. 2 March 2004, pp. e21-e5 .

Mennella, J, Pepino, M & Teff, K 2005, 'Acute alcohol consumption disrupts the hormonal milieu of lactating women', *The Journal of Clinical Endocrinology and Metabolism,* vol. 90, no. 4, pp. 1979-85.

National Academy of Sciences 1991, Nutrition During Lactation. Report of the Subcommittee on Nutrition During Lactation of the Committee on Nutritional Status during Pregnancy and Lactation, National Academy Press, Washington, D.C.

National Health and Medical Research Council 2001, *Australian Alcohol Guidelines: Health Risks and Benefits*, National Health and Medical Research Council, Canberra.

New South Wales Department of Health (Ed.) 2006, Background papers to the National clinical guidelines for the management of drug use during pregnancy, birth and the early development years of the newborn., NSW Department of Health, Sydney.

O'Leary, C 2004, 'Fetal alcohol syndrome: Diagnosis, epidemiology, and developmental outcomes', *Journal of Paediatrics and Child Health,* vol. 40, pp. 2-7.

Parackal, S, Ferguson, E & Harraway, J 2007, 'Alcohol and tobacco consumption among 6-24-months post-partum New Zealand women', *Maternal and Child Nutrition,* vol. 3, no. 1, pp. 40-51.

Peat, J, Allen, J, Nguyen, N, Hayen, A, Oddy, W & Mihrshahi, S 2004, 'Motherhood meets epidemiology: measuring risk factors for breast-feeding cessation', *Public Health Nutrition,* vol. 7, no. 8, pp. 1033-7.

Pesa, J & Shelton, M 1999, 'Health-enhancing behaviours correlated with breastfeeding among a national sample of mothers', *Public Health Nursing,* vol. 16, no. 2, pp. 120-4.

Scott, J, Binns, C, Graham, K & Oddy, W 2006a, 'Temporal changes in the determinants of breastfeeding initiation', *Birth,* vol. 33, no. 1, pp. 37-45.

Scott, J, Binns, C, Oddy, W & Graham, K 2006b, 'Predictors of breastfeeding duration: evidence from a cohort study', *Pedatrics,* vol. 117, no. 4, pp. e646-e55.

Scott, JA, Aitkin, I, Binns, CW & Aroni, RA 1999, 'Factors associated with the duration of breastfeeding amongst women in Perth, Australia', *Acta Paediatr,* vol. 88, no. 4, pp. 416-21.

Scott, JA, Landers, MC, Hughes, RM & Binns, CW 2001, 'Factors associated with breastfeeding at discharge and duration of breastfeeding', *J Paediatr Child Health,* vol. 37, no. 3, pp. 254-61.

Scott, JA, Shaker, I & Reid, M 2004, 'Parental attidtudes toward breastfeeding: Their association with feeding outcome at hospital discharge', *Birth,* vol. 31, no. 2, pp. 125-31.

U.S. Department of Health and Human Services and U.S. Department of Agriculture 2005, *Dietary Guidelines for Americans, 2005,* 6th edn, U.S. Government Printing Office, Washington, DC.

World Health Organization 1991, Indicators for assessing breastfeeding practices., WHO, Geneva.

Chapter 6 Alcohol, pregnancy and breastfeeding; a comparison of the 1995 and 2001 National Health Survey data

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Abstract

Alcohol enters breastmilk by passive diffusion and reflects levels in maternal blood within 30 to 60 minutes after ingestion. If not timed appropriately drinking alcohol throughout the period of lactation can negatively impact on lactation performance and the mental development of the infant. The aim of this study was to explore the drinking patterns of pregnant, lactating and other Australian women of child bearing age using the 1995 and 2001 National Health Survey Confidientialised Unit Record Files.

Alcohol consumption was categorised according to Guideline 11 from the National Health and Medical Research Council (NHMRC) current Australian Alcohol Guidelines, which state that if pregnant or lactating women choose to drink, over a week, they should have less than 7 standard drinks. Despite a low intake by most pregnant and lactating women from both surveys, approximately 16.4% and 1.3% (95% CI: 7.0 to 23.2) of pregnant women from the 1995 and 2001 NHS respectively, and 13% of and 16.8% (95% CI: -6.5 to -1.1) of lactating mothers from the 1995 NHS and 2001 NHS respectively, were drinking above this national guideline. There were significantly more pregnant women in the 1995 NHS, and lactating women in the 2001 NHS, exceeding this recommendation.

Pregnancy and lactation are vulnerable times of infant growth and development. There is a definite need in Australia for improved antenatal, and maternal and child health programs that address this significant public health issue.

Keywords: breastfeeding, alcohol, Australian women, pregnancy

(Final publication accepted after thesis submission. See Appendix 7 for final text.)

6.1 Background

Alcohol has a major role in Australian society and alcoholic beverages are consumed by the majority of Australians. The 2001 National Health Survey (NHS) (Australian Bureau of Statistics 2003b) showed that 56.5% of women in the 18-44 year age group had consumed alcohol in the past week. Over 8% of women aged 18 years or more consumed alcohol at a level that created a health risk for them and many of these women were in the age group for pregnancy or for breastfeeding.

Breastfeeding is the normal way to feed infants and is recommended for every infant in Australia, exclusively for six months and on to twelve months of age, together with complementary foods (Binns & Davidson 2003). The World Health Organization (WHO) recommends extending the breastfeeding period until two years of age together with solid foods (World Health Organization 2001). The most recent research in Australia conducted by our research team shows that despite 75.6% of women exclusively breastfeeding on hospital discharge, less than 1% of infants are exclusively breastfed at six months of age. At 12 months of age, only 19.2% of infants were receiving any breastmilk (Scott et al. 2006b).

The benefits of breastfeeding for the infant and the mother are well known and for the infant these include nutritional, immunological and psychological benefits. Health benefits for lactating women include lactation amenorrhea, maternal weight or fat loss, protection against premenopausal breast cancer and ovarian cancer, bone remineralisation to levels exceeding those present before lactation, and more optimal blood glucose profiles in women with gestational diabetes (Dobson & Murtaugh 2001). Exclusive breastfeeding will provide the greatest gains for infant development, protection against childhood obesity and the prevention of chronic disease later in adult life (Binns & Davidson 2003; Leon-Cava 2002; Martorell, Stein & Schroeder 2001).

Women of an age to breastfeed often consume alcohol (Australian Bureau of Statistics 2003b). It has been commonly recommended that alcohol should be avoided during pregnancy and during breastfeeding. In Australia the National Health and Medical Research Council (NHMRC) provide a guideline for alcohol consumption for pregnant or soon to be pregnant women (Guideline 11) (see Box 1) (National Health and Medical Research Council 2001). Despite this recommendation, a literature search has not revealed any published papers on alcohol consumption during breastfeeding in Australia.

Internationally recommendations for alcohol intake during pregnancy and breastfeeding vary considerably and many countries only provide a recommendation for pregnancy (see Box 2). The NHMRC recommend that breastfeeding women follow the same guideline given to pregnant women (National Health and Medical Research Council 2001) (see Box 1).

Box 1. Australian Alcohol Guidelines

Guideline 11 Women who are pregnant or might soon become pregnant

11.1 may consider not drinking at all;

11.2 most importantly, should never become intoxicated;

11.3 if they choose to drink, over a week, should have less than 7 standard drinks, AND, on any one day, no more than 2 standard drinks (spread over at least two hours);

11.4 should note that the risk is highest in the early stages of pregnancy, including the time from conception to the first missed period.

Women who are breastfeeding are advised not to exceed the levels of drinking recommended during pregnancy, and may not consider drinking at all.

(National Health and Medical Research Council 2001).

Alcohol enters breastmilk by passive diffusion and reflects levels in maternal blood within 30 to 60 minutes after ingestion (Kesaniemi 1974; Lawton 1985; Mennella & Beauchamp 1993). In many countries and cultures there is the belief that alcohol can actually promote breastmilk production and aid in settling the infant (Mennella 2001a). Contrary to these beliefs research shows that drinking alcohol during lactation can result in a decrease in breastmilk production (through its effect on oxytocin), disturbed sleep patterns and altered gross motor development (Little et al. 1989; Mennella 2001a; Mennella, Pepino & Teff 2005). Nationally and internationally there is limited available research data outlining the prevalence of alcohol intake during lactation. The research literature reports on one study in, Norway in which 80% of breastfeeding (partially or totally) women were consuming alcohol and breastfeeding at six months or longer, postpartum (Avlik, Haldorsen & Lindemann 2006).

Box 2. International Alcohol Recommendations for Pregnancy and Breastfeeding	
Recommendation for Pregnancy	**Recommendation for Lactation**
Complete abstinence	Complete abstinence
New Zealand, Netherlands, Canada, United States (Health Canada 1996; Health Council of the Netherlands 2005; Ministry of Health 2006; U.S. Department of Health and Human Services and U.S. Department of Agriculture 2005)	United States, (U.S. Department of Health and Human Services and U.S. Department of Agriculture 2005)
Occasional drinking of low/moderate amounts	Scheduled occasional drinking of low/moderate amounts
Denmark, United Kingdom (UK) (Department of Health 2006; Health Canada 1996; The Danish National Board of Health 2006)	New Zealand, Canada, UK, Netherlands (Best Start; Department of Health 2006) (Health Council of the Netherlands 2005) (Ministry of Health 2006)

The objective of this paper is to estimate and compare the proportion of pregnant, lactating women and non-mothers consuming alcohol by analysing unpublished data from the 1995 and 2001 NHS (Australian Bureau of Statistics 1995, 2003b).

6.2 Methods

6.2.1 Sample

The 1995 NHS was conducted on a multistage area sample of private dwellings and a list sample of non-private dwellings in all States and Territories of Australia (Australian Bureau of Statistics 1995). The final sample size was 21787 households. Information was obtained by personal interview with each adult member of the selected household. The unit record data file contains detailed information on each person in the sample, but identifying data has been removed to preserve confidentiality. For each child under the age of four years, a number of questions relating to breastfeeding were asked. Responses were provided on behalf of the child by an adult, generally a parent, and the mother in approximately 80% of cases.

The 2001 NHS was conducted in 17918 private dwellings selected throughout non-sparsely settled areas of Australia (Australian Bureau of Statistics 2003b). Information was obtained by personal interview about one adult, all children aged 0 to 6 years, and one child aged 7 to 17 years in each selected household. Data on each person in the unit record file has been de-identified to maintain confidentiality. A parent or guardian was asked to answer questions on behalf of their children aged less than 18 years. This person was referred to as the child proxy. Responses were provided on behalf of the child by an adult, generally a parent, and the mother in almost 80% of cases.

In addition to the 1995 and 2001 NHS standard interview questionnaires, adult female respondents were invited to complete a Women's Health Supplementary questionnaire relating to specific aspects of women's health, which included information on pregnancies and breastfeeding. It was completed by the respondent in writing and returned to the interviewer in a sealed envelope. This approach was adopted in recognition of the potential sensitivity of the topics covered.

In the 1995 NHS 'core sections' of the survey were administered to all respondents, however due to time and cost constraints certain sections of the survey were administered to only half the sample (e.g. General Health and Well-Being [SF-36] questionnaire, Women's Health Supplementary Form, Alcohol consumption).

The sub-samples of lactating mothers for each NHS were defined as follows:

1995 Lactating Mothers: were women who stated they have ever breastfed[10] and lived in a household where there was a child aged four years or less in the same household.

2001 Lactating Mothers: were women who stated they have ever breastfed and lived in a household where there was a child aged four years or less in the same household.

For both surveys, non-mothers were aged between 18-44 years and reported not having children. Pregnant women were those women who reported that they were currently pregnant at the time of the survey interview.

In the 1995 survey as some sections of the survey were administered to half the sample only, not applicable responses are a result of only half of the adult sample receiving any questionnaire on alcohol consumption. However, special weights are provided such that estimates can be produced relating to the total population. In the 2001 NHS, not applicable responses are a result of respondents not consuming alcohol in the reference week and therefore not being able to respond to subsequent follow-on questions (e.g. main drink type consumed in the reference week) (Australian Bureau of Statistics 2001).

[10] The level of breastfeeding is not ascertained from respondents in the NHS. The response 'ever breastfed' is interpreted as partial breastfeeding .

6.2.2 *Alcohol consumption measures*

Adult respondents were asked how long ago (within the last 12 months or longer) they last had an alcoholic drink. Those who reported they had a drink within the previous week were asked the days in that week on which they had consumed alcohol (excluding the day on which the interview was conducted), and for each of the last 3 days on which they drank, the types and quantities of drinks they had consumed. This methodology used to collect information regarding alcohol intake was essentially the same in both the 1995 and 2001 NHS and is considered by the Australian Bureau of Statistics (ABS) to be directly comparable (Australian Bureau of Statistics 2001).

Reported quantities of drinks were converted to millilitres of alcohol present in those drinks, which respondents reported they had consumed.

The alcohol intakes of the pregnant and lactating women were compared with Guideline 11 from the NHMRC Australian Alcohol Guidelines (National Health and Medical Research Council 2001) (see Box 1). Alcohol intakes of the non-mothers are presented but as is appropriate, are not compared to this guideline. One Australian standard drink contains 10g of alcohol (equivalent to 12.5ml of ethanol).

6.2.2.1 Data Analysis

The data has been analysed using frequency analysis. Ninety five percent confidence intervals are presented and have been calculated using Excel (version 2003) by estimating the difference between 2 proportions (e.g. 1995 NHS lactating mothers and pregnant women) by assuming the samples are independent and have been taken from a binomial distribution (success and failure).

6.2.2.2 Estimation Procedure

In the unit record data, the ABS provides a weighting for each person to be used when estimating parameters for the Australian population. All proportions in this paper were calculated using the weighted estimates and are presented together with the sample population.

6.2.2.3 Methodological considerations

This paper draws attention to the methodology used in the 1995 and 2001 NHS. The methodology used in these surveys is different to that used in the National Drug Survey Household Strategy (NDSHS) and for this reason it is difficult to make direct comparisons (Clemens, Donath & Stockwell 2006). Despite this limitation the data extracted in this analysis provides valid and statistically comparable data (Australian Bureau of Statistics 2006).

6.2.2.4 Ethics

Utilisation of the 1995 and 2001 Basic Confidentialised Unit Record Files (CD-ROM) was undertaken in accordance with the conditions of use provided by the Australian Bureau of Statistics. The study was approved by the Curtin University Human Research Ethics Committee.

6.3 Results

There were a total of 1461 lactating mothers in the 1995 NHS and 1248 lactating mothers in the 2001 NHS.

The majority of lactating mothers (62.4%) and pregnant women (64.8%) in the 1995 NHS were in the 25-34 age group. The majority of non-mothers fall within the 20-34 age group (65.5%). In the 2001 NHS the majority of lactating mothers (58.4%) and pregnant women (73.6%) were also in the 25-34 age group. Approximately 55% of the non-mothers were in the 35-44 year age group (see Table 6.3.1).

Table 6.3.1 Age of lactating mothers, pregnant woment and non-mothers 1995 and 2001 NHS

Age (yr)	1995 Lactating Mothers		1995 Pregnant Women		1995 Non-mothers		2001 Lactating Mothers		2001 Pregnant Women		2001 Non-mothers	
	n	%	n	%	n	%	n	%	n	%	n	%
18 - 19	15	1.3			81	5.6	11	.8	3	2.2	65	4.2
20 - 24	166	11.5	14	13.2	379	26.6	144	10.9	13	9.2	181	7.2
25 - 29	385	26.2	27	35.7	335	21.9	304	24.4	49	35.2	336	11.4
30 - 34	528	36.2	22	29.1	259	17.0	405	34.0	52	38.4	618	22.4
35 - 39	251	16.7	12	15.1	215	14.1	283	21.6	18	13.8	818	28.3
40 - 44	94	6.1	8	6.7	220	14.8	87	7.1	2	1.2	746	26.5
45 - 49	22	2.0	1	.2			14	1.3				
Total	1461	100	84	100	1489	100	1248	100	137	100	2764	100

Table 6.3.2 outlines the prevalence and period of drinking by all women from the 1995 and 2001 NHS. The majority of women did not consume alcohol during the reference week. The most common volume of alcohol consumed in the reference week from both the 1995 and 2001 NHS was two standard drinks (see Table 6.3.3).

There were significantly more lactating women and non-mothers consuming alcohol in the 2001 NHS compared to these sub samples in the 1995 NHS. Significantly less pregnant women were consuming alcohol in the 2001 NHS compared to the 1995 NHS (see Table 6.3.3).

Table 6.3.2 Prevalence of alcohol consumption (%)

Sub-sample population	In the last week	In the last 12 months (incl. last wk)	>12mo/ Never	Not known	Not applicable [11]
1995 NHS					
Lactating Mothers	42.5	76.6	22.1	1.3	-
Pregnant Women	40.3	91.3	8.7	0	-
Non-mothers	28.8	43.3	3.5	0.4	52.7
2001 NHS					
Lactating Mothers	47.8	80.9	18.3	0.7	-
Pregnant Women	26.6	78.6	20	1.4	-
Non-mothers	53.7	82.2	16.9	0.8	-

[11] In the 1995 survey as some sections of the survey were administered to half the sample only, not applicable responses are a result of only half of the adult sample receiving any questionnaire on alcohol consumption. In the 2001 NHS, not applicable responses are a result of respondents not consuming alcohol in the reference week and therefore not being able to respond to subsequent follow-on questions (eg main drink type consumed in the reference week).

Table 6.3.3 Number of standard drinks consumed during the reference week of the 1995 and 2001 NHS

Standard drinks	1995 Lactating Mothers (95% CI for diff.)[a]		2001 Lactating Mothers (95% CI for diff.)		1995 Pregnant Women (95% CI for diff.)		2001 Pregnant Women (95% CI for diff.)		1995 Non-mothers (95% CI for diff.)		2001 Non-mothers (95% CI for diff.)	
	n	%	n	%	n	%	n	%	n	%	n	%
Nil	818	57.5	638	52.2	46	59.7	98	73.4	1052	71.2	1254	46.3
	(1.0 to 8.4)*				(-26.5 to -0.9)*				(21.9 to 27.9)*			
One	91	7.2	72	5.5	6	6.5	8	4.2	36	2.8	150	5.8
	(0.0 to 3.6)				(-4.0 to 8.6)				(-4.2 to -1.8)*			
Two	118	7.8	131	11.6	8	9.1	14	10.1	49	3.2	279	10.7
	(-6.0 to -1.6)*				(-9.0 to 7.0)				(-9.0 to -6.0)*			
Three	99	5.8	73	5.2	3	2.6	5	3.1	61	3.5	180	6.0
	(-0.9 to 2.5)				(-5.0 to 4.0)				(-3.8 to -1.2)*			
Four	52	3.5	48	3.1	3	3.0	5	4.4	35	2.2	112	3.9
	(-0.1 to 1.6)				(-6.4 to 3.6)				(-2.7 to -0.7)*			
Five	38	2.6	40	2.7	2	1.8	2	1.6	26	1.6	103	3.7
	(1.2 to -1.2)				(-3.3 to 3.7)				(-3.0 to -1.2)*			
Six	43	2.7	35	3.0	1	1.1	3	1.9	32	1.9	88	3.1
	(-1.9 to 0.7)				(-4.0 to 2.4)				(-2.1 to -0.3)*			
Seven	27	1.7	25	1.9	-	-	-	-	22	1.5	66	2.3
	(-1.2 to 0.8)								(-1.6 to 0.0)			
Eight	36	2.3	28	2.6	1	.6	-	-	26	1.7	66	2.2
	(-1.6 to 0.8)								(-1.4 to 0.4)			
Nine	18	1.4	24	2.1	5	5.1	-	-	10	.8	66	2.4
	(-1.6 to 0.4)								(-2.3 to -0.9)*			

Ten - Fifteen	70	4.6	76	5.7	1	8.2	2	1.3	17	4.5	217	7.2
	(-2.7 to 0.7)				(0.7 to 1.3)*				(-4.1 to -1.3)*			
> Fifteen	50	3.0	58	4.5	8	2.5	-	-	123	5.0	183	6.3
	(-2.7 to 0.1)								(-2.7 to 0.1)			
Total	1460[b]	100.0	1248	100.0	84	100.0	137	100.0	1489	100.0	2764	100.0

[a]95% confidence intervals for the difference in weighted percentages between the 1995 and 2001 NHS samples are presented in brackets. Positive values indicate a higher percentage in the 1995 NHS sample of women.
*$p<0.05$
[b]one missing value

Most women from both surveys who were consuming alcohol did so on one day of the reference week (see Table 6.3.4).

Table 6.3.4 Total days of alcohol consumption in the 1995 and 2001 NHS

Number of days	1995 Lactating Mothers (95% CI for diff.)[a] n	%	2001 Lactating Mothers (95% CI for diff.) n	%	1995 Pregnant Women (95% CI for diff.) n	%	2001 Pregnant Women (95% CI for diff.) n	%	1995 Non-mothers (95% CI for diff.) n	%	2001 Non-mothers (95% CI for diff.) n	%
N/A	818	57.5	638	52.2	46	59.7	98	73.4	1052	71.2	1254	46.3
	(1.0 to 8.4)*				(-26.5 to -0.9)*				(21.8 to 28.0)*			
One	309	21.4	328	25.8	20	24.1	26	17.4	166	11.1	702	25.6
	(-7.3 to -0.9)*				(-4.4 to 78.0)				(-16.8 to -12.2)*			
Two	160	9.6	105	8.1	5	5.3	10	7.4	117	7.5	285	10.1
	(-0.3 to 3.9)				(-8.6 to 4.4)				(-4.3 to -0.9)*			
Three	72	4.8	81	6.6	7	6.9	3	1.8	79	5.4	223	7.7
	(-3.3 to 0.1)				(-0.8 to 11.0)				(-3.85 to –0.8)*			
Four	23	1.3	32	2.3	2	.4			26	1.7	89	3.3
	(-2.0 to 0.0)								(-2.5 to -0.7)*			
Five	19	1.2	14	1.0	1	1.1			9	.4	42	1.3
	(-0.6 to 1.0)								(-1.4 to -0.4)*			
Six	14	1.0	9	.6	2	1.4			8	.5	20	.7
	(-0.3 to 0.9)								(-0.6 to 0.2)			
Seven	46	3.3	41	3.4	1	1.1			32	2.3	149	5.1
	(-1.7 to 1.1)								(-3.9 to –1.7)*			
Total	1461	100	1248	100.0	84	100.0	137	100.0	1489	100.0	2764	100.0

[a]95% confidence intervals for the difference in weighted percentages between the 1995 and 2001 NHS samples are presented in brackets. Positive values indicate a higher percentage in the 1995 NHS sample of women.
$p<0.05$

Table 6.3.5 shows that the most popular drink types for all women from both the 1995 and 2001 NHS were wine, followed by spirits then full strength beer.

Table 6.3.5 Main drink type consumed for the 1995[a] and 2001 NHS

Drink type	1995 Lactating Mothers		1995 Pregnant Women		1995 Non-mothers		2001 Lactating Mothers		2001 Pregnant Women		2001 Non-mothers	
	n	%	n	%	n	%	n	%	n	%	n	%
Not applicable[a]							638	52.2	98	73.4	1254	46.3
Low alcohol beer	21	1.3	2	2.2	9	0.6	15	1.4	1	.4	41	1.7
Mid strength beer	44	3.1	3	3.8	28	1.8	13	1.0	1	.1	32	1.1
Full strength beer	116	7.7	9	10.7	118	8.1	64	4.9	2	1.6	137	4.6
Wine	383	24.2	25	24.5	273	17.8	306	24.9	22	17.3	794	28.2
Spirits	194	13.1	10	11.4	161	11.0	188	14.0	11	6.3	445	16.2
Fortified wine	19	1.0	2	2.5	14	0.8	9	.7	1	.7	23	.8
Other	38	2.5	-	-	44	2.2	15	1.1	1	.3	38	1.2
Total[b]	815[b]	52.9	51[b]	55.1	647[b]	42.3	1248	100.0	137	100.0	2764	100.0

[a]Only relevant to 2001 NHS sample
[b]Multiple response question in the 1995 NHS only

6.4 Discussion

The consumption of alcohol in Australia is part of the cultural norm, however it appears from this analysis that most mothers reduce their alcohol intake during pregnancy and lactation compared to women of child bearing age who are neither pregnant or breastfeeding. Figures from the 2001 NDSHS show that 36% of pregnant women and 28% of lactating women did not drink at all in the last 12 months (Australian Institute of Health and Welfare 2003). Similarly in the 2004 NDSHS 38% of pregnant women and 30% of breastfeeding women abstained from consuming alcohol in the last 12 months (Australian Institute of Health and Welfare 2005c). These figures are higher than those found in this analysis of the National Health Surveys and can most likely be attributed to the methodological differences between these two national data collection surveys.

The majority of pregnant women and lactating mothers in both the 1995 and 2001 NHS were from the 25-34 year age group. Non-mothers tended to be older in the 2001 NHS than in the 1995 NHS, reflecting Australia's ageing population (Australian Bureau of Statistics 2004).

The majority of all women were not consuming alcohol in the reference week, with the exception of non-mothers from the 2001 NHS. Significantly more pregnant women reported abstaining from alcohol intake in the last week, in the 2001 NHS than in the 1995 NHS (see Table 6.3.3). This is most likely attributable to the greater public health awareness of the risk of alcohol intake during pregnancy in recent years (National Health and Medical Research Council 2001).

Most commonly all women who did drink alcohol from both the 1995 and 2001 NHS consumed two standard drinks in the reference week. Despite this overall low level of alcohol consumption, lactating mothers from the 2001 NHS and pregnant women in the 1995 NHS were consuming 10-15 drinks during the reference week as the next most common volume of alcohol (following two standard drinks). This would equate to approximately 1.4 to two standard drinks per day.

Results from this analysis show that 16.4% and 1.3% of pregnant women from the 1995 and 2001 NHS, respectively were consuming more than that recommended in 'Guideline 11' (ie >7 std drinks/wk) (National Health and Medical Research Council 2001). Furthermore they are consuming much more than that recommended by other leading national and international authorities who advise complete abstinence at this time (Health Canada 1996; Ministry of Health 2006; U.S. Department of Health and Human Services and U.S. Department of Agriculture 2005).

Breastfeeding women in this analysis would also be exceeding national and international guidelines for alcohol intake during lactation and there were significantly more lactating mothers consuming alcohol in the 2001 NHS than the 1995 NHS (Health Council of the Netherlands 2005; Ministry of Health 2006; National Health and Medical Research Council 2001; U.S. Department of Health and Human Services 2000). An appendage to Guideline 11 from the NHMRC guidelines is some 'prudent' advice for lactating women 'not to exceed the levels of drinking recommended during pregnancy, and to consider not drinking at all.'(p.16) Thirteen percent of lactating mothers from the 1995 NHS and 16.8% from the 2001 NHS were consuming more than seven standard drinks of alcohol in the reference week, thus exceeding this recommendation.

As under-reporting of alcohol consumption is common, both in terms of persons identifying as having drank alcohol in the reference week, and in the quantities reported (Australian Bureau of Statistics 2001; Carruthers & Binns 1992; Chikritzhs et al. 2003; Kaskutas & Graves 2001), these volumes may potentially be greater thus true risk levels of alcohol consumption may be higher than presented here.

Drinking alcohol while pregnant increases the risk of fetal problems developing. Fetal Alcohol Syndrome Disorder (FASD) describes the range of effects that can occur in an individual whose mother drank alcohol during pregnancy. These effects may include physical, mental, behavioral, and/or learning disabilities with possible lifelong implications. FASD refers to conditions such as fetal alcohol syndrome (FAS), fetal alcohol effects (FAE), alcohol-related neurodevelopmental disorder (ARND), and alcohol-related birth defects (ARBD) (U.S. Department of Health and Human Services 2006).

At present existing evidence, fails to determine any adverse effect on pregnancy outcome with low to moderate levels of prenatal alcohol consumption. However this does not mean that it is safe for women to drink at these levels during pregnancy (Henderson, Gray & Brocklehurst 2007). Given that over 40% of pregnant women in the 1995 NHS and over a quarter of pregnant women in the 2001 NHS were consuming alcohol at any level during the reference week, there remains the potential for considerable public health risk of FASD in the Australian community.

Alcohol consumption at a level of two standard drinks per day during lactation can result in a deficit in motor development (Little et al. 1989) and consuming this amount of alcohol shortly before the beginning of a breastfeed can inhibit lactational performance and negatively disrupt an infant’s sleep-wake behavioural patterns (Mennella & Garcia-Gomez 2001; Mennella, Pepino & Teff 2005). In addition women who consume alcohol during lactation have been shown to have a shorter duration of breastfeeding (Little, Lambert & Worthington-Roberts 1990a).

Lactating women from both surveys in this analysis are therefore at risk of contributing to developmental, growth and behavioural problems in their infants, and the early cessation of breastfeeding which in itself is associated with its own negative health implications.

Although non-mothers were the group most often to report nil alcohol intake during the reference week of the 1995 NHS, their most common alcohol intake was greater than 15 standard drinks. This is in contrast to the non-mothers in the 2001 NHS who were the least likely to abstain from alcohol in the reference week but were most likely to drink two standard drinks if they did consume alcohol that week. It is likely that public education programs regarding safe drinking levels were responsible for the reduction in risk levels seen in the 2001 survey (National Health and Medical Research Council 2001).

The most favoured drink types of all women were wine followed by spirits for both surveys. Most often all women from both surveys drank alcohol on only one day during the reference week.

There has previously been criticism that a seven-day retrospective diary was not used to collect alcohol intake in the 1995 NHS and that the three-day method used is less accurate (Clemens, Donath & Stockwell 2006; Donath 1999). Despite this concern, the three-day method was again used in the 2001 NHS and the Australian Bureau of Statistics considers that the results for the two surveys are directly comparable (Australian Bureau of Statistics 2006).

6.5 Conclusion

The current Australian Alcohol Guidelines state that if pregnant or lactating women choose to drink; over a week, they should have less than 7 standard drinks, and, on any one day, no more than 2 standard drinks (spread over at least two hours). Data from this analysis of the 1995 and 2001 NHS indicate that the majority of mothers and pregnant women were low risk consumers of alcohol, however there was a small proportion of pregnant women and lactating mothers who were drinking above this national guideline (National Health and Medical Research Council 2001). Since the 1995 NHS there has been a slight but significant increase in the proportion of lactating women consuming alcohol compared to the 2001 NHS.

From this analysis it appears that pregnant women have become more aware of the dangers associated with alcohol intake at this vulnerable time and have reduced their alcohol intake since the 1995 NHS. It is most likely that health promotion campaigns highlighting the dangers of antenatal drinking have prompted this timely decline in alcohol consumption. Despite the negative health effects of drinking during breastfeeding a similar decline in drinking alcohol over this period has not occurred and the reverse has actually taken place.

The information in this paper prompts health professionals working in maternal and child health to consider engaging in client discussions regarding alcohol intake and providing education on low risk alcohol intakes at this time. Currently the Australian Alcohol Guidelines: Health Risks and Benefits are under revision, however as illustrated in this paper there is a strong need for the pregnancy, and including lactation, guideline to be more directive and provide concise information on a minimum safe level during these critical lifecycle stages.

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Authors' contribution

RG was responsible for the data analysis and led the writing of the manuscript.

CWB supervised and contributed to the writing of the manuscript. CWB provided extensive revision of the manuscript.

References

Australian Bureau of Statistics 1995, *National Health Survey, Australia 1995, Basic Confidentialised Unit Record File*, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics 2001, *National Health Survey: Users' Guide, 2001*, Australian Bureau of Statistics, Canberra, http://www.abs.gov.au/Ausstats/abs@.nsf/66f306f503e529a5ca25697e0017661f/777CA8D289E66729CA256D32001B5324?opendocument

Australian Bureau of Statistics 2003, *National Health Survey, Australia (2001), Basic Confidentialised Unit Record File*, Australian Bureau of Statistics, Canberra, Cat no. 4324.0.30.001.

Australian Bureau of Statistics 2004, *Year Book Australia, 2004*, Australian Bureau of Statistics, Canberra, 86 Cat no. 1301.0. http://www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/F024F2664BCE12D4CA256DEA00053A1A?opendocument.

Australian Bureau of Statistics 2006, *Review of strategic statistical issues for future national health surveys. Final report*, Australian Bureau of Statistics, Canberra. http://forums.abs.gov.au/QuickPlace/health_forum/PageLibraryCA256FA10014E1C0.nsf/h_Toc/CA32FCB40CED1B96CA25724A001253C7/?OpenDocument&Form=h_PageUI

Australian Institute of Health and Welfare 2003, *Statistics on drug use in Australia 2002*, AIHW, Canberra., (Drug Statistics Series No. 12.). http://www.aihw.gov.au/publications/index.cfm/title/8390.

Australian Institute of Health and Welfare 2005, *Statistics on drug use in Australia 2004*, AIHW, Canberra, (Drug Statistics Series No. 15). http://www.aihw.gov.au/publications/index.cfm/title/10143.

Avlik, A, Haldorsen, T & Lindemann, R 2006, 'Alcohol consumption, smoking and breastfeeding in the first six months after delivery', *Acta Paediatrica,* vol. 95, pp. 686-93.

Best Start 2005, *Drinking alcohol while breastfeeding*, Motherisk. http://www.beststart.org/resources/alc_reduction/index.html

Binns, CW & Davidson, GP 2003, 'Infant Feeding Guidelines for Health Workers', in NHMRC (ed.), *Food for Health: Dietary Guidelines for Children and Adolescents in Australia*, ISBN 1864961538 edn, NHMRC, Canberra, p. 452.

Carruthers, S & Binns, CW 1992, 'The standard drink and alcohol consumption', *Drug and Alcohol Review,* vol. 11, pp. 363-70.

Chikritzhs, T, Catalano, P, Stockwell, T, Donath, S, Ngo, H, Young, D & Matthews, S 2003, *Australian Alcohol Indicators. Patterns of Alcohol Use and Related Harms for Australian States and Territories 1990 - 2001*, Curtin University of Technology, Perth. http://www.ndri.curtin.edu.au/pdfs/naip/naipaaifullreport.pdf.

Clemens, S, Donath, S & Stockwell, T 2006, *Alcohol consumption in Australia; national surveys from 1989 to 2001*, Curtin University of Technology, Perth.

Department of Health 2006, *The Pregnancy Book: 2006 Edition*, Department of Health, London. http://www.dh.gov.uk/PublicationsAndStatistics/Publications/PublicationsPol icyAndGuidance/PublicationsPolicyAndGuidanceArticle/fs/en?CONTENT_ID=4136417&chk=saaOhH

Dobson, B & Murtaugh, M 2001, 'Position of the American Dietetic Association: Breaking the barriers to breastfeeding', *Journal of the American Dietetic Association,* vol. 101, no. 10, pp. 1213-20.

Donath, S 1999, 'Estimated alcohol consumption in the 1995 National Health Survey: some methodological issues', *Australian and New Zealand Journal of Public Health,* vol. 23, no. 2, pp. 131-4.

Health Canada 1996, Joint Statement: Prevention of Fetal Alcohol Syndrome (FAS) Fetal Alcohol Effects (FAE) in Canada, Ottawa.

Health Council of the Netherlands 2005, *Risks of alcohol consumption related to conception, pregnancy and breastfeeding.*, Health Council of the Netherlands, The Hague.

Henderson, J, Gray, R & Brocklehurst, P 2007, 'Systematic review of effects of low-moderate prenatal alcohol exposure on pregnancy outcome ', *BJOG: An International Journal of Obstetrics and Gynaecology,* vol. 114, no. 3, pp. 243-52.

Kaskutas, LA & Graves, K 2001, 'Pre-pregnancy drinking: how drink size affects risk assessment', *Addiction,* vol. 96, pp. 1199–209.

Kesaniemi, YA 1974, 'Ethanol and acetaledhyde in the milk and peripheral blood of lactating women after ethanol administration', *The Journal of Obstetrics and Gynaecology,* vol. 81, no. January, pp. 84-6.

Labbok, M & Krasovec, K 1990, 'Toward consistency in breastfeeding defintions', *Studies in Family Planning,* vol. 21, pp. 226-30.

Lawton, M 1985, 'Alcohol in breastmilk', Australian and New Zealand Journal of Obstetrics and Gynaecology, vol. 25, pp. 71-3.

Leon-Cava, N 2002, *Quantifying the benefits of breastfeeding: A summary of the evidence*, Pan American Health Organisation, Washington D C. http://www.aed.org/ToolsandPublications/upload/quantifyingbenefits.pdf.

Little, R, Anderson, K, Ervin, C, Worthington-Roberts, B & Clarren, S 1989, 'Maternal alcohol use during breast-feeding and infant mental and motor development at one year', *N Engl J Med,* vol. 321, pp. 425-30.

Little, R, Lambert, M & Worthington-Roberts, B 1990, 'Drinking and smoking at 3 months postpartum by lactation history', *Paediatric and Perinatal Epidemiology,* vol. 4, pp. 290-302.

Martorell, R, Stein, A & Schroeder, D 2001, 'Obesity in developing countries: Biological and ecological factors. Early nutrition and later adiposity.' *Journal of Nutrition,* vol. 131, no. 3, pp. 874S-80S.

Mennella, J 2001, 'Alcohol's effect on lactation', *Alcohol Research and Health,* vol. 25, no. 3, pp. 230-4.

Mennella, J & Beauchamp, G 1993, 'Beer, breast feeding and folklore', *Developmental Psychobiology,* vol. 26, no. 8, pp. 459-66.

Mennella, J & Garcia-Gomez, P 2001, 'Sleep disturbances after acute exposure to alcohol in mother's milk', *Alcohol,* vol. 25, pp. 153-8.

Mennella, J, Pepino, M & Teff, K 2005, 'Acute alcohol consumption disrupts the hormonal milieu of lactating women', *The Journal of Clinical Endocrinology and Metabolism,* vol. 90, no. 4, pp. 1979-85.

Ministry of Health 2006, *Food and Nutrition Guidelines for Healthy Pregnant and Breastfeeding Women: A background paper*, Ministry of Health, Wellington. http://www.moh.govt.nz/moh.nsf/by+unid/F4F10903136588EFCC25716200123030?Open.

National Health and Medical Research Council 2001, *Australian Alcohol Guidelines: Health Risks and Benefits*, National Health and Medical Research Council, Canberra.

Scott, J, Binns, C, Oddy, W & Graham, K 2006, 'Predictors of breastfeeding duration: evidence from a cohort study', *Pedatrics,* vol. 117, no. 4, pp. e646-e55.

The Danish National Board of Health 2006, *Public Health/ The National Centre for Health Promotion and Prevention*, Denmark. http://www.sst.dk

U.S. Department of Health and Human Services 2000, *HHS Blueprint for Action on Breastfeeding*, U.S. Department of Health and Human Services, Office on Women's Health, Washington, D.C.

U.S. Department of Health and Human Services and U.S. Department of Agriculture 2005, *Dietary Guidelines for Americans, 2005,* 6th edn, U.S. Government Printing Office, Washington, DC.

U.S. Department of Health and Human Services, SAaMHSA 2006, *SAMHSA Fetal Alcohol Spectrum Disorders Centre for Excellence*, Rockville. http://www.fascenter.samhsa.gov/

World Health Organization 2001, The optimal duration of exclusive breastfeeding. Report of an expert consultation, WHO, Geneva.

Chapter 7 Alcohol and breastfeeding: what do Australian mothers know?

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Abstract

Background: Drinking alcohol during pregnancy can cause many birth defects and developmental disabilities. There is considerable information available for pregnant women regarding the dangers of drinking alcohol during this time. Postpartum many women enter the period of lactation, which can last for several months to years. However information regarding safe levels of alcohol consumption during lactation is limited despite potential harmful effects on infant development and maternal lactational performance.

Methods: A descriptive study using qualitative methods. Data was collected in focus groups interviews conducted from February 2004 to December 2005. Women eligible to participate in the focus groups were currently breastfeeding or had been breastfeeding within the previous 12 months.

Results: Seventeen women aged 28 to 41 years participated in postpartum focus groups. The mothers were largely unaware of the effects of alcohol on breastfeeding performance and the development of the infant. Most women expressed concern at the lack of information available regarding 'safe' alcohol consumption practices during lactation and reported being more diligent during pregnancy with regard to abstaining from alcohol.

Conclusion: There is a variable level of knowledge regarding consuming alcohol and breastfeeding among Australian mothers. The majority of participants were aware of the recommendations regarding alcohol during pregnancy and felt that a similar level of information was required to provide direction and support during lactation.

Key words: breastfeeding, alcohol, knowledge, attitudes

7.1 Introduction

Alcohol consumed by a lactating mother enters the breastmilk within 30 to 60 minutes after ingestion and depending on the amount consumed, may have detrimental effects on the infant.(Kesaniemi 1974) In a review of the literature a deficit in motor development, reduced lactational performance and disrupted sleep-wake behavioural patterning of the infant are reported at intakes of two standard drinks per day (one Australian standard drink is equivalent to 10g [12.5ml] alcohol).(Giglia & Binns 2006b) Despite these adverse health effects, available information on the postpartum effect of alcohol in the breastmilk on the developing human infant is limited.

In contrast the potential adverse effects of alcohol consumption on the developing foetus have been well documented.(O'Leary 2004) Many studies report a reduced maternal alcohol intake during pregnancy and a return to prepregnancy levels, or at least higher intakes than during pregnancy, shortly following birth.(Little, Lambert & Worthington-Roberts 1990a; Mennella & Gerrish 1998; O'Connor, Brill & Sigman 1986) Research shows that in some instances physicians, nurses and lactation consultants advocate an increase in alcohol intake by breastfeeding mothers.(Mennella 1997)

Current Australian research shows that the majority of women limit or completely restrict alcohol intake during lactation. In the 2001 National Health Survey approximately 47% of lactating mothers reported any alcohol consumption in the previous week and most often this was two standard drinks.(Giglia & Binns in press) Determining the factors that influence the alcohol consumption behaviours of lactating women is important in developing initiatives aimed at supporting safe drinking practices and continued breastfeeding.(Worsley 2002) The objective of this research was to investigate the level of understanding that Australian women have regarding the relationship between alcohol and lactation.

7.2 Methods

A descriptive study using qualitative methods was conducted in the Perth metropolitan area of Western Australia between February 2004 and December 2005.(Sandelowski 2000) Data was gathered through focus group discussions. Women eligible to participate were currently breastfeeding or had been breastfeeding within the previous 12 months.

7.2.1 Data Collection

Participants were recruited from women attending a private antenatal clinic and private hospital postnatal physiotherapy program. Child Health Nurses (CHN) located in the northeastern corridor of the Perth metropolitan area; and lactation consultants, and midwives attending Perth's major maternity hospital, distributed information about the study to eligible clients. All participants self-selected to attend a focus group and informed consent was obtained from participants prior to their involvement.

The chief investigator moderated three focus groups using open-ended questions, derived from previous research findings, to help structure the discussion.(Giglia & Binns 2006b) The questions related to general breastfeeding, 'being a new mother' experiences, and alcohol and breastfeeding (see example questions in Box 1). Whilst the focus group schedule of questions guided the discussion, the moderator allowed for the development of emergent themes from the current focus group to be discussed and investigated during subsequent focus groups.

7.2.2 Data Analysis

All focus group and interview data were transcribed verbatim immediately following the discussions. Qualitative content analysis(Morgan 1993) was applied to systematically summarise recurring themes.

Box 1. Example Focus Group Questions

Let's discuss people's initial breastfeeding experiences.

How did most people find their appetite at this time?

Did anyone find that some foods upset the baby?

What about foods to promote breastmilk production?

Let's talk about alcohol and breastfeeding. What's your opinion?

7.3 Results

Of the 17 participating women, all of them were married, Caucasian and ranged in age from 28 to 40 years. The majority of the women had completed a university degree and were currently working part-time. None of the women had returned to full-time employment. Fifteen of the women were primiparous and all of the women had breastfed their most recent child.

Focus groups results are presented thematically with direct quotations recorded in *italics*.

HAVE YOU HEARD OF ANY FOODS THAT PROMOTE BREASTMILK PRODUCTION?

Initially the majority of mothers responded that they had not heard of anything specific with the exception of consuming water. However, in all groups at least one woman had heard that alcoholic beverages, in particular stout, could increase breastmilk production. The majority of mothers then concurred but were unable to explain how the potential increase in breastmilk would occur. For some women, family and friends had been the source of this information.

Two women had tried to increase their breastmilk production by drinking stout. These women were unable to confirm how successful consuming stout had been in increasing their breastmilk supply.

'It certainly made me feel better and I felt it did help my breastmilk. It definitely made me feel better.'

'My aunty turned up with a 6 pack for me!'

WHAT IS YOUR OPINION OF ALCOHOL AND BREASTFEEDING?

Some women consumed wine and did this at the evening meal or after the last breastfeed for the evening. Several women expressed that initially when they first commenced breastfeeding they would rarely drink, but as the child matured and they breastfed less they tended to consume more alcohol and on a more regular basis. Some women indicated they did not consume spirits due to the higher alcohol content.

There was a general consensus from the women that they had been more diligent in abstaining from alcohol throughout their pregnancy due to the perception that there was more chance of the alcohol 'getting into the baby's system' than when breastfeeding. In addition, mothers expressed that due to their abstinence during pregnancy they felt entitled to recommence drinking alcohol once the baby had been born.

'More conscientious when I was pregnant because of the developing foetus. You have to give it a chance. Once they're out you can breastfeed them.'

'You spend all that time when you are pregnant trying not to drink and then when you get to breastfeeding – it can be a year and it's like a YES (now I can drink).'

A few mothers consumed alcohol after a breastfeed to minimise the effect on the baby, however babies are often unpredictable in their sleeping patterns when they are young and in two cases the mothers were then required to feed again.

'I did that very similar thing after a wedding where I'd had a couple of drinks and he woke up and I fed him. He slept for 12 hours and I felt terrible like I'd poisoned him…after that I felt like a terrible person because the alcohol had made him go to sleep. But I can see how it happens.'

'I remember going out to a function when she was 6 weeks old and I fed her before we went. When we got there I had one of the pre-dinner drinks, a half a half a glass – like I picked the smallest one on the tray…20 minutes later she's screaming and I had to feed her. I was feeling dreadful and really berating myself being at a big function not knowing what to do… me being in the audience with a screaming baby and I didn't want to feed her but I didn't know what else to do. So you know things like that did happen.'

HAS ANYONE SOUGHT ADVICE ON CONSUMING ALCOHOL DURING LACTATION?

The majority of women had read that consuming alcohol throughout pregnancy could cause Foetal Alcohol Syndrome (FAS). However they indicated they had been unable to find any information about consuming alcohol whilst breastfeeding and that often the information they did find was conflicting. Some had read books in an effort to research the risks to the infant from consuming alcohol during breastfeeding, and a smaller number had asked their obstetrician, GP, child health nurse, Breastfeeding Australia (a breastfeeding support organisation) or searched the internet.

'I don't think I was actively discouraged even from my obstetrician. I wasn't encouraged but I wasn't discouraged put it that way. He never said I shouldn't have any.'

'I find that there seems to be a degree of acceptance of alcohol during breastfeeding from the GPs. My GP was very lackadaisical about it and I have friends who are GPs who like me have the occasional drink with a meal. I wouldn't say they drink a lot but it does seem to be quite accepted by the medical profession.'

'Technically I don't think you should do it but I did. After the paediatrician had said I should have a couple of beers I thought right…'

The majority of women reported a need to have more information about breastfeeding during lactation readily available in the community, particularly information that was correct.

'I didn't quite realise the direct effect it had on the breastmilk. So I guess lack of education did effect my behaviour with it (alcohol).'

'I guess I wish there was more really good literature and good guidelines. One of my friends says ' a stout a day' is good for the baby and she is a 40 year old midwife!! There is so much misinformation. And I know someone who drinks a full glass of wine and then breastfeeds. We are all doing different things. And I think the guilt is hard to deal with.'

WHAT WOULD BE THE EFFECT OF ALCOHOL ON THE BABY?

Mothers were asked about the perceived effect of alcohol on the infant. Those mothers who had personal experience responded that they thought the baby had been more unsettled, however they were unable to tell if this was just a coincidence or if there were other events (e.g. 'teething') that were causing the baby to be unsettled. The participants also discussed the effect on the mother.

'If I didn't know and then I had to feed her I would just feed her. If she slept longer than she was supposed to then I would feel guilty and probably jump on the internet and find out all the crazy stuff about it but I wouldn't be doing it all the time.'

General thoughts regarding the perceived immediate effect of the alcohol on the baby varied between the effect on sleep and the contentedness of the baby. The baby would sleep better and go to sleep quicker were common responses. The baby would be more irritable or suffer from a 'mini' hangover.

'If they [adults] get a headache from it maybe the baby does as well.'

In the long term mothers thought that there could be long term developmental problems.

7.4 Discussion

There was a range of issues emerging from this qualitative study. Perhaps the most pervasive was that among breastfeeding women generally there is a lack of knowledge on the effect of alcohol on the breastfed infant. Coupled with this is the equal desire for more accurate information to be made available in this area through the usual channels of antenatal care.

It is useful to consider the health promotion Theory of Reasoned Action (TRA) and Theory of Planned Behaviour (TPB)(Azjen & Driver 1991; Azjen & Fishbein 1980) when developing recommendations based on this study and to guide future investigations (see Figure 7.4.1). Together these theories explore the relationship between behavior and beliefs, attitudes, and intentions. A person's behavior is determined by her intention to perform the behavior and this intention is, in turn, is a function of her attitude toward the behavior and her subjective norms.

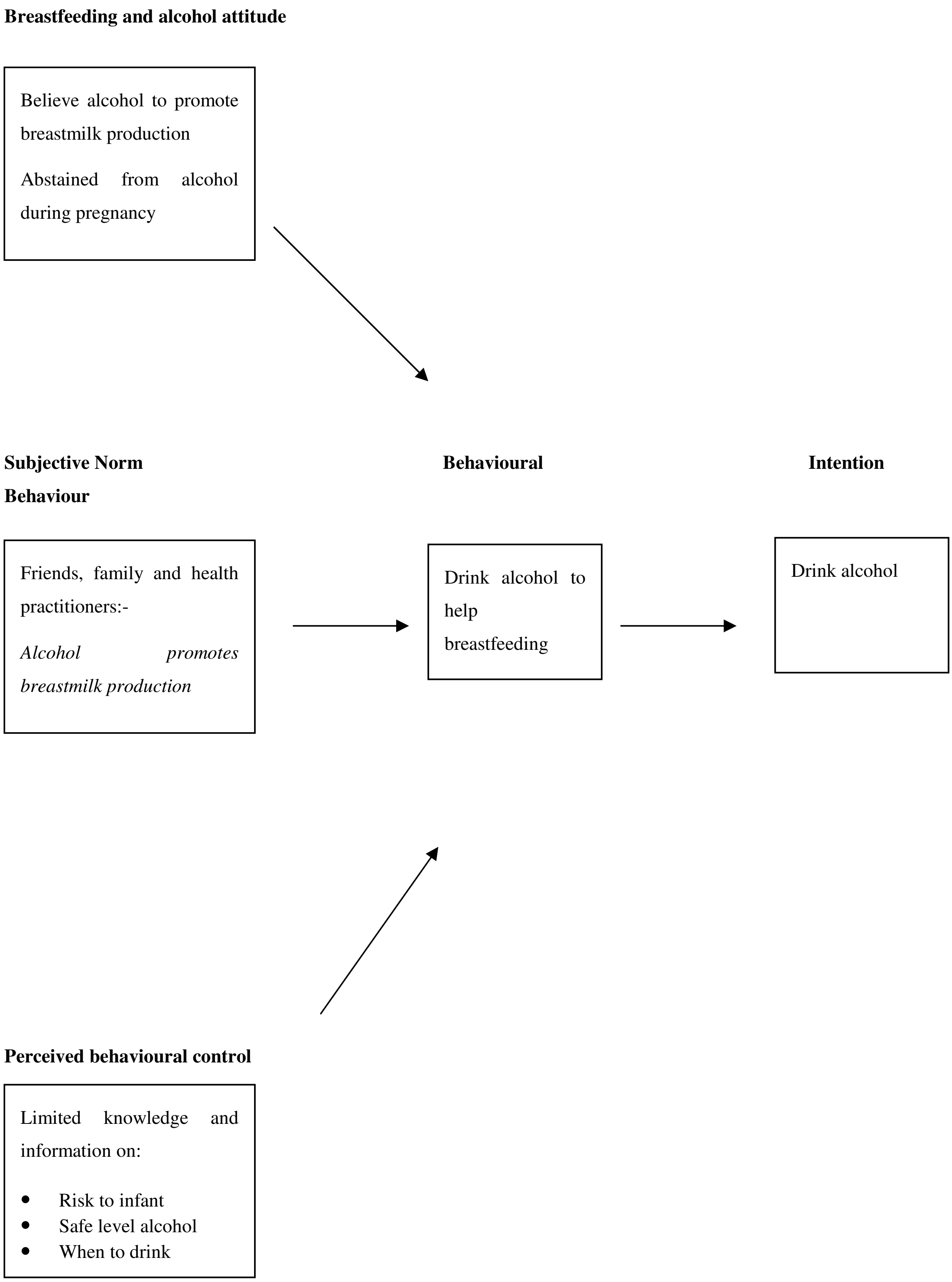
In this study the behavioural intention is to drink (or not drink) alcohol during the period of lactation. This decision is influenced by an individual's attitude towards this behavior. If the mother believes that drinking alcohol can promote breastmilk production then she is more likely to drink alcohol during lactation.

In our study the theme that alcohol is a galactagogue can be identified as a behavioural belief of the target group. In this group of women this belief may translate into the attitude that drinking alcohol can increase breastmilk production.

In addition to the individual’s attitudes toward the behavior, is the individual’s subjective norms, that is their beliefs about how people they care about will view the behavior in question. The concept that alcohol is a galactagogue can also be investigated as a subjective norm of friends, family and some health practitioners of the women, and their motivation to comply with those around them.

Finally, perceived behavioral control influences intentions. Perceived behavioral control refers to people's perceptions of their ability to perform a given behavior. The lack of information available to the women regarding the risks of drinking alcohol during lactation will affect the control the mothers have over the behavioural intention. Mothers have the option of abstaining or not abstaining from alcohol, or timing their alcohol intake to minimise the risk to the infant. However, the results from our study suggest that women are not aware of the risks of drinking alcohol to the infant or the options for ‘safe’ alcohol consumption and this lack of education/information may limit the control (perceived or otherwise) that women have over this behaviour.

Figure 7.4.1 Theory of planned alcohol consumption behaviour during lactation



However, as not all the women report drinking alcohol to increase breastmilk production, there must be additional factors that prevent this behaviour. It is possible the profuse availability of health information regarding FAS accessed during pregnancy, may still be influencing the abstinent behaviour of these women and influencing their behavioural beliefs. Alternatively, their lack of knowledge of about drinking alcohol and the effect on the infant may be inhibiting this behaviour.

Based on this examination, interventions to promote safe alcohol intake during lactation need to dispel the myths about alcohol and breastmilk production, and expose the risks of drinking alcohol during lactation. Educational material that provides direction for safe drinking practices may help promote the initiation of breastfeeding and support continued breastfeeding duration. This information should be widely disseminated to ensure greater public and professional understanding. In this way, an ecological perspective of the consumption of alcohol during lactation needs to be considered when developing education interventions in the future (see Table 7.4.1).

This descriptive study employed a variety of methods to recruit a representative sample of women and to elicit their opinions and experiences with respect to drinking alcohol during lactation. Despite this the study was limited in attracting women from the very disadvantaged socioeconomic groups reflecting the 'hard to reach' groups of health promotion. Notwithstanding the overall low number of women and lack of representativeness of the very disadvantaged socioecomic groups in the sample, we did find that many of the ideas were repeatedly expressed in each of the focus group discussions. Given that alcohol intake during and after pregnancy is related to higher social class(Bell & Lumley 1989; Counsell, Smale & Geddis 1994; McLeod et al. 2002) it is possible that the women in this study reflect those women most likely to be consuming alcohol during lactation.

The authors are unaware of any previous qualitative research in this area and further research that examines women's opinions and experiences with alcohol during lactation is needed. Future research that interviews breastfeeding mothers, from a greater distribution of socioeconomic backgrounds, several times during the infant's first year will help provide a better understanding of the issues identified in this study. Clear evidence-based guidelines on alcohol consumption during this period need to be developed and disseminated to practitioners so that the advice given to breastfeeding mothers is consistent, realistic and based on research findings.

Table 7.4.1 An ecological perspective: levels of influence

Concept	Definition/Example
Intrapersonal Level	Individual knowledge, attitudes, beliefs and personality traits.
Interpersonal Level	Interpersonal processes and primary groups. Influence of family, friends and supportive role models.
Community Level	
Institutional Factors	Policies and information that may promote or constrain recommended behaviours. Information from community health nurse, midwife, GP, obstetrician, paediatrician.
Community Factors	Social networks and norms, which exist as formal or informal among individuals, groups, and organizations. E.g. Women or Mother's group.
Public Policy	Local, state and federal policies and laws that regulate or support healthy actions for breastfeeding. A lack of a federal policy and evidence-based guidelines that outlines safe drinking practices for lactating women.

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RCG had primary responsibility for the data collection, data analysis and writing the manuscript.

CWB contributed to project design and writing the manuscript.

References

Azjen, I & Driver, BL 1991, 'Prediction of leisure participation from behavioral, normative, and control beliefs: an application of the theory of planned behavior', *Leisure Sciences,* vol. 13, pp. 185–204.

Azjen, I & Fishbein, M 1980, *Understanding attitudes and predicting social behaviour*, Prentice-Hall, Englewood Cliffs.

Bell, R & Lumley, J 1989, 'Alcohol consumption, cigarette smoking and fetal outcome in Victoria, 1985', *Community Health Studies,* vol. 8, no. 4, pp. 484-91.

Counsell, A, Smale, P & Geddis, D 1994, 'Alcohol consumption by New Zealand women during pregnancy', *The New Zealand Medical Journal,* vol. 107, no. 982, pp. 278-81.

Giglia, RC & Binns, CW 2006, 'Alcohol and lactation: a systematic review', *Nutrition and Dietetics,* vol. 63, pp. 103-16.

Giglia, RC & Binns, CW in press, 'Alcohol, pregnancy and breastfeeding; an analysis of the 1995 and 2001 National Health Survey data', *BMC Public Health*.

Kesaniemi, YA 1974, 'Ethanol and acetaledhyde in the milk and peripheral blood of lactating women after ethanol administration', *The Journal of Obstetrics and Gynaecology,* vol. 81, no. January, pp. 84-6.

Little, R, Lambert, M & Worthington-Roberts, B 1990, 'Drinking and smoking at 3 months postpartum by lactation history', *Paediatric and Perinatal Epidemiology,* vol. 4, pp. 290-302.

McLeod, D, Pullon, S, Cookson, T & Cornford, E 2002, 'Factors influencing alcohol consumption during pregnancy and after giving birth', *New Zealand Medical Journal,* vol. 115, no. 1157, p. U29.

Mennella, J 1997, 'Infant's suckling responses to the flavor of alcohol in mothers' milk', *Alcoholism: Clinical and Experimental Research,* vol. 21, no. 4, pp. 581-5.

Mennella, J & Gerrish, C 1998, 'Effects of exposure to alcohol in mother's milk on infant sleep', *Pediatrics,* vol. 101, no. 2 March 2004, pp. e21-e5 .

Morgan, DL 1993, 'Qualitative Content Analysis: A guide to paths not taken', *Qualitative Health Research,* vol. 3, pp. 112-21.

O'Connor, M, Brill, N & Sigman, M 1986, 'Alcohol use in primiparous women older than 30 years of age: relation to infant development', *Pediatrics,* vol. 78, no. 3, pp. 444-50.

O'Leary, C 2004, 'Fetal alcohol syndrome: Diagnosis, epidemiology, and developmental outcomes', *Journal of Paediatrics and Child Health,* vol. 40, pp. 2-7.

Sandelowski, M 2000, 'Focus on Research Methods. Whatever happened to qualitative description?' *Research in Nursing and Health,* vol. 23, pp. 334-40.

Worsley, A 2002, 'Nutrition knowledge and food consumption: can nutrition knowledge change food behaviour?' *Asia Pacific Journal of Clinical Nutrition,* vol. 11, no. Suppl, pp. S579–S85.

Chapter 8 Which mothers smoke before, during and after pregnancy?

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Summary

Objective: To investigate the sociodemographic factors associated with cigarette smoking in women before, during and after pregnancy.

Study Design: A 12-month longitudinal study.

Method: All eligible mothers at two public maternity hospitals in Perth, Australia were asked to participate in a study of infant feeding. While in hospital, participating mothers completed a self-administered baseline questionnaire. Follow up telephone interviews were conducted at 4, 10, 16, 22, 32, 40 and 52 weeks. Data collected included sociodemographic, biomedical, hospital-related and psychosocial factors associated with the initiation and duration of breastfeeding.

Results: A total of 587 (55%) mothers participated in the study. Thirty nine percent of mothers reported smoking pre- pregnancy. Mothers who smoked were more likely to have a partner who smoked, to have consumed alcohol prior to pregnancy and less likely to attend antenatal classes. They were also less likely to have know how they were going to feed their baby before conception and likely to be more inclined to consider stopping breastfeeding before four months postpartum.

Conclusion: Having a partner (father of the newborn infant) who smoked and maternal alcohol consumption prenatally were factors associated with pre-pregnancy smoking. In addition, if a woman decided how she would feed her infant before the pregnancy occurred and intended to breastfeed for longer than four months she was less likely to smoke in the prenatal period.

Having a father (of the newborn infant) who smoked during pregnancy continued to be a factor significantly associated with maternal smoking in the antenatal and postnatal period. Not attending antenatal classes and not intending to breastfeed for longer than four months were also factors associated with maternal smoking. At ten weeks postpartum being of Caucasian origin and having a low Iowa Infant Feeding Attitude Score were factors significantly associated with smoking postnatally.

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8.1 Introduction

Smoking has been shown to negatively effect fecundity and fertility, and evidence shows that cigarette smoking is linked to a variety of adverse pregnancy outcomes including low birth weight, spontaneous abortion, and infant death (US Department of Health and Human Services 2001). Upon birth, low birth weight babies have been shown to have difficulty breastfeeding due to an ineffective suck correlated with immaturity, which further compromises their early growth and development (Hill, Hanson & Mefford 1994). They are disadvantaged in adulthood as evidenced by the association between low birth weight and the development of type 2 diabetes, hypertension and coronary heart diseases (Sallout & Walker 2003).

Breastfeeding in the postnatal period enables infants to achieve optimal growth and development (Binns & Davidson 2003; Labbok, Clark & Goldman 2004) however cigarette smoking has been shown to be associated with a decreased initiation and duration of breastfeeding (Horta, Kramer & Platt 2001) which further compromises the health and development of an infant already exposed to cigarette smoke. Further to this maternal smoking in the postnatal period poses an indirect threat to the infant through environmental smoke and a direct threat through the transfer of nicotine in the breastmilk (US Department of Health and Human Services 2001).

The physiological mechanism of nicotine in decreasing breastfeeding initiation has been ascribed to nicotine dependent alterations in prolactin and oxytocin production resulting in a subsequent diminished let-down reflex and decreased breastmilk volume (US Department of Health and Human Services 2001). However continued research fails to support this theory (Amir & Donath 2002). What is supported is that psychosocial factors play an important role in breastfeeding rates among women who smoke (Amir & Donath 2002).

Current Australian and World Health Organisation (WHO) guidelines recommend exclusive breastfeeding for the first six months of life, with continued breastfeeding until two years of age together with complementary foods (National Health and Medical Research Council 2003b; World Health Organization 2001). Australian breastfeeding initiation rates from the 2001 National Health Survey (NHS) was 83%, (Australian Bureau of Statistics 2003a) however rates as high as 93.8% have been reported in a more recent longitudinal study conducted in Perth, Western Australia (Graham et al. 2005). Regardless of these high initiation rates, national levels for infants fully breastfed at three months or less, and six months or less had fallen to 54%, and to 32% respectively in the 2001 NHS (Australian Bureau of Statistics 2003a).

The 2001 NHS identified approximately 27% of women of childbearing age (18-44 years), who are smokers and will potentially smoke during pregnancy and lactation (Australian Bureau of Statistics 2003b). The National Health and Medical Research Council (NHMRC) sets an Australian target of 80% of infants being breastfed at the age of six months (National Health and Medical Research Council 2003b). As smoking is a known risk factor for the early cessation of breastfeeding and with more than a quarter of Australian women of childbearing age smoking, it has become a significant barrier to achieving national breastfeeding goals.

The connection between maternal cigarette smoking and breastfeeding duration warrants further investigation into those factors associated with maternal smoking. This paper describes the pre-pregnancy, during pregnancy and postnatal smoking patterns of a sample of women and examines the sociodemographic factors, which may provide information essential for the development of effective strategies to support continued breastfeeding.

8.2 Methods

The second Perth Infant Feeding Study (PIFSII) was conducted between mid-September 2002 and mid-July 2003 to monitor breastfeeding rates and identify changes in breastfeeding practices and the determinants of breastfeeding. The study was conducted using the same methodology as the first Perth Infant Feeding Study

(PIFSI). PIFSI was conducted 10 years previous and results have been reported elsewhere (Scott et al. 1999).

Mothers were contacted within the first three days following the birth of their infant. Women were considered eligible for the study if they had delivered a live infant free of any serious health conditions requiring transfer to the neonatal intensive care unit at Perth's major maternity hospital. Mothers whose infants were admitted to the Special Care Nurseries (SCN) of the participating hospitals were eligible for recruitment.

Those women agreeing to participate in the study completed the self-administered baseline questionnaire while in hospital or shortly after discharge. Women declining to participate were asked to provide some basic sociodemographic data in order to determine the representativeness of the sample. All women regardless of their chosen infant feeding method were followed up by telephone interview at 4, 10, 16, 22, 32, 40 and 52 weeks postpartum. The study instruments used were essentially the same as that used in PIFSI, with only minor improvements and additions being made to the instruments used in the PIFSII.

Mothers were asked if they had smoked before pregnancy and if they had smoked during pregnancy as part of the baseline questionnaire. Women were classified as smokers or non-smokers during pregnancy according to their self-reported smoking status. At each follow up interview mothers' smoking status was once again confirmed.

8.2.1 Statistical analysis

In addition to descriptive analysis, univariate analysis using cross-tabulation and X^2 statistics, and multivariate logistic regression modeling using the Statistical Package for Social Sciences, Version 11.0 (SPSS for Windows, SPSS Inc., Chicago, IL, USA) were used to explore variation in factors influencing smoking before, during and after pregnancy.

We used both findings from the literature and univariate analyses (criterion for inclusion: $p<0.15$) to decide which variables should be entered into the final multivariate logistic model. In the final model all variables were entered simultaneously. All variables were kept in the final model, even those not statistically significant, to illustrate their diminished effect of these factors, which are often considered to be correlated with cigarette smoking (e.g. education and income level).

Presented *P* values are two-sided, and a 5% significance level was used.

8.2.2 Ethical considerations

The PIFSII was approved by the human ethics committee of Curtin University and the Research Ethics Committees of the two participating hospitals. Signed informed consent was obtained from participants.

8.3 Results

In total, 1068 women were eligible to participate in the PIFSII. Of these 870 (68%) were contacted and 587 (55%) completed the baseline questionnaire. There were no significant differences in the age or level of education of participants compared to non-participants (Graham et al. 2005). Table 8.3.1 outlines the characteristics of the participants by smoking status.

Table 8.3.1 Characteristics of the participants prior to, and during pregnancy (%)

	Pre-Pregnancy				Pregnancy			
	Non-smoker (n=358)		Smoker (n= 228)		Non-smoker (n=427)		Smoker (n=153)	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Maternal age (yr)								
<20	11	3.1	21	9.2	16	3.7	16	10.5
20 – 24	63	17.6	59	25.9	89	20.8	31	20.3
25 – 29	106	29.6	64	28.1	123	28.8	45	29.4
30 – 35	116	32.4	61	26.8	129	30.2	46	30.1
35+	62	17.3	23	10.1	70	16.4	15	9.8
Maternal education level								
did not complete secondary school	100	27.9	111	48.7	126	29.5	83	54.2
completed secondary school/trade	198	55.3	108	47.4	234	54.8	68	44.4
bachelor degree or higher	60	16.8	9	3.9	67	15.7	2	1.3
Income								
<$25 000	175	48.9	140	61.4	213	49.9	99	64.7
>$25 000	175	48.9	83	36.4	204	47.8	51	33.3

Tables 8.3.2 – 8.3.4 present the univariate and multivariate results.

Table 8.3.2 Relationship between pre-pregnancy smoking and explanatory variables

	Smoker before pregnancy % (n= 228)	Multivariate Odds Ratio (95% CI)	p
Maternal alcohol intake			0.010
drank alcohol pre-pregnancy	77.0	2.9 (1.3-6.5)	
did not drink alcohol pre-pregnancy	23.0	1	
Father's smoking status pre-pregnancy			0.000
Smoker	75.2	7.0 (3.7-13.2)	
non-smoker	24.8	1	
When first decided how to feed baby			0.001
during/after pregnancy	53.5	3.1 (1.6-6.1)	
before pregnancy	46.5	1	
Attend antenatal			0.026
No, never	46.3	2.1 (1.1-4.1)	
Yes, this and/or previous	53.7	1	
Intended duration			0.048
<4months	26.2	2.2 (1.0-4.8)	
4 months+	73.8	1	

Variables in full models included maternal age (<25 years, >25 years), maternal education level (did not complete secondary education, completed secondary school/trade**,** bachelor degree or higher), timing of pregnancy (actively trying, mistimed, unplanned), income (<$25 000, >$25 000), Mother's country of birth (Caucasian, other), Maternal Iowa Score(IIFAS) (low score, high score).

Smoking in pre-pregnancy was significantly associated with maternal alcohol intake and a father (partner) who smoked.

Mothers who had decided how to feed their baby during or after pregnancy were more likely to be smokers in pre-pregnancy than women who had decided on their feeding method prior to pregnancy. Similarly women who did not attend antenatal classes were twice as likely to smoke before pregnancy. Intending to breastfeed for less than four months was significantly associated with pre-pregnancy smoking.

Father's smoking status remained significantly associated with a mother's likelihood of smoking during pregnancy. Women who had not attended antenatal classes, and those intending to breastfeed for less than four months were more likely to smoke during pregnancy.

Table 8.3.3 Relationship between smoking during pregnancy and explanatory variables

	Smoking in pregnancy (%) (n=153)	Multivariate Odds Ratio (95% CI)	p
Father's smoking status during pregnancy			0.000
smoker	74.8	5.7 (2.9-11.3)	
non-smoker	25.2	1	
Attend antenatal			0.001
No, never	52.0	3.2 (1.6-6.2)	
Yes, this and/or previous	48.0	1	
Intended duration			0.012
<4months	27.5	2.7 (1.2-5.9)	
4 months+	72.5		

Variables in full models included maternal education level (did not complete secondary education, completed secondary school/trade**,** bachelor degree or higher), when first decided how to feed baby (during/after pregnancy, before pregnancy), timing of pregnancy (actively trying, mistimed, unplanned), income (<$25 000, >$25 000), Mother's country of birth (Caucasian, other), Maternal Iowa Score(IIFAS), (low score, high score).

Postnatally, mothers were more likely to smoke if the father was a smoker. Mother's country of birth was dichotomised into Caucasian and 'other'. Caucasian women were predominantly from Australia, New Zealand, the UK, North America and Europe, and 'other' women comprised all other nations. Caucasian women were between five and six times more likely to be smokers after the birth of their child.

Table 8.3.4 Relationship between postnatal smoking (week 10) and explanatory variables

	Smoking postnatal (%) (n=123)	Multivariate Odds Ratio (95% CI)	p
Father's smoking status during pregnancy			0.000
smoker	31.6	6.7 (3.0-15.2)	
non-smoker	68.4	1	
Mother's country of birth			0.044
Caucasian	96.7	5.2 (1.0-25.7)	
Other	3.3	1	
Maternal Iowa Score(IIFAS)			0.009
low score	67.5	2.9 (1.3-6.6)	
high score	32.5	1	

Variables in full models included maternal education level (did not complete secondary education, completed secondary school/trade**,** bachelor degree or higher), maternal age (<25 years, > 25 years), when first decided how to feed baby (during/after pregnancy, before pregnancy), timing of pregnancy (actively trying, mistimed, unplanned), attend antenatal classes (No, never, Yes, this and/or previous pregnancy), Intended duration of breastfeeding (>4 months, >4 months).

A mother's attitude towards infant feeding was measured by the Iowa Infant Feeding Attitude Scale (IIFAS) (De la Mora et al. 1999). The IIFAS is a valid and reliable 17 item scale which measures attitudes towards both breast and formula feeding with regards to the health and nutritional benefits, and the cost and convenience of each method (Scott, Shaker & Reid 2004). Mothers with a low Maternal Iowa were more likely to be smoking postnatally.

8.4 Discussion

In our study 39% of women reported smoking prior to pregnancy. Past studies on pre-pregnancy smoking report prevalence levels ranging from 21.5%-46% (Dejin-Karlsson et al. 1996; Fingerhut, Kleinman & Kendrick 1990; Kahn, Certain & Whitaker 2002; Najman et al. 1998; O'Campo & Faden 1992; Severson et al. 1995) In 1998, an Australian study reported a pre-pregnancy smoking level of 45.9% (Najman et al. 1998).

The variability in reported smoking prevalence may be a consequence of self-reported smoking. A limitation of the current study may be our measure of self reported smoking in pre-pregnancy was recalled up to one week after delivery and social desirability may lead to a biased recall of smoking in new mothers. Like other studies of self reported smoking levels in pre-pregnancy, our reports of smoking were not biochemically confirmed (Fingerhut, Kleinman & Kendrick 1990; Kahn, Certain & Whitaker 2002; O'Campo & Faden 1992). Some studies have claimed reasonably accurate self reports of smoking, even long after pregnancy, (Heath et al. 2003) however others have found that smoking during pregnancy is underreported or undisclosed (Russell, Crawford & Woodby 2004).

Smoking prevalence decreased during pregnancy (26%) despite this our level was higher than the most recent national Australian figures reported (18%), (McDermott, Russell & Dobson 2002) and lower than 31% recorded from 1996-1998 in a previous Australian study (Phung et al. 2003).

Postpartum smoking prevalence further decreased to 23%. Previous research reports values of 26%-28% of women smoking postnatally (Kahn, Certain & Whitaker 2002).

Maternal age has been shown to be a strong independent indicator of smoking before, (Fingerhut, Kleinman & Kendrick 1990; Kahn, Certain & Whitaker 2002; Najman et al. 1998; O'Campo & Faden 1992; Severson et al. 1995) and during pregnancy (Dejin-Karlsson et al. 1996). We failed to find a lack association between young age and maternal smoking which may simply be a reflection of current national Australian smoking trends. Nationally female smoking rates peak in the 20-29 and 30-39 age group at 22.9% and 21.8%, respectively (Australian Institute of Health and Welfare 2005b).

Unlike previous studies we were unable to find a significant relationship between smoking before, during and after pregnancy and education level after adjusting for covariates (Dejin-Karlsson et al. 1996; Fingerhut, Kleinman & Kendrick 1990; Kahn, Certain & Whitaker 2002; O'Campo & Faden 1992; Severson et al. 1995). This may be due to other factors exerting a stronger influence over maternal smoking throughout this emotionally and physically demanding time, particularly after the birth.

Our finding that pre-pregnant smokers were almost three times as likely to drink alcohol as non-smokers is supported by the literature (Kahn, Certain & Whitaker 2002; Severson et al. 1995). Alcohol has also been shown to be a factor strongly associated with relapse in women who quit smoking prior to pregnancy (Severson et al. 1995).

The lack of association between alcohol and smoking during pregnancy is most likely attributable to the public health awareness of reducing alcohol intake during pregnancy that exists today. Postnatally women may find they no longer desire the taste of alcohol due to their abstinence during pregnancy or they may find a lack of social occasions to drink alcohol in their new mothering role.

A strong relationship was confirmed between smoking pre-pregnancy, during pregnancy and postnatally, and the father's smoking status. This effect has been documented prior to pregnancy, (Kahn, Certain & Whitaker 2002; Severson et al. 1995) during pregnancy, (Dejin-Karlsson et al. 1996; Severson et al. 1995) and postnatally, (Kahn, Certain & Whitaker 2002; Najman et al. 1998; Severson et al. 1995) in previous research.

In our study, we assumed the father of the child to be the mother's partner as approximately 90% of smoking mother's responded that the only (other) smoker in the household was the father. Given this information we found that if the father smoked the mother was between five and seven times more likely to smoke herself, prior to falling pregnant, during pregnancy and after the birth. Research has shown this relationship extends beyond the partner, in that women who cohabitat with a smoker are less likely to quit smoking during pregnancy and more likely to relapse if they have quit (Kahn, Certain & Whitaker 2002; Severson et al. 1995).

Infants exposed to Environmental Tobacco Smoke (ETS) are at increased risk of respiratory illness, and a continuation of both parents smoking poses a health risk for the newborn infant (US Department of Health and Human Services 2001). Having a father who smokes makes it difficult for the mother not to smoke as the presence of another smoker within the household automatically provides for the availability of cigarettes and therefore the opportunity to smoke as well as the temptation to smoke.

Women who decided how they were going to feed their baby before becoming pregnant were less likely to be smokers prior to pregnancy. When adjusted for, this association only existed with smoking prior to pregnancy and to date no other study has investigated this variable as a factor in maternal smoking.

Intending to breastfeed for less than four months was significantly associated with smoking prior to pregnancy and during pregnancy. This is akin to O’Campo and Faden (O'Campo & Faden 1992) who found that women intending to breastfeed were less likely to smoke prior to pregnancy and more likely to quit during pregnancy than women intending to formula feed.

Antenatal classes aim to prepare expectant parents for childbirth and their new family life. Our finding that mothers not attending antenatal classes was significantly associated with smoking before and during pregnancy agrees with the literature (Fabian, Ra`destad & Waldenstr`om 2004). Women who are smoking and not attending antenatal classes may not be receiving information related to exposure of their infant to nicotine and ETS further amplifying the hazards of smoking and may not be provided with opportunities for education on smoking cessation.

It is possible that together the attendance at antenatal classes, intended duration of breastfeeding, timing of both the pregnancy and the decision of how to feed the baby may signify the preparedness of the mother for the oncoming pregnancy. A lack of readiness for this major life event may be enacted through a continuation of smoking whereas those women enthusiastically anticipating this event have had time to contemplate and quit smoking before conception.

Unlike previous studies (Kahn, Certain & Whitaker 2002; McDermott, Russell & Dobson 2002; Najman et al. 1998; Phung et al. 2003) we failed to find a significant relationship between smoking and income level or social group. This discrepancy between our study and those before us may be due to power differences between their investigations and the current one. In addition, education and age are considered to be highly correlated with income. Women who are older are often more educated and more aware of the dangers of smoking before, during and after pregnancy and therefore less likely to smoke.

Kahn, Certain and Whittaker (Kahn, Certain & Whitaker 2002) found that Caucasian race was a significant predictor of smoking in the 12 months before pregnancy. Likewise in our study Caucasian women were four times more likely to smoke before pregnancy than 'other' women. The most recent national Australian data, (McDermott, Russell & Dobson 2002) and Australian study, (Phung et al. 2003) also found that women from English speaking countries or predominantly Caucasian women had a higher smoking level during pregnancy than 'other' women.

A low IIFAS is indicative of negative maternal breastfeeding attitudes and previous studies have indicated that positive maternal breastfeeding attitudes are strongly correlated with maternal age, level of education, income, and marital status (De la Mora et al. 1999). In our study a low IIFAS score was significantly associated with smoking postnatally. As a high score indicates willingness to breastfeed, a low IIFAS score may also be a proxy for the lack of anticipation of the approaching birth.

This study is the first Australian study to assess the relationship between smoking before, during and after pregnancy with sociodemographic factors predictive of smoking, but it needs to be replicated to verify our results and to investigate further other factors that may play a role in predicting maternal smoking habits. In addition several limitations of this study exist.

All smoking behaviours were self-reported and cigarette smoking may have been underreported particularly during the antenatal period when there is increased stigma associated with smoking, as opposed to smoking before and after pregnancy. However self-reported smoking status is considered to be reasonably accurate (Heath et al. 2003). Future studies should consider the inclusion of alternative measures of cigarette smoking.

The relatively small sample size, and the fact that all women came from government hospitals is a limitation of this study. Thus, the results may not be generalisable to the rest of Australia or to other cultures. Future studies in other countries that use larger, more representative samples and that investigate sociodemographic factors indicative of maternal smoking should be conducted to confirm our findings.

In summary this study further substantiates a number of factors independently associated with smoking prior to pregnancy, during pregnancy and postnatally. Foremost is the impact partner's (father's) smoking status has on all stages of pregnancy. This potentially modifiable risk factor (Blackburn et al. 2005) is paramount in promoting positive breastfeeding outcomes and optimum health of the baby.

Alcohol intake is a health risk behaviour known to cluster with cigarette smoking and in this study maternal alcohol intake was associated with smoking prior to pregnancy (English, Najman & Bennett 1997). Being emotionally prepared for the pregnancy and making important choices for the care of the baby (e.g., feeding method) is possibly another factor in the conundrum of maternal smoking and an important area for education.

Smoking cessation interventions targeted at women of child bearing age need to consider the likelihood of women conceiving a baby and the harmful effect of smoking on the unborn foetus and newborn baby. Factors predictive of pre-pregnancy, antenatal and postnatal smoking highlighted in this and previous research are essential in tailoring client interventions. Most importantly since a smoker's partner often smokes as well, the anti-smoking efforts in antenatal care must be complementary to the general preventive work in the community and inclusive of the partner.

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References

Amir, LH & Donath, SM 2002, 'Does maternal smoking have a negative physiological effect on breastfeeding? The epidemiological evidence', *Birth,* vol. 29, no. 2, pp. 112-23.

Australian Bureau of Statistics 2003a, *Breastfeeding in Australia, 2001*, Australian Bureau of Statistics, Canberra, Report No. 4810.0.55.001.

Australian Bureau of Statistics 2003b, *National Health Survey, Australia (2001), Basic Confidentialised Unit Record File*, Australian Bureau of Statistics, Canberra, Cat no. 4324.0.30.001.

Australian Institute of Health and Welfare 2005, *2004 National Drug Strategy Household Survey: First Results. AIHW Cat. no. PHE 57*, AIHW (Drug Statistics Series No. 13), Canberra.

Binns, CW & Davidson, GP 2003, 'Infant Feeding Guidelines for Health Workers', in NHMRC (ed.), *Food for Health: Dietary Guidelines for Children and Adolescents in Australia*, ISBN 1864961538 edn, NHMRC, Canberra, p. 452.

Blackburn, C, Bonas, S, Spencer, N, Dolan, A, Coe, C & Moy, R 2005, 'Smoking behaviour change among fathers of new infants', *Social Science and Medicine,* vol. 61, pp. 517-26.

De la Mora, A, Russell, D, Dungy, C, Losch, M & Dusdieker, L 1999, 'The Iowa Infant Feeding Attitude Scale: analysis of reliability and validity', *Journal of Applied Social Psychology,* vol. 29, no. 11, pp. 2362-80.

Dejin-Karlsson, E, Hanson, BS, Ostergren, P, Ranstam, J, Isacsson, S & Sjoberg, N 1996, 'Psychosocial resources and persistent smoking in early pregnancy - a population study of women in their first pregnancy in Sweden', *Journal of Epidemiology and Community Health,* vol. 50, pp. 33-9.

English, RM, Najman, JM & Bennett, SA 1997, 'Dietary intake of Australian smokers and nonsmokers', *Australian and New Zealand Journal of Public Health,* vol. 21, pp. 141-6.

Fabian, HM, Ra`destad, IJ & Waldenstr`om, U 2004, 'Characteristics of Swedish women who do not attend childbirth and parenthood education classes during pregnancy', *Midwifery,* vol. 20, pp. 226-35.

Fingerhut, LA, Kleinman, JC & Kendrick, JS 1990, 'Smoking before, during and after pregnancy', *American Journal of Public Health,* vol. 80, no. 5, pp. 541-4.

Graham, KI, Scott, JA, Binns, CW & Oddy, WH 2005, 'National targets for breastfeeding at hospital discharge have been achieved in Perth', *Acta Paediatrica,* vol. 94, pp. 352-6.

Heath, AC, Knopik, VS, Madden, PA, Neuman, RJ, Lynskey, MJ, Slutske, WS, Jacob, T & Martin, NG 2003, 'Accuracy of mother's retrospective reports of smoking during pregnancy: comparison with twin sister informant ratings', *Twin Research,* vol. 6, no. 4, pp. 297-301.

Hill, PD, Hanson, KS & Mefford, AL 1994, 'Mothers of low birthweight infants: breastfeeding patterns and problems', *Journal of Human Lactation,* vol. 10, pp. 169-76.

Horta, BL, Kramer, MS & Platt, RW 2001, 'Maternal smoking and the risk of early weaning: a meta-analysis', *Am J Public Health,* vol. 91, no. 2, pp. 304-7.

Kahn, RS, Certain, L & Whitaker, RC 2002, 'A reexamination of smoking before, during, and after pregnancy', *American Journal of Public Health,* vol. 92, pp. 1801-8.

Labbok, M, Clark, D & Goldman, A 2004, 'Breastfeeding: maintaining an irreplaceable immunological resource', *Nature Reviews. Immunology,* vol. 4, pp. 565-72.

McDermott, L, Russell, A & Dobson, A 2002, *Cigarette smoking among women in Australia*, National Tobacco Strategy. Commonwealth Department of Health and Ageing, Canberra.

Najman, JM, Lanyon, A, Andersen, M & Williams, G 1998, 'Socioeconomic status and maternal cigarette smoking before, during and after pregnancy', *Australian and New Zealand Journal of Public Health,* vol. 22, no. 1, pp. 60-6.

National Health and Medical Research Council 2003, *Dietary Guidelines for Children and Adolescents in Australia*, Commonwealth of Australia, Canberra.

O'Campo, P & Faden, RR 1992, 'The impact of pregnancy on women's prenatal and postpartum smoking behaviour', *American Journal of Preventive Medicine,* vol. 8, pp. 8-13.

Phung, HN, Bauman, AE, Young, L, Tran, MH & Hillman, KM 2003, 'Ecological and individual predictors of maternal smoking behaviour. Looking beyond individual socioeconomic predictors at the community setting', *Addictive Behaviours,* vol. 28, pp. 1333-42.

Russell, TV, Crawford, MA & Woodby, LL 2004, 'Measurements for active cigarette smoke exposure in prevalence and cessation studies: Why simply asking pregnant women isn't enough', *Nicotine and Tobacco Research,* vol. 6, no. Supplement 2 (April 2004), pp. S141–S51.

Sallout, B & Walker, M 2003, 'The fetal origin of adult diseases', *Journal of Obstetrics and Gynaecology,* vol. 23, pp. 555–60.

Scott, JA, Aitkin, I, Binns, CW & Aroni, RA 1999, 'Factors associated with the duration of breastfeeding amongst women in Perth, Australia', *Acta Paediatr,* vol. 88, no. 4, pp. 416-21.

Scott, JA, Shaker, I & Reid, M 2004, 'Parental attidtudes toward breastfeeding: Their association with feeding outcome at hospital discharge', *Birth,* vol. 31, no. 2, pp. 125-31.

Severson, HH, Andrews, JA, Lichtenstein, E, Wall, M & Zoref, L 1995, 'Predictors of smoking during and after pregnancy: a survey of mothers of newborns', *Preventive Medicine,* vol. 24, pp. 23-8.

US Department of Health and Human Services 2001, *Women and smoking: a report of the Surgeon General - 2001*, Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Washington, DC.

World Health Organization 2001, The optimal duration of exclusive breastfeeding. Report of an expert consultation, WHO, Geneva.

Chapter 9 Maternal cigarette smoking and breastfeeding duration

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Abstract

Aim: To examine the relationship between cigarette smoking and breastfeeding duration at two weeks, six months, and longer.

Methods:

Design: A twelve-month longitudinal study.

Setting: Two public maternity hospitals in the Perth metropolitan area (Western Australia).

Subjects: Eligible mothers of healthy new born infants.

Interventions: Participants completed a self-administered baseline questionnaire while in hospital or shortly after discharge. All women regardless of their chosen infant feeding method were followed up by telephone interview at 4, 10, 16, 22, 32, 40 and 52 weeks postpartum.

Main outcome measures: Prevalence of breastfeeding at 2 wk, 2 wk to 6 mo and >6mo in women who smoked during pregnancy. Breastfeeding duration.

Results: Women who smoked during pregnancy had a lower prevalence and shorter duration of breastfeeding than non-smoking mothers (28 weeks versus 11 weeks, 95% CI: 8.3-13.7). This effect remained even after adjustment for age, education, income, father's smoking status, mother's country of birth, intended duration of breastfeeding >6 months and birth weight (risk ratio HR) 1.59, 95% CI 1.22 to 2.08).

Conclusion: Women who smoke during pregnancy are at greater risk of not achieving national and international targets for breastfeeding. Encouraging smoking cessation in the antenatal setting is an area for considerable public health gain.

Keywords: breastfeeding, duration, smoking

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9.1 Introduction

Based on the evidence supporting the long term health benefits of breastfeeding to both the mother and infant, current Australian and World Health Organisation (WHO) guidelines recommend exclusive breastfeeding for the first six months of life, with continued breastfeeding until two years of age together with complementary foods (National Health and Medical Research Council 2003b; World Health Organization 2001).

It is well documented that cigarette smoking during pregnancy compromises these benefits by negatively impacting on the initiation and duration of lactation (Antoniou et al. 2005; Clements et al. 1997; Dennis 2002; Haug et al. 1998; Horta, Kramer & Platt 2001; Lande et al. 2003; Scott & Binns 1998; Yang et al. 2004). Despite this conclusive evidence base there are at present no clear national or international guidelines that pregnant or lactating women cease smoking. Health professionals working closely with pregnant and lactating women are encouraged to promote smoking cessation however these interventions are often haphazard and unstructured (Hunt & Lumley 2002), and to date only the American Academy of Pediatrics (AAP) has moved to address smoking at this critical time by removing nicotine from its list of contraindicated drugs of abuse during breastfeeding in an effort to increase breastfeeding rates in the United States and to promote opportunities for physician based smoking cessation advice during pregnancy and lactation (American Academy of Pediatrics 2001).

The fact that smoking mothers cease breastfeeding earlier remains an area of topical debate. Do mothers cease breastfeeding earlier because of the stigma associated with smoking at this time or are there other contributing socio-demographic factors affecting duration? This study aims to examine the relationship between cigarette smoking and breastfeeding duration at two weeks, six months, and longer; and to contribute to the body of evidence supporting maternal cigarette smoking as a risk factor for the early cessation of breastfeeding.

9.2 Methods

9.2.1 Sample

The second Perth Infant Feeding Study (PIFSII) was conducted between mid-September 2002 and mid-July 2003 to monitor breastfeeding rates and identify changes in breastfeeding practices and the determinants of breastfeeding. The study was conducted in the same hospitals using the same methodology as the first PIF Study (PIFSI). PIFSI was conducted 10 years previous and results have been reported elsewhere (Scott et al. 1999).

Mothers were contacted within the first three days following the birth of their infant. Women were considered eligible for the study if they had delivered a live infant free of any serious health conditions requiring transfer to the neonatal intensive care unit at Perth's major maternity hospital.

Those women agreeing to participate in the study completed the self-administered baseline questionnaire while in hospital or shortly after discharge. Women declining to participate were asked to provide some basic socio-demographic data in order to determine the representativeness of the sample. All women regardless of their chosen infant feeding method were followed up by telephone interview at 4, 10, 16, 22, 32, 40 and 52 weeks postpartum. The study instruments used were essentially the same as that used in PIFSI, with only minor improvements and additions being made to the instruments used in the PIFSII. Questions relating to smoking were based on the 1989-90 National Health Survey (Australian Bureau of Statistics 1991).

Mothers were asked if they had smoked before pregnancy and if they had smoked during pregnancy as part of the baseline questionnaire. Women were classified as smokers or non-smokers during pregnancy according to their self-reported smoking status.

9.2.2 Statistical analysis

Data were entered and analysed using the Statistical Package for Social Sciences, Version 11.0 (SPSS for Windows, SPSS Inc., Chicago, IL, USA). Crude and adjusted analyses were conducted at specific time points (<2wk, 2 wk–6 mo and >6 mo), in which the outcome variable was categorical (i.e. method of infant feeding: yes, breastfeeding full or partial; no, receiving full formula). These time periods were chosen for the following reasons. Less than two weeks was considered to be an adequate amount of time for mothers to have been at home with their new baby and to make their decision on whether they would continue breastfeeding without the influence of the hospital environment. From two weeks to six months, and greater than six months, are time periods based on the WHO recommendations for exclusive breastfeeding and were considered to be significant reference points for infant feeding duration. Findings from the literature and univariate analyses were used (criterion for inclusion: $p \leq 0.15$) to decide which variables should be entered into the final multivariate logistic model. In the final model, variables were entered stepwise and all variables were kept in the final model. Potential interaction effects were also assessed. The relationship between smoking status and breastfeeding duration was determined using Kaplan Meier survival analysis. This was adjusted by using a Cox regression model with smoking status as time-dependent covariate. This extension of the standard Cox model allows changes over time to be taken into account, and it does not assume proportionality of risks (Therneau & Grambsch 2000).

Presented p values are two-sided, and a 5% significance level was used.

9.2.3 Ethical considerations

The PIFSII was approved by the Human Ethics Committee of Curtin University and the Research Ethics Committees of the two participating hospitals. Signed informed consent was obtained from participants.

9.3 Results

Twenty six percent (26%) of women smoked during pregnancy. Some of the characteristics of the smokers and non-smokers at the time of pregnancy are summarized in Table 9.3.1.

Table 9.3.1 Characteristics of smoking and non-smoking women during pregnancy

	n=	Percentage smoking	No smoking in pregnancy[a] (%) (n=427)	Smoking in pregnancy[a] (%) (n=153)	p^a
Maternal age (yr)					
<20	32	50	3.8	10.5	0.014
20 – 24	120	26	20.9	20.3	
25 – 29	168	27	28.9	29.4	
30 – 35	175	26	30.3	30.1	
35+	85	18	16.2	9.8	
Maternal education level					
did not complete highschool	209	40	29.5	54.2	<0.001
completed highschool or trade	302	23	54.8	44.4	
bachelor degree or higher	69	3	15.7	1.3	
Marital status					
Single	46	37	6.8	11.1	0.090
married/defacto	534	25	93.2	88.9	
Country of birth					
Caucasian	496	29	83.1	95.4	<0.001
Other	78	9	16.9	4.6	
Intended duration of breastfeeding					
<4 months	114	34	18.5	27.5	0.024
>4 months	433	24	81.5	72.5	
Feeding method at discharge					
full formula	36	42	4.9	9.8	0.057
partial breastfeeding	98	30	16.2	19.0	
fully breastfeeding	446	24	78.9	71.2	
Breastfeeding at 4 months	286	17	65.6	40.7	<0.001
Breastfeeding at 6 months	250	15	58.8	31.6	<0.001

[a] X^2 test

Women who smoked were significantly less likely to be breastfeeding between two weeks and six months, and longer than six months postpartum, even after adjustment for confounding covariates (see Table 9.3.2).

Table 9.3.2 Smoking during pregnancy and breastfeeding duration at less than 2 weeks, 2 weeks to 6 months, and longer than 6 months (n=587)

Variable	OR breastfeeding at 2wks (95% CI)	OR breastfeeding 2wk - 6 mo 95% CI	OR breastfeeding >6 mo 95% CI
Smoking in pregnancy	0.6 (0.4-0.9)†	0.3 (0.2-0.4)‡	0.3 (0.2-0.4)‡
Smoking in pregnancy[a, b]	0.8 (0.4-1.6)	0.2 (0.1-0.4)‡	0.3 (0.2-0.5)‡

† significant at $p \leq 0.05$, ‡ significant at $p \leq 0.001$
[a]reference group is 'non-smokers'

Using Kaplan Meier survival analysis the median duration of breastfeeding for non-smoking mothers was 28 weeks (95%CI: 25.2-30.8) and for smoking mothers was 11 weeks (95% CI: 8.3 to 13.7) (log rank 18.9, $p<0.001$).

Figure 9.3.1 Duration of breastfeeding by smoking status at pregnancy

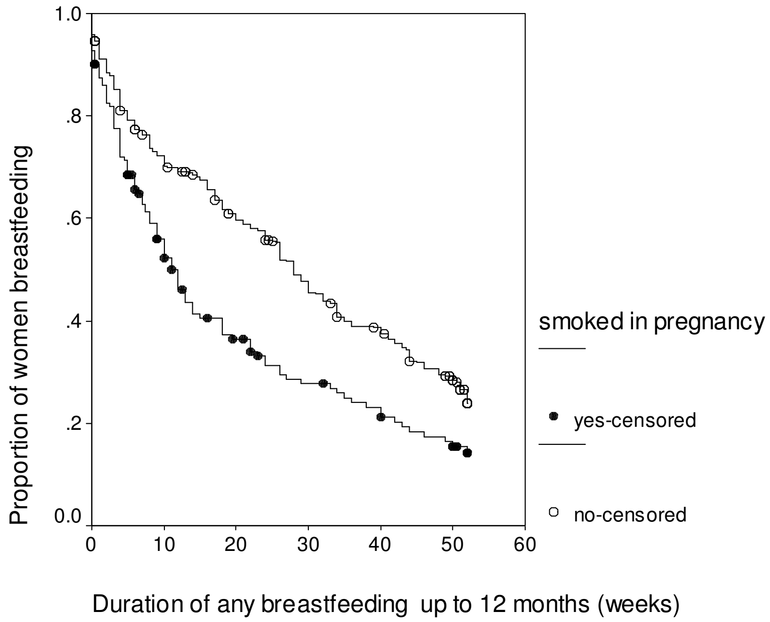

Table 9.3.3 indicates that smoking was significantly related to a shorter duration of breastfeeding. Women who smoked were 60% more likely to cease breastfeeding than non-smoking mothers, even after adjustment for potential confounders.

Table 9.3.3 Smoking during pregnancy and breastfeeding duration (n=587)

	Stopping breastfeeding HR; 95% CI	*p*-value
Smoking	1.6 (1.3-2.0)	<0.001
Smoking[a, b]	1.6 (1.2-2.1)	0.001

HR: hazard ratios were calculated using Cox regression model with time-dependent covariates
[a]reference group is 'non-smokers'
[b]adjusted for age, education, income, father's smoking status, mother's country of birth, intended duration of breastfeeding >6 months and birth weight

Results conclusively indicate that cigarette smoking during pregnancy was significantly associated with a shorter duration of breastfeeding even after adjustment for confounding covariates.

9.4 Discussion

A strong negative association was observed between maternal smoking during pregnancy and breastfeeding duration. At least four possible explanations may apply.

The association between a decrease in the duration of breastfeeding among smoking mothers was first described in 1950 (Mills 1950). It is thought that nicotine inhibits breastmilk supply by suppressing prolactin levels (Howard & Lawrence 1998). Despite a suggested physiological mechanism ascribed to nicotine dependent alterations in prolactin and oxytocin production resulting in a subsequent diminished let-down reflex and decreased breastmilk volume (Howard & Lawrence 1998; Vio, Salazar & Infante 1991), continued research fails to support this theory (Amir 2001; Amir & Donath 2002).

In their review of the epidemiological evidence, Donath and Amir (Donath & Amir 2004) state ‘if smoking had a negative physiological effect on breastfeeding, we would expect the effects of smoking to be seen universally’ (p1517) in reference to studies from Jordan, Hong Kong and New Zealand in which maternal smoking was not associated with a decreased duration of breastfeeding. Similarly, our research group have found that high rates of smoking in Aboriginal women did not adversely affect breastfeeding initiation or duration (Gilchrist et al. 2004).

Second, excessive crying has been observed in infants of smoking mothers (Reijneveld et al. 2005). This irritability may be interpreted as hunger and a mother may cease breastfeeding prematurely and commence formula feeding in response.

Third, our findings that mothers who smoke are significantly more likely to have a shorter duration of any breastfeeding even after adjustment for potential confounders conforms with the literature (Bertini et al. 2003; Clements et al. 1997; Haug et al. 1998; Horta, Kramer & Platt 2001). Age, income, education, parity, mother's country of birth, partner's smoking status and birth weight have all been shown to play a role in maternal smoking status and breastfeeding duration; however when controlled for, maternal smoking was still significantly associated with a shorter duration of breastfeeding (Bertini et al. 2003; Clements et al. 1997; Haug et al. 1998; Yang et al. 2004). Breastfeeding intention has previously been shown to have a greater effect on breastfeeding duration than maternal smoking (Donath & Amir 2004), however in our study maternal smoking remained a significant predictor of breastfeeding duration even after controlling for an intended breastfeeding duration of greater than six months.

Finally, smoking mothers who stop breastfeeding earlier than non-smokers might do so because they consider breastfeeding combined with smoking to be harmful to the baby (Haug et al. 1998). Although continued breastfeeding is recommended for mothers who smoke (American Academy of Pediatrics 2001), lower rates of breastfeeding amongst this group may stem from an unwillingness of these women to seek advice from health professionals for breastfeeding problems for fear of being stigmatized as smoking mothers (Amir 1999; Bertini et al. 2003).

Haug et al. suggests that those women who continue to smoke during pregnancy (and postnatally) belong to a group of "hardcore" smokers and it may be that these mothers will continue to smoke regardless of socio-demographic characteristics or health beliefs (Haug et al. 1998).

As in most studies of smoking during pregnancy, all smoking behaviours were self-reported in this study. Cigarette smoking tends to be underreported particularly during the antenatal period when there is increased stigma associated with smoking (Klebanoff et al. 2001), and therefore the effect of smoking on breastfeeding duration may be even more pronounced than results presented here. Although this study used a standardized questionnaire to elicit smoking information, future studies should consider the inclusion of alternative measures of cigarette smoking.

Notwithstanding the relatively small sample size, and the fact that all women came from government-based hospitals, results from this study do reflect the current evidence. In addition these mothers are representative of the “hard to reach” groups in Australian health promotion. Therefore the lessons learned from this study could be usefully used in health education programs.

Smoking mothers in our study were at greater risk of not achieving national and international breastfeeding targets. These results validate the importance of smoking as a health promotion challenge for health professionals working with pregnant and breastfeeding women. Mothers are a highly motivated group and will go to great lengths to provide the best care for their unborn fetus and infant children. Given this high level of motivation and the central role of smoking in breastfeeding duration, there is a need for the development of specific programs for smoking cessation before, during and after pregnancy. However, until these programs are developed, it should be stressed that smoking cessation is paramount for optimum antenatal and lactation outcomes, mothers who continue to smoke should be encouraged to breastfeed in accordance with evidence-based recommendations.

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References

American Academy of Pediatrics 2001, 'The transfer of drugs and other chemicals into human milk', *Pediatrics,* vol. 108, no. 3, pp. 776-89.

Amir, LH 1999, 'Smoking status of breastfeeding women', *Acta Paediatrica,* vol. 88, pp. 1412-4.

Amir, LH 2001, 'Maternal smoking and reduced duration of breastfeeding: a review of possible mechanisms', *Early Hum Dev,* vol. 64, no. 1, pp. 45-67.

Amir, LH & Donath, SM 2002, 'Does maternal smoking have a negative physiological effect on breastfeeding? The epidemiological evidence', *Birth,* vol. 29, no. 2, pp. 112-23.

Antoniou, E, Daglas, M, Iatrakis, G, Kourounis, G & Greatsas, G 2005, 'Factors associated with initiation and duration of breastfeeding in Greece', *Clinical and Experimental Obstetrics and Gynecology,* vol. 32, no. 1, pp. 37-40.

Australian Bureau of Statistics 1991, *National Health Survey Questionnaire 1989-1990*, Canberra.

Bertini, G, Perugi, S, Dani, C, Pezzati, M, Tronchin, M & Rubaltelli, F 2003, 'Maternal education and the incidence and duration of breast feeding: a prospective study', *Journal of Pediatric Gastroenterology and Nutrition,* vol. 37, pp. 447-52.

Clements, M, Mitchell, E, Wright, S, Esmail, A, Jones, D & Ford, R 1997, 'Influences on breastfeeding in southeast England', *Acta Paediatrica,* vol. 86, pp. 51-6.

Dennis, CL 2002, 'Breastfeeding initiation and duration: a 1990-2000 literature review', *J Obstet Gynecol Neonatal Nurs,* vol. 31, no. 1, pp. 12-32.

Donath, S & Amir, L 2004, 'The relationship between maternal smoking and breastfeeding duration after adjustment for maternal infant feeding intention', *Acta Paediatrica,* vol. 93, pp. 1514-8.

Gilchrist, D, Woods, B, Binns, CW, Scott, JA, Gracey, M & Smith, H 2004, 'Aboriginal mothers, breastfeeding and smoking', *Australian and New Zealand Journal of Public Health,* vol. 28, no. 3, pp. 225-8.

Haug, K, Irgens, L, Baste, V, Markestad, T, Skjaerven, R & Schreuder, P 1998, 'Secular trends in breastfeeding and parental smoking', *Acta Paediatrica,* vol. 87, no. 1023-1027.

Horta, BL, Kramer, MS & Platt, RW 2001, 'Maternal smoking and the risk of early weaning: a meta-analysis', *Am J Public Health,* vol. 91, no. 2, pp. 304-7.

Howard, C & Lawrence, R 1998, 'Breast-feeding and drug exposure', *Obstetrics and Gynecology Clinics of North America,* vol. 25, no. 1, pp. 195-217.

Hunt, JM & Lumley, J 2002, 'Are recommendations about routine antenatal care in Australia consistent and evidence-based?' *Medical Journal of Australia,* vol. 176, pp. 255-9.

Klebanoff, MA, Levine, RJ, Morris, CD, Hauth, JC, Sibai, BM, Curet, LB, Catalano, P & Wilkins, DG 2001, 'Accuracy of self-reported cigarette smoking among pregnant women in the 1990s', *Paediatric and Perinatal Epidemiology,* vol. 15, pp. 140-3.

Lande, B, Andersen, L, Baeug, A, Trygg, K, Lund-Larsen, K, Veierød, M & Bjørneboe, G 2003, 'Infant feeding practices and associated factors in the first six months of life: The Norwegian Infant Nutrition Survey', *Acta Paediatrica,* vol. 92, pp. 152-61.

Mills, CA 1950, 'Tobacco smoking: some hints of its biologic hazards', *Ohio State Medical Journal,* vol. 46, pp. 1165-70.

National Health and Medical Research Council 2003, *Dietary Guidelines for Children and Adolescents in Australia*, Commonwealth of Australia, Canberra.

Reijneveld, SA, Lanting, CI, Crone, MR & Van Wouwe, J 2005, 'Exposure to tobacco smoke and infant crying', *Acta Paediatrica,* vol. 94, pp. 217-21.

Scott, J & Binns, C 1998, 'Factors associated with the initiation and duration of breastfeeding: a review of the literature', *Australian Journal of Nutrition and Dietetics,* vol. 55, pp. 51-61.

Scott, JA, Aitkin, I, Binns, CW & Aroni, RA 1999, 'Factors associated with the duration of breastfeeding amongst women in Perth, Australia', *Acta Paediatr,* vol. 88, no. 4, pp. 416-21.

Therneau, TM & Grambsch, PM 2000, *Modelilng survival data. Extending the Cox Model*, Springer, New York.

Vio, F, Salazar, G & Infante, C 1991, 'Smoking during pregnancy and lactation and its effects on breast-milk volume', *The American Journal of Clinical Nutrition,* vol. 54, pp. 1011-6.

World Health Organization 2001, The optimal duration of exclusive breastfeeding. Report of an expert consultation, WHO, Geneva.

Yang, Q, Wen, S, Dubois, L, Chen, Y, Walker, M & Krewski, D 2004, 'Determinants of breast-feeding and weaning in Alberta, Canada', *Journal of Obstetrics and Gyanecology Canada,* vol. 26, no. 11, pp. 975-81.

Chapter 10 Which women stop smoking during pregnancy and the effect on breastfeeding duration?

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Abstract

Background

Cigarette smoking during pregnancy increases the risk of adverse pregnancy outcomes and women who quit smoking at this time are able to reduce the risk of low birth weight, preterm labour, spontaneous abortion and perinatal death. This study investigates the socio-demographic characteristics of pregnant women who stop smoking during pregnancy and the association between stopping smoking and breastfeeding duration.

Methods

A 12 month longitudinal study was conducted in two public maternity hospitals in Perth, Australia between mid-September 2002 and mid-July 2003. While in hospital, participating mothers completed a self-administered baseline questionnaire. Follow up telephone interviews were conducted at 4, 10, 16, 22, 32, 40 and 52 weeks.

Results

A total of 587 (55%) mothers participated in the study. Two hundred and twenty six (39%) mothers reported smoking prior to pregnancy and 77 (34%) of these stopped smoking during pregnancy. Women who were pregnant for the first time were twice as likely (OR = 2.05; 95% CI 1.047 - 4.03; $p<0.05$) to quit smoking as multiparous women. Women who smoked more than 10 cigarettes per day were significantly less likely to quit smoking during pregnancy (OR = 0.36; 95% CI 0.18 - 0.69; $p<0.05$). Women who consumed alcohol before pregnancy were three times more likely to quit smoking (OR = 2.58; 95% CI 1.00 - 6.66; $p<0.05$). Quitting smoking during pregnancy was significantly associated with breastfeeding for longer than six months (OR = 3.70; 95% CI 1.55 - 8.83; $p<0.05$).

Conclusions

Pregnancy is a time when many women are motivated to quit smoking and providing targeted smoking cessation interventions at this time, which take into account factors predictive of quitting smoking, are more likely to be successful.

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10.1 Background

Despite considerable public understanding of the dangers of smoking during pregnancy, prevalence levels in Australia range between approximately 17%, reported in 2001, and 35%, reported in 1996 (Centre for Epidemiology and Research New South Wales Department of Health 2002; Women's Health Australia).

Substantial public health gains remain to be made in perinatal mortality and morbidity through the reduction of smoking during pregnancy (US Department of Health and Human Services 2001) and pregnancy appears to be a time when women are highly motivated to quit smoking in the best interests of their unborn foetus. However, despite this not all women choose to quit smoking at this time and the differences between women who do stop smoking during pregnancy and those who don’t may be caused by factors that can be influenced.

Lu et al reviewed nine cohort studies and found that the determinants of smoking cessation during pregnancy included maternal age, parity, number of cigarettes per day and duration of smoking, education level, partner’s smoking status and socioeconomic status (Lu, Tong & Oldenburg 2001). Furthermore, Ershoff, Solomon and Dolan-Mullen found additional sociodemographic and psychosocial differences between women with low intentions to stop smoking and those with high intentions (Ershoff, Solomon & Dolan-Mullen 2000). In order to develop successful maternal smoking cessation public health programs the major determinants of quitting smoking during pregnancy need to be incorporated into intervention efforts.

The research team has already reported a significant increase over a 10 year period in the number of women breastfeeding upon discharge from hospital in Perth, Western Australia (Graham et al. 2005). Likewise the major determinants of breastfeeding duration have been identified from the Perth Infant Feeding Study (PIFSII) cohort study (Scott JA et al. 2006). The aims of this study were to document the number of women stopping smoking during pregnancy and to further examine the factors influencing the ability to stop smoking at this time. In addition, consideration was given to the exploration of variables (alcohol use before and during pregnancy; and attendance at antenatal classes) not previously reported in the Australian literature. The relationship between stopping smoking during pregnancy and breastfeeding duration was also examined.

10.2 Methods

The second Perth Infant Feeding Study (PIFSII) was conducted between mid-September 2002 and mid-July 2003 to monitor breastfeeding rates and identify changes in breastfeeding practices and the determinants of breastfeeding. The study was conducted in the same hospitals using the same methodology as the first Perth Infant Feeding Study (PIFSI). PIFSI was conducted 10 years previous and results have been reported elsewhere (Scott et al. 1999).

Mothers were contacted within the first three days following the birth of their infant. Women were considered eligible for the study if they had delivered a live infant free of any serious health conditions requiring transfer to the neonatal intensive care unit at Perth's major maternity hospital. Mothers whose infants were admitted to the Special Care Nurseries (SCN) of the participating hospitals were eligible for recruitment.

Those women agreeing to participate in the study completed the self-administered baseline questionnaire while in hospital or shortly after discharge. Women declining to participate were asked to provide some basic sociodemographic data in order to determine the representativeness of the sample. All women regardless of their chosen infant feeding method were followed up by telephone interview at 4, 10, 16, 22, 32, 40 and 52 weeks postpartum. The study instruments used were essentially the same as that used in PIFSI, with only minor improvements and additions being made to the instruments used in the PIFSII. Questions relating to smoking were based on the 1989-90 National Health Survey (Australian Bureau of Statistics 1991). Mothers were asked if they had smoked before pregnancy and if they had smoked during pregnancy as part of the baseline questionnaire. Mothers who acknowledged that they had smoked before pregnancy but had not smoked during pregnancy were categorised as ‘stopping smoking’ during pregnancy.

10.2.1 Statistical analysis

Data were entered and analysed using the Statistical Package for Social Sciences, Version 11.0 (SPSS for Windows, SPSS Inc., Chicago, IL, USA). Risk factors associated with stopping smoking during pregnancy were analysed using the baseline questionnaire. Variables identified in the literature as being associated with breastfeeding initiation and duration were examined and included in the development of each statistical model.

Estimation of odds ratios was performed for univariate analysis testing statistical significance by $\chi 2$ test. Adjusted odds ratios were calculated by logistic regression. All variables presented in Table 10.3.2 were entered into the model for the multivariate analysis of predicting stopping smoking during pregnancy. The model was reduced manually by excluding those variables with a less significant value.

The difference between duration of breastfeeding in those who stopped smoking during pregnancy and those who did not was initially explored using Kaplan Meier survival analysis. This relationship was further examined using logistic regression to examine breastfeeding duration less than and greater than six months using a variety of sociodemographic, biomedical and psychosocial factors reported to have an effect on breastfeeding duration in the literature. Variables were entered into the model to determine the effect on breastfeeding duration for more than or less than six months. Non-significant variables ($p>0.10$) were manually excluded from the final model. Further analysis of this relationship using a Cox proportional hazard model was not attempted as the proportionality assumption had been violated and additional potential analytical techniques were considered beyond the scope of this paper. The six month time period was chosen based on the WHO recommendations for exclusive breastfeeding and was considered to be a significant reference point for infant feeding duration.

A mother's attitude towards infant feeding was measured by the Iowa Infant Feeding Attitude Scale (IIFAS) (De la Mora et al. 1999). The IIFAS is a 17 item scale which measures attitudes towards both breast and formula feeding with regards to the health and nutritional benefits, and the cost and convenience of each method. It has been shown previously to be a valid and reliable measure of infant feeding attitudes amongst women in the USA (De la Mora et al. 1999) and Scotland (Scott, Shaker & Reid 2004). Each item is measured on a 5-point scale and total scores could range from 17 (reflecting positive formula feeding attitudes) to a high of 85 (indicating attitudes that favour breastfeeding). For the purposes of the analysis mothers were split into two groups, those with an IIFAS score at or above the median (≥65) and those with a score less than the median (<65).

Presented *p* values are two-sided, and a 5% significance level was used.

10.2.2 Ethical considerations

The PIFSII was approved by the Human Ethics Committee of Curtin University and the Research Ethics Committees of the two participating hospitals. Signed informed consent was obtained from participants. Confidentiality was assured and mothers were advised that their participation was voluntary and that they could withdraw at any time without prejudice.

10.3 Results

In the PIFSII, 870 women of the 1068 women eligible to participate were contacted and 587 completed baseline questionnaires (55%) and were maintained throughout the study period, representing 68% of women contacted. Those women discharged from hospital within the first 24 hours or not on the ward at the times that the researcher visited account for the eligible women not contacted. A similar proportion of eligible women participated in the PIFSI (58%) and the PIFSII (55%) studies. No significant differences were found in the age or level of education of participants compared with non-participants in either study (McDermott, Russell & Dobson 2002).

A total of 226 women were smoking before pregnancy. This represents 39% of the total population of mothers. The proportion of mothers smoking decreased to 25% (n=149) during pregnancy. Of the women who reported smoking before they became pregnant (n=226), 34% of these (n=77) stopped smoking during pregnancy, a reduction of 14%. Table 10.3.1 outlines the prevalence of smoking mothers and their partners.

Table 10.3.1 Smoking history of women (n=226) and their partners (n=270) (%)

Smoking history	Before pregnancy		During pregnancy		Week 4 postpartum	
	Women	Partners	Women	Partners	Women	Partners
Smoked	226 (100)	270 (100)	149 (66)	245 (91)	122 (54)	172 (64)
Stopped smoking	N/A	N/A	77 (34)	25 (4)	17 (8)	N/A

N/A – This data not available.

Table 10.3.2 shows the results of the univariate analysis of smoking cessation during pregnancy using variables previously reported to be important and other relevant demographic variables. Stopping smoking during pregnancy was significantly associated with primiparous women (OR = 2.6; 95% CI 1.5-4.5; $p<0.05$). A woman was less likely to stop smoking during pregnancy if she had a partner who smoked, had less than 12 years of education, smoked more than ten cigarettes per day, had an unplanned pregnancy and did not attend antenatal classes. Age, income level and mother's country of origin were not significantly associated with stopping smoking during pregnancy. Drinking alcohol before pregnancy was significantly associated with stopping smoking during pregnancy. However drinking alcohol during pregnancy was not associated with stopping smoking during pregnancy.

Table 10.3.2 Characteristics of women who did and did not stop smoking in pregnancy (n=226). Figure are a percentage if not otherwise stated

	Women who stopped smoking (n=77)	Women who did not stop smoking (n=149)	p value	Univariate OR (95% CI)
<25 years >25 years	46.8 53.2	35.6 64.4	0.103	1.6 (0.9-2.8) 1
Income <$25 000 Income >$25 000	56 44	65.8 34.2	0.156	0.7 (0.4-1.2) 1
Primiparous Multiparous	55.8 44.2	32.9 67.1	0.001	2.6 (1.5-4.5)† 1
Caucasian Non-caucasian	90.9 9.1	96.6 3.4	0.068	0.3 (0.1-1.1) 1
Father smoked in pregnancy Father did not smoke in pregnancy	61 39	75.5 24.5	0.025	0.5 (0.3-0.9)† 1
<12 years education >12 years education	46.1 53.9	62.8 37.2	0.016	0.5 (0.3-0.9)† 1
Drank alcohol before pregnancy Non-drinker before pregnancy	87 13	72.3 27.7	0.012	2.6 (1.2-5.5)† 1

Alcohol during preg No alcohol in preg	40.3 59.7	38.9 61.1	0.846	1.1 (0.6-1.9) 1
Cigs before preg <10/day Cigs before preg >10/day	63.6 36.4	36.4 63.6	 <0.001	1 0.3 (0.2-0.6)†
Timing of pregnancy Planned Mistimed Unplanned	 44 41.3 14.7	 37.3 32.4 30.3	0.045	 1 1.1 (0.6-2.0) 0.4 (0.2-0.9)†
Attend antenatal classes Did not attend antenatal classes	33.8 66.2	52 48	 0.009	1 0.5 (0.3-0.8)†

†Significant at p≤0.05.

Table 10.3.3 shows the results of the multivariate analysis used to determine which variables were independent predictors of stopping smoking during pregnancy. It indicates that women who were primigravida and women who drank alcohol before pregnancy were more likely to stop smoking during pregnancy. Women who smoked more than ten cigarettes per day were less likely to stop smoking during pregnancy.

Table 10.3.3 Multivariate analysis of factors predicting likelihood of stopping smoking during pregnancy (n=77)

	OR of stopping smoking during pregnancy (CI 95%)	p
Before pregnancy >10 cigarettes/day	0.4 (0.2-0.7)	0.002
Primiparous	2.1 (1.0-4.0)	0.036
Drank alcohol before pregnancy	2.6 (1.0-6.7)	0.049

Variables in the full model included age, income, mother's nationality, whether father smoked during the pregnancy, maternal years of education and whether the mother attended antenatal classes.

The association between stopping smoking and breastfeeding duration was explored using multivariate analysis. Table 10.3.4 indicates that stopping smoking during pregnancy was significantly related to breastfeeding duration. Of the 77 women who stopped smoking during pregnancy 35 (45%) of these continued to breastfeed for longer than six months. One hundred and forty nine women continued to smoke during pregnancy and of these, 34 (23%) breastfed for longer than six months. Women who stopped smoking were almost four times more likely to breastfeed for longer than six months, after adjustment for potential confounders (OR = 2.8; 95% CI 1.6 – 5.1; $p<0.05$, adjusted OR = 3.7; 95% CI 1.6 – 8.8; $p<0.05$).

Table 10.3.4 Stopping smoking during pregnancy and breastfeeding for longer than 6 months (n=77)

Variable	OR breastfeeding >6 months (95% CI)	p
Stopping smoking in pregnancy[a]	2.8 (1.6-5.1)	0.001
Stopping smoking in pregnancy[b,c]	3.7 (1.6-8.8)	0.003

[a]unadjusted
[b]reference group is women who did not stop smoking
[c]adjusted for income, age of infant when mother returned to work, breastfeeding problems at or before week four postpartum, age of infant when pacifier first used and mothers infant feeding attitude (IIFAS).

10.4 Discussion

In this study approximately 34% of women who smoked before pregnancy reported stopping smoking during pregnancy. This is slightly higher than figures reported in the 1999 – 2002/3 National Tobacco Strategy of 20 to 30%, (Australian Institute of Health and Welfare 2005a) however since this time smoking cessation rates in pregnancy may have increased in line with the general community (McDermott, Dobson & Russell 2004). In the analysis of the Australian Longitudinal Study on Women's Health year 2000 dataset a figure of 55% of women quitting was reported (Moshin & Bauman 2005). Most recently however a figure of 4% of women quitting smoking during pregnancy has been reported by Moshin and Bauman (Connor & McIntyre 1999) in a large cross sectional study in New South Wales, Australia. Internationally figures range from 15.8% of women quitting smoking during pregnancy from a national survey in Canada (McLeod, Pullon & Cookson 2003) to 26.8% from New Zealand (Severson et al. 1995). The disparity in these prevalence levels is most likely due to the timing of the data collection and whether the method of survey is cohort based or cross-sectional (Liu, Rosenberg & Sandoval 2006).

The relationship between smoking cessation during pregnancy and breastfeeding duration for longer than six months postpartum has not previously been reported in the research literature. More commonly continued maternal smoking in pregnancy has been reported in association with reduced breastfeeding initiation and duration

(Binns & Davidson 2003; World Health Organization 2001), and only one previous study has explored smoking status and breastfeeding duration up to 26 weeks (Gilchrist et al. 2004; Leung, Lam & Ho 2002). In this study women who stopped smoking during pregnancy were significantly more likely to breastfeed for longer than six months, which is in accordance with national and international recommendations (Binns & Davidson 2003; Labbok, Clark & Goldman 2004). Although stopping smoking is not exclusively responsible for prolonged breastfeeding duration, (Severson et al. 1995) promoting smoking cessation during pregnancy supports both positive perinatal outcomes and supports optimal breastfeeding duration, known to be associated with protection against infection, some chronic diseases and improved cognitive development in the infant (Kahn, Certain & Whitaker 2002).

The reported effects of alcohol consumption as a predictor of smoking cessation during pregnancy are varied and inconsistent, however in this study consuming alcohol prior to pregnancy was significantly associated with stopping smoking during pregnancy. In previous research Severson et al (Pirie et al. 2000) looked at alcohol in the week prior to the study questionnaire being administered (administered two weeks postpartum) and found that mothers who stopped smoking during pregnancy were less likely to have consumed alcohol in this week. Using data from the US National Maternal and Infant Health Survey, consuming one or more drinks during pregnancy was independently associated with a lower likelihood of quitting smoking during pregnancy (Torrent et al. 2004) and in a study of the relationship between quitting tobacco, alcohol and caffeine consumption during pregnancy, Pirie et al found that quitting either alcohol or cigarettes was not associated with an increased likelihood of quitting the other substance (e.g. quitting alcohol was not associated with quitting smoking or vice versa). Although this relationship was not significant in the multivariate model the clustering of multiple substance use in individuals was (Dejin-Karlsson et al. 1996). More recently a subset population of women in Spain who consumed alcohol (time of consumption not confined to either during pregnancy or three months after the birth) were also found to have a lower chance of quitting smoking (Connor & McIntyre 1999).

In contrast, early research conducted in Sweden found continued alcohol consumption during pregnancy was not associated with a decrease in mothers stopping smoking (McLeod, Pullon & Cookson 2003). Similarly, data from Canada demonstrated that drinking during pregnancy was positively related to a woman's likelihood of attempting to quit smoking during pregnancy (English, Najman & Bennett 1997; Pirie et al. 2000). However alcohol consumption was also significantly associated with cessation relapse before the child was born and the authors propose that although more women who drink make cessation attempts they are also more likely to relapse as it may be too difficult to give up smoking and drinking alcohol at the same time, or that continued alcohol use impairs the cessation maintenance. More recently, a New Zealand study found that women who quit smoking in the first trimester were more likely to report alcohol consumption at this time compared to women who reported not consuming alcohol (Cnattingius, Lindmark & Meirik 1992; Hakansson, Lendahls & Petersson 1999; Kahn, Certain & Whitaker 2002; Lindqvist & Aberg 2001; McLeod, Pullon & Cookson 2003; Moshin & Bauman 2005; Panjari et al. 1997; Pirie et al. 2000; Suzuki et al. 2005; Torrent et al. 2004).

In the current study alcohol intake before and during pregnancy was considered with regard to smoking cessation during pregnancy. The associations between alcohol before and during pregnancy with stopping smoking during pregnancy have previously not been studied concurrently. We found that women who consumed alcohol before pregnancy were more likely ($OR=2.6$;95% CI 1.0-6.7; $p<0.049$) to stop smoking during pregnancy. Alcohol intake is a health risk behaviour known to cluster with cigarette smoking (Fingerhut, Kleinman & Kendrick 1990; Hakansson, Lendahls & Petersson 1999; Lindqvist & Aberg 2001; Panjari et al. 1997; Pirie et al. 2000; Severson et al. 1995; Wakefield & Jones 1991) and therefore it is likely that those women who are consuming alcohol are also smoking hence the women most likely to stop smoking are those women drinking alcohol. Alcohol consumption during pregnancy was not significantly related to smoking cessation at this time.

In accordance with previous research, a woman was more likely to stop smoking during pregnancy if she was primigravida (Hakansson, Lendahls & Petersson 1999; Panjari et al. 1997; Severson et al. 1995; Suzuki et al. 2005; Torrent et al. 2004).

Women who have smoked during a previous pregnancy generally have an experience of giving birth to one or more healthy children and are therefore less motivated to quit smoking for subsequent pregnancies.

Pre-pregnancy smoking levels indicate that women who quit smoking during pregnancy are probably less addicted to smoking than women who continue to smoke. In the present study a woman was more likely to stop smoking if she reported smoking less than 10 cigarettes per day in the pre-pregnancy period. This result conforms with the current literature in that women who smoke at low levels are more likely to quit smoking (Severson et al. 1995).

Having a partner who smokes (Wakefield et al. 1998) and a low level of education (Moshin & Bauman 2005; Panjari et al. 1997) are factors previously found to be predictive of continued smoking during pregnancy. Although significant at the univariate level, education and father's smoking status were no longer significant when included in the multivariate analysis. Interestingly, a greater number of fathers stopped smoking after the baby was born. This may be due to the perception that the baby does not seem 'real' until after the birth when fathers are prompted by the baby's presence to quit smoking (Dejin-Karlsson et al. 1996).

Antenatal classes aim to prepare expectant parents for childbirth and their new family life. Attendance at antenatal classes was a significant predictor of smoking cessation in the univariate analysis, although not significant in the multivariate model. Previous studies have found that early attendance at antenatal care was predictive of stopping smoking during pregnancy (Kahn, Certain & Whitaker 2002).

Timing of the pregnancy as a predictive factor for stopping smoking during pregnancy has not previously been reported using Australian data. Internationally previous research has shown that women having an unplanned pregnancy were more likely to continue smoking during pregnancy (Severson et al. 1995), whereas others have failed to find an effect of an unintended pregnancy (Fingerhut, Kleinman & Kendrick 1990; Suzuki et al. 2005; Wakefield & Jones 1991). In this study, women whose pregnancy was unplanned were less likely to stop smoking during pregnancy, however this was not significant in the multivariate analysis. A planned pregnancy enables a woman the opportunity to consider stopping smoking in preparation for the antenatal period, whereas women who become pregnant unexpectantly have less time to implement this change.

Neither age nor income was related to the likelihood of stopping smoking during pregnancy. The correlation with age has been found in some previous studies (Orleans et al. 2000) but not in others (Ford & Dobson 2004). A relationship between age and smoking cessation during pregnancy is still unclear and further research is required in this area.

Studies have reported 66% higher medical costs attributed to complicated births for smoking mothers compared with non-smoking mothers (Lumley et al. 2005). In Australia it has been estimated that smoking during pregnancy is responsible for 78 infant deaths, 6890 hospital separations and a cost of AUD23 million dollars to the health care system each year (Miller & Wood 2001).

As smoking cessation programs have been shown to reduce the odds of continued smoking in pregnancy (Hunt & Lumley 2002; Mabbutt, Bauman & Moshin 2002), it is imperative that the factors found in this study and previous research to predict smoking cessation during pregnancy be addressed in evidence based intervention programs. This concurs with recommendations from the 2001 National Tobacco Strategy (DiClemente, Dolan-Mullen & Windsor 2000). However despite this recommendation there appears to be a lack in the provision of any routine antenatal smoking cessation advice in the Australian health care setting (Wakefield & Jones 1991).

This study did not define those women who quit in the pre-pregnancy period from those who quit during pregnancy, often referred to as ‘spontaneous quitters’ (Heath et al. 2003; Klebanoff et al. 2001). In addition, there is considerable evidence outlining a high prevalence of relapse in the postpartum period in women who quit smoking during pregnancy, (World Health Organization 1991) however the design of this research study did not enable this issue to be addressed. Future cohort studies should take smoking abstinence into consideration in the design phase. Consideration of factors contributing to residual confounding, such as emotional antenatal attachment to the foetus in relation to smoking cessation, were not measured in this research. Future research should examine these additional potential factors that may help further explain the relationship between pregnancy and smoking cessation.

As in most studies of smoking during pregnancy, all smoking behaviours were self-reported in this study and cigarette smoking may have been underreported particularly during the antenatal period when there is an increased stigma associated with smoking. Nevertheless, self-reported smoking status is considered to be reasonably accurate (Labbok & Krasovec 1990) and results presented here give a good picture of smoking during pregnancy. Although this study used a standardised questionnaire, to elicit smoking information, future studies should consider the inclusion of alternative measures of cigarette smoking.

A further limitation of the study is having less than 60% of eligible women participate. Nevertheless, the sample size is still relatively large (>500), and there was no significant difference in maternal age and level of education between participant and non-participants, suggesting that the sample was representative of the population from which it was drawn.

Notwithstanding the relatively small sample size, and the fact that all women came from government-based hospitals, results from this study do reflect the current evidence. In addition these mothers are representative of the 'hard to reach' groups in Australian health promotion. Therefore the lessons learned from this study could be usefully applied in health education programs.

10.5 Conclusion

Quitting smoking during pregnancy is a potential area for huge public health gain in the short term through decreasing smoking related harm, and in the long term by promoting the positive health benefits of prolonged breastfeeding. Pregnancy is a time when women are more receptive to quitting smoking and many opportunities exist for implementing cessation efforts that are succinct and simple. A large proportion of women stop smoking voluntarily at this time, however many continue putting their health and that of their unborn foetus at risk. The current study highlights women who are primiparous, smoke less than 10 cigarettes per day before pregnancy, and consume alcohol before pregnancy, as significant predictors of quitting smoking at this time. Quitting smoking during pregnancy is supportive of breastfeeding for longer than six months.

In an effort to decrease the risk of adverse pregnancy outcomes and promote the best possible health outcomes for the infant and the mother, smoking cessation intervention programs in pregnancy should be designed with the predictive factors identified in this study in mind. It is also important that tobacco control strategies targeting the mainstream population run concurrently with smoking cessation programs for pregnant women. Antenatal care services at all levels and in both the public and private domain are paramount in supporting these cessation efforts.

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Authors' contribution

RCG had primary responsibility for the data analysis and writing the manuscript.

CWB supervised the design and execution of the study, and contributed to writing the manuscript.

HA participated in the final data analyses and contributed to writing the manuscript.

References

Adhikari, P & Summerill, A 2000, *1998 National Drug Strategy Household Survey: Detailed findings.*, Australian Institute of Health and Welfare, Canberra, AIHW Cat no. PHE 27 (Drug Statistics Series No. 6). http://www.aihw.gov.au/publications/health/ndshs98d/index.html

Akre, J 1989, 'Infant feeding: the physiological basis', *Bulletin of the World Health Organization,* vol. 67, no. Suppl, pp. 1-108.

American Academy of Pediatrics 2001, 'The transfer of drugs and other chemicals into human milk', *Pediatrics,* vol. 108, no. 3, pp. 776-89.

American Academy of Pediatrics 2005, 'Breastfeeding and the use of human milk', *Pedatrics,* vol. 115, no. 2, pp. 496-506.

Amir, LH 1999, 'Smoking status of breastfeeding women', *Acta Paediatrica,* vol. 88, pp. 1412-4.

Amir, LH 2001, 'Maternal smoking and reduced duration of breastfeeding: a review of possible mechanisms', *Early Hum Dev,* vol. 64, no. 1, pp. 45-67.

Amir, LH & Donath, SM 2002, 'Does maternal smoking have a negative physiological effect on breastfeeding? The epidemiological evidence', *Birth,* vol. 29, no. 2, pp. 112-23.

Antoniou, E, Daglas, M, Iatrakis, G, Kourounis, G & Greatsas, G 2005, 'Factors associated with initiation and duration of breastfeeding in Greece', *Clinical and Experimental Obstetrics and Gynecology,* vol. 32, no. 1, pp. 37-40.

Arenz, S & von Kries, R 2005, 'Protective effect of breastfeeding against obesity in childhood', *Advances in Experimental Medicine and Biology,* vol. 569, pp. 40-8.

Australian Bureau of Statistics 1991, *National Health Survey Questionnaire 1989-1990*, Canberra.

Australian Bureau of Statistics 1995, *National Health Survey, Australia 1995, Basic Confidentialised Unit Record File*, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics 1996, *National Health Survey: User's Guide 1995, Cat. no. 4363.0*, Australia Bureau of Statistics, Canberra.

Australian Bureau of Statistics 1998, National Nutrition Survey: Nutrient intakes and physical measurements. Cat no. 4805.0., Commonwealth of Australia, Canberra.

Australian Bureau of Statistics 2001, *National Health Survey: Users' Guide, 2001*, Australian Bureau of Statistics, Canberra. http://www.abs.gov.au/Ausstats/abs@.nsf/66f306f503e529a5ca25697e0017661f/777CA8D289E66729CA256D32001B5324?opendocument

Australian Bureau of Statistics 2002a, *National Health Survey 2001 : Summary of results*, Australia Bureau of Statistics, Canberra, ABS 4364.0.

Australian Bureau of Statistics 2002b, Socio-economic indexes for areas 2001 : a comprehensive profile of the Australian people, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics 2003a, *Breastfeeding in Australia, 2001*, Australian Bureau of Statistics, Canberra, Report No. 4810.0.55.001.

Australian Bureau of Statistics 2003b, *National Health Survey, Australia (2001), Basic Confidentialised Unit Record File*, Australian Bureau of Statistics, Canberra, Cat no. 4324.0.30.001.

Australian Bureau of Statistics 2004, *Year Book Australia, 2004*, Australian Bureau of Statistics, Canberra, 86 Cat no. 1301.0. http://www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/F024F2664BCE12D4CA256DEA00053A1A?opendocument

Australian Bureau of Statistics 2006, *Review of strategic statistical issues for future national health surveys. Final report*, Australian Bureau of Statistics, Canberra. http://forums.abs.gov.au/QuickPlace/health_forum/PageLibraryCA256FA10014E1C0.nsf/h_Toc/CA32FCB40CED1B96CA25724A001253C7/?OpenDocument&Form=h_PageUI

Australian Institute of Health and Welfare 2003, *Statistics on drug use in Australia 2002*, AIHW, Canberra., (Drug Statistics Series No. 12.). http://www.aihw.gov.au/publications/index.cfm/title/8390

Australian Institute of Health and Welfare 2005a, *2004 National Drug Strategy Household Survey: First Results. AIHW cat. no. PHE 57.*, AIHW, Canberra, (Drug Statistics Series No. 13). http://www.aihw.gov.au/publications/phe/ndshs04/ndshs04.pdf

Australian Institute of Health and Welfare 2005b, *2004 National Drug Strategy Household Survey: First Results. AIHW Cat no. PHE 57*, AIHW (Drug Statistics Series No. 13), Canberra.

Australian Institute of Health and Welfare 2005c, *Statistics on drug use in Australia 2004*, AIHW, Canberra, (Drug Statistics Series No. 15). http://www.aihw.gov.au/publications/index.cfm/title/10143

Avlik, A, Haldorsen, T & Lindemann, R 2006, 'Alcohol consumption, smoking and breastfeeding in the first six months after delivery', *Acta Paediatrica,* vol. 95, pp. 686-93.

Azjen, I & Driver, BL 1991, 'Prediction of leisure participation from behavioral, normative, and control beliefs: an application of the theory of planned behavior', *Leisure Sciences,* vol. 13, pp. 185–204.

Azjen, I & Fishbein, M 1980, *Understanding attitudes and predicting social behaviour*, Prentice-Hall, Englewood Cliffs.

Bell, R & Lumley, J 1989, 'Alcohol consumption, cigarette smoking and fetal outcome in Victoria, 1985', *Community Health Studies,* vol. 8, no. 4, pp. 484-91.

Bertini, G, Perugi, S, Dani, C, Pezzati, M, Tronchin, M & Rubaltelli, F 2003, 'Maternal education and the incidence and duration of breast feeding: a prospective study', *Journal of Pediatric Gastroenterology and Nutrition,* vol. 37, pp. 447-52.

best start Ontario's maternal newborn and early child development resource centre 2005, *Drinking alcohol while breastfeeding*, Motherisk. http://www.beststart.org/resources/alc_reduction/index.html

Binkiewicz, A, Robinson, M & Senior, B 1978, 'Pseudo-Cushing syndrome caused by alcohol in breast milk', *Journal of Pediatrics,* vol. 93, pp. 965-7.

Binns, CW & Davidson, GP 2003, 'Infant Feeding Guidelines for Health Workers', in NHMRC (ed.), *Food for Health: Dietary Guidelines for Children and Adolescents in Australia*, ISBN 1864961538 edn, NHMRC, Canberra, p. 452.

Blackburn, C, Bonas, S, Spencer, N, Dolan, A, Coe, C & Moy, R 2005, 'Smoking behaviour change among fathers of new infants', *Social Science and Medicine,* vol. 61, pp. 517-26.

British Medical Association 2004, *Smoking and reproductive life: the impact of smoking on sexual, reproductive and child health*, BMA science and education department, British Medical Association and Tobacco Control Resource Centre, London.

Carlson, HE, Wasser, HL & Reidelberger, RD 1985, 'Beer-induced prolactin secretion: A clinical and laboratory study of the role of salsolinol', *Journal of Clinical Endocrinology and Metabolism,* vol. 60, no. 4, pp. 673-7.

Carruthers, S & Binns, CW 1992, 'The standard drink and alcohol consumption', *Drug and Alcohol Review,* vol. 11, pp. 363-70.

Centers for Disease Control and Prevention 2002, *Alcohol use among women of childbearing age - United States, 1991-1999*, Centers for Disease Control and

Prevention, Atlanta. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5113a2.htm#fig1

Centre for Epidemiology and Research New South Wales Department of Health 2002, 'Mothers and babies, 2001', *NSW Public Health Bulletin,* vol. 13, no. 13, pp. S-4.

Chen, L & Nyomba, B 2004, 'Whole body insulin resistance in rat offspring of mothers consuming alcohol during pregnancy or lactation: comparing prenatal and postnatal exposure', *Journal of Applied Physiology,* vol. 96, pp. 167-72.

Chikritzhs, T, Catalano, P, Stockwell, T, Donath, S, Ngo, H, Young, D & Matthews, S 2003, *Australian Alcohol Indicators. Patterns of Alcohol Use and Related Harms for Australian States and Territories 1990 - 2001*, Curtin University of Technology, Perth. http://www.ndri.curtin.edu.au/pdfs/naip/naipaaifullreport.pdf

Clemens, S, Donath, S & Stockwell, T 2006, *Alcohol consumption in Australia; national surveys from 1989 to 2001*, Curtin University of Technology, Perth.

Clement, C, Glasier, A & McNeilly, A 1992, 'Endocrine control of lactation', in MF Picciano & B Lonnerdal (eds), *Mechanisms regulating lactation and infant nutrient utilization*, vol. 15, Wiley-Liss, New York, pp. 34-42.

Clements, M, Mitchell, E, Wright, S, Esmail, A, Jones, D & Ford, R 1997, 'Influences on breastfeeding in southeast England', *Acta Paediatrica,* vol. 86, pp. 51-6.

Cnattingius, S, Lindmark, G & Meirik, O 1992, 'Who continues to smoke while pregnant?' *Journal of Epidemiology and Community Health,* vol. 46, pp. 218-21.

Cobo, E 1973, 'Effect of different doses of ethanol on the milk-ejecting reflex in lactating women', *American Journal of Obstetrics and Gynecololgy,* vol. 115, no. 6, pp. 817-21.

Condon, J & Hilton, C 1988, 'A comparison of smoking and drinking behaviours in pregnant women: who abstains and why', *The Medical Journal of Australia,* vol. 148, pp. 381-5.

Connor, SK & McIntyre, L 1999, 'The sociodemographic predictors of smoking cessation among pregnant women in Canada', *Canadian Journal of Public Health,* vol. 90, no. 5, pp. 352-5.

Counsell, A, Smale, P & Geddis, D 1994, 'Alcohol consumption by New Zealand women during pregnancy', *The New Zealand Medical Journal,* vol. 107, no. 982, pp. 278-81.

Davidson, S, Alden, L & Davidson, P 1981, 'Changes in alcohol consumption after childbirth', *Journal of Advanced Nursing,* vol. 6, pp. 195-8.

De la Mora, A, Russell, D, Dungy, C, Losch, M & Dusdieker, L 1999, 'The Iowa Infant Feeding Attitude Scale: analysis of reliability and validity', *Journal of Applied Social Psychology,* vol. 29, no. 11, pp. 2362-80.

Dejin-Karlsson, E, Hanson, BS, Ostergren, P, Ranstam, J, Isacsson, S & Sjoberg, N 1996, 'Psychosocial resources and persistent smoking in early pregnancy - a population study of women in their first pregnancy in Sweden', *Journal of Epidemiology and Community Health,* vol. 50, pp. 33-9.

Dempsey, D & Benowitz, N 2001, 'Risks and benefits of nicotine to aid smoking cessation in pregnancy', *Review Drug Safety,* vol. 24, pp. 277-322.

Dennis, CL 2002, 'Breastfeeding initiation and duration: a 1990-2000 literature review', *J Obstet Gynecol Neonatal Nurs,* vol. 31, no. 1, pp. 12-32.

Department of Health 2006, *The Pregnancy Book: 2006 Edition*, Department of Health, London. http://www.dh.gov.uk/PublicationsAndStatistics/Publications/PublicationsPolicyAndGuidance/PublicationsPolicyAndGuidanceArticle/fs/en?CONTENT_ID=4136417&chk=saaOhH

DeRosa, G, Corsello, SM, Ruffilli, MP, Della Casa, S & Pasargiklian, E 1981, 'Prolactin secretion after beer', *The Lancet,* vol. 2, p. 934.

Detering, N, Reed, W, Ozand, P & Karahasan, A 1979, 'The effects of maternal ethanol consumption in the rat on the development of their offspring', *Journal of Nutrition,* vol. 109, pp. 999-1009.

DiClemente, CC, Dolan-Mullen, P & Windsor, RA 2000, 'The process of pregnancy cessation: implications for interventions', *Tobacco Control,* vol. 9, no. iii16-iii21.

Dobson, B & Murtaugh, M 2001, 'Position of the American Dietetic Association: Breaking the barriers to breastfeeding', *Journal of the American Dietetic Association,* vol. 101, no. 10, pp. 1213-20.

Donath, S 1999, 'Estimated alcohol consumption in the 1995 National Health Survey: some methodological issues', *Australian and New Zealand Journal of Public Health,* vol. 23, no. 2, pp. 131-4.

Donath, S & Amir, L 2004, 'The relationship between maternal smoking and breastfeeding duration after adjustment for maternal infant feeding intention', *Acta Paediatrica,* vol. 93, pp. 1514-8.

Donath, S, Amir, L & The ALSPAC Study Team 2003, 'Relationship between prenatal infant feeding intention and initiation and duration of breastfeeding: a cohort study', *Acta Paediatrica,* vol. 92, pp. 352-6.

Donath, S, M & Amir, L, H 2005, 'Breastfeeding and the introduction of solids in Australian infants: data from the 2001 National Health Survey', *Australian and New Zealand Journal of Public Health,* vol. 29, pp. 171-5.

Ebrahim, S, Luman, E, Floyd, R, Murphy, C, Bennett, E & Boyle, C 1998, 'Alcohol consumption by pregnant women in the United States during 1988-1995', *Obstetrics and Gynecology,* vol. 92, pp. 187-92.

Ekholm, O 2004, 'Influence of the recall period on self-reported alcohol intake', *European Journal of Clinical Nutrition,* vol. 58, pp. 60-3.

English, RM, Najman, JM & Bennett, SA 1997, 'Dietary intake of Australian smokers and nonsmokers', *Australian and New Zealand Journal of Public Health,* vol. 21, pp. 141-6.

Ershoff, DH, Solomon, LJ & Dolan-Mullen, P 2000, 'Predictors of intentions to stop smoking early in prenatal care', *Tobacco Control,* vol. 9, no. Suppl 3, pp. iii41-iii5.

Fabian, HM, Ra`destad, IJ & Waldenstr`om, U 2004, 'Characteristics of Swedish women who do not attend childbirth and parenthood education classes during pregnancy', *Midwifery,* vol. 20, pp. 226-35.

Fingerhut, LA, Kleinman, JC & Kendrick, JS 1990, 'Smoking before, during and after pregnancy', *American Journal of Public Health,* vol. 80, no. 5, pp. 541-4.

Ford, JH & Dobson, AJ 2004, 'Smoking and pregnancy', *Medical Journal of Australia,* vol. 181, no. 5, pp. 285-6.

Forster, D, McLachlan, H & Lumley, J 2006, 'Factors associated with breastfeeding at six months postpartum in a group of Australian women', *International Breastfeeding Journal,* vol. 1, no. 18.

Fuchs, A 1969, 'Ethanol and the inhibition of oxytocin release in lactating rats', *Acta Endocrinologica,* vol. 62, pp. 546-54.

Giglia, R & Binns, C 2006a, 'Patterns of alcohol intake of pregnant and lactating women in Perth, Australia', *in press.*

Giglia, R, Binns, C & Alfonso, H 2006, 'Maternal cigarette smoking and breastfeeding duration', *Acta Paediatrica,* vol. 95, pp. 1370-4.

Giglia, RC & Binns, CW 2006b, 'Alcohol and lactation: a systematic review', *Nutrition and Dietetics,* vol. 63, pp. 103-16.

Giglia, RC & Binns, CW 2007, 'Alcohol and breastfeeding: what do Australian mothers know?' *Asia Pacific Journal of Clinical Nutrition,* vol. 16 (Suppl 1), pp. 473-7.

Giglia, RC & Binns, CW *in press*, 'Alcohol, pregnancy and breastfeeding; an analysis of the 1995 and 2001 National Health Survey data', *Breastfeeding Review*.

Gilchrist, D, Woods, B, Binns, CW, Scott, JA, Gracey, M & Smith, H 2004, 'Aboriginal mothers, breastfeeding and smoking', *Australian and New Zealand Journal of Public Health,* vol. 28, no. 3, pp. 225-8.

Graham, KI, Scott, JA, Binns, CW & Oddy, WH 2005, 'National targets for breastfeeding at hospital discharge have been achieved in Perth', *Acta Paediatrica,* vol. 94, pp. 352-6.

Hakansson, A, Lendahls, L & Petersson, C 1999, 'Which women stop smoking?' *Acta Obstetricia et Gynaecologica Scandinavica,* vol. 78, pp. 217-24.

Hard, M, Einarson, T & Koren, G 2001, 'The role of acetaldehyde in pregnancy outcome after prenatal alcohol exposure', *Theraputic Drug Monitoring,* vol. 23, pp. 286-92.

Haug, K, Irgens, L, Baste, V, Markestad, T, Skjaerven, R & Schreuder, P 1998, 'Secular trends in breastfeeding and parental smoking', *Acta Paediatrica,* vol. 87, no. 1023-1027.

Health Canada 1996, Joint Statement: Prevention of Fetal Alcohol Syndrome (FAS) Fetal Alcohol Effects (FAE) in Canada, Ottawa.

Health Canada October 1996, JOINT STATEMENT: Prevention of Fetal Alcohol Syndrome (FAS) Fetal Alcohol Effects (FAE) in Canada, Ottawa.

Health Council of the Netherlands 2005, *Risks of alcohol consumption related to conception, pregnancy and breastfeeding.*, Health Council of the Netherlands, The Hague.

Heath, AC, Knopik, VS, Madden, PA, Neuman, RJ, Lynskey, MJ, Slutske, WS, Jacob, T & Martin, NG 2003, 'Accuracy of mother's retrospective reports of smoking during pregnancy: comparison with twin sister informant ratings', *Twin Research,* vol. 6, no. 4, pp. 297-301.

Hector, D, King, L & Webb, K 2004, *Overview of recent reviews of interventions to promote and support breastfeeding*, NSW Centre for Public Health Nutrition and NSW Department of Health, Sydney. http://www.cphn.biochem.usyd.edu.au/resources/OverviewBreastfeeding.pdf

Heil, S & Subramanian, M 2000, 'Chronic alcohol exposure and lactation. Extended observations', *Alcohol,* vol. 21, pp. 127-32.

Hekmatpanah, J, Haghighat, N & Adams, C 1994, 'Alcohol consumption by nursing rats and its effect on the cerebellum of the offspring', *Alcohol an Alcoholism,* vol. 29, no. 5, pp. 535-47.

Henderson, J, Gray, R & Brocklehurst, P 2007, 'Systematic review of effects of low-moderate prenatal alcohol exposure on pregnancy outcome ', *BJOG: An International Journal of Obstetrics and Gynaecology,* vol. 114, no. 3, pp. 243-52.

Hill, PD, Hanson, KS & Mefford, AL 1994, 'Mothers of low birthweight infants: breastfeeding patterns and problems', *Journal of Human Lactation,* vol. 10, pp. 169-76.

Ho, E, Collantes, A, Kapur, B, Moretti, M & G, K 2001, 'Alcohol and breast feeding: calculation of time to zero level in milk', *Biology of the Neonate,* vol. 80, pp. 219-22.

Horta, BL, Kramer, MS & Platt, RW 2001, 'Maternal smoking and the risk of early weaning: a meta-analysis', *Am J Public Health,* vol. 91, no. 2, pp. 304-7.

Horta, BL, Victora, CG, Menezes, AM & Barros, FC 1997, 'Environmental tobacco smoke and breastfeeding duration.' *American Journal of Epidemiology,* vol. 146, pp. 128-33.

Howard, C & Lawrence, R 1998, 'Breast-feeding and drug exposure', *Obstetrics and Gynecology Clinics of North America,* vol. 25, no. 1, pp. 195-217.

Hunt, JM & Lumley, J 2002, 'Are recommendations about routine antenatal care in Australia consistent and evidence-based?' *Medical Journal of Australia,* vol. 176, pp. 255-9.

Ioffe, S & Chernick, V 1990, 'Prediction of subsequent motor and mental retardation in newborn infants exposed to alcohol in utero by computerized EEG analysis', *Neuropediatrics,* vol. 21, pp. 11-7.

Kahn, RS, Certain, L & Whitaker, RC 2002, 'A reexamination of smoking before, during, and after pregnancy', *American Journal of Public Health,* vol. 92, pp. 1801-8.

Kaskutas, LA & Graves, K 2001, 'Pre-pregnancy drinking: how drink size affects risk assessment', *Addiction,* vol. 96, pp. 1199–209.

Kesaniemi, YA 1974, 'Ethanol and acetaledhyde in the milk and peripheral blood of lactating women after ethanol administration', *The Journal of Obstetrics and Gynaecology,* vol. 81, no. January, pp. 84-6.

Kesmodel, U & Frydenberg, M 2004, 'Binge drinking during pregnancy - Is it possible to obtain valid information on a weekly basis?' *American Journal of Epidemiology,* vol. 159, no. 8, pp. 803-8.

Kesmodel, U, Kesmodel, P, Larsen, A & Secher, N 2003, 'Use of alcohol and illicit drugs among pregnant Danish women, 1998', *Scandinavian Journal of Public Health,* vol. 31, pp. 5-11.

Klebanoff, MA, Levine, RJ, Morris, CD, Hauth, JC, Sibai, BM, Curet, LB, Catalano, P & Wilkins, DG 2001, 'Accuracy of self-reported cigarette smoking among pregnant women in the 1990s', *Paediatric and Perinatal Epidemiology,* vol. 15, pp. 140-3.

Kwok, P, Correy, J, Newman, N & Curran, J 1983, 'Smoking and alcohol consumption during pregnancy: an epidemiological study in Tasmania', *Medical Journal of Australia,* vol. 1, no. March 5, pp. 220-3.

Labbok, M 2001, 'Effects of breastfeeding on the mother', *Pediatric Clinics of North America,* vol. 48, no. 1, pp. 143-58.

Labbok, M, Clark, D & Goldman, A 2004, 'Breastfeeding: maintaining an irreplaceable immunological resource', *Nature Reviews. Immunology,* vol. 4, pp. 565-72.

Labbok, M & Krasovec, K 1990, 'Toward consistency in breastfeeding defintions', *Studies in Family Planning,* vol. 21, pp. 226-30.

Lande, B, Andersen, L, Baeug, A, Trygg, K, Lund-Larsen, K, Veierød, M & Bjørneboe, G 2003, 'Infant feeding practices and associated factors in the first six months of life: The Norwegian Infant Nutrition Survey', *Acta Paediatrica,* vol. 92, pp. 152-61.

Laws, PJ & Sullivan, EA 2005, *Australia's mothers and babies 2003. AIHW Cat. No. PER 29*, AIHW National Perinatal Statistics Unit (Perinatal Statistics Series No. 16), Sydney.

Lawton, M 1985, 'Alcohol in breastmilk', Australian and New Zealand Journal of Obstetrics and Gynaecology, vol. 25, pp. 71-3.

Leon-Cava, N 2002, *Quantifying the benefits of breastfeeding: A summary of the evidence*, Pan American Health Organisation, Washington D C. http://www.aed.org/ToolsandPublications/upload/quantifyingbenefits.pdf

Leung, GM, Lam, T & Ho, L 2002, 'Breast-feeding and its relation to smoking and mode of delivery', *Obstetrics and Gynecology,* vol. 99, pp. 785-94.

Lindqvist, R & Aberg, H 2001, 'Who stops smoking during pregnancy?' *Acta Obstetricia et Gynaecologica Scandinavica,* vol. 80, pp. 137-41.

Little, R, Anderson, K, Ervin, C, Worthington-Roberts, B & Clarren, S 1989, 'Maternal alcohol use during breast-feeding and infant mental and motor development at one year', *N Engl J Med,* vol. 321, pp. 425-30.

Little, R, Lambert, M & Worthington-Roberts, B 1990a, 'Drinking and smoking at 3 months postpartum by lactation history', *Paediatric and Perinatal Epidemiology,* vol. 4, pp. 290-302.

Little, R, Northstone, K & Golding, G 2002, 'Alcohol, breastfeeding, and development at 18 months', *Pediatrics,* vol. 109, no. 5, p. e72.

Little, RE, Lambert, MD & Worthington-Roberts, B 1990b, 'Drinking and smoking at 3 months postpartum by lactation history', *Paediatr Perinat Epidemiol,* vol. 4, no. 3, pp. 290-302.

Liu, J, Rosenberg, KD & Sandoval, AP 2006, 'Breastfeeding duration and perinatal cigarette smoking in a population-based cohort', *American Journal of Public Health,* vol. 96, no. 2, pp. 309-14.

Lu, Y, Tong, S & Oldenburg, B 2001, 'Determinants of smoking cessation during and after pregnancy', *Health Promotion International,* vol. 16, pp. 355-65.

Lumley, J, Oliver, SS, Chamberlain, C & Oakley, L 2005, 'Interventions for promoting smoking cessation during pregnancy (Review)', *Cochrane Database of Systematic reviews, Published in the Cochrane Library 2005 Issue 4*.

Mabbutt, J, Bauman, A & Moshin, M 2002, 'Tobacco use of pregnant women and their male partners who attend antenatal classes: what happened to routine quit smoking advice in pregnancy?' *Australian and New Zealand Journal of Public Health,* vol. 26, no. 571-572.

Martorell, R, Stein, A & Schroeder, D 2001, 'Obesity in developing countries: Biological and ecological factors. Early nutrition and later adiposity.' *Journal of Nutrition,* vol. 131, no. 3, pp. 874S-80S.

McDermott, L, Dobson, A & Russell, A 2004, 'Changes in smoking behaviour among young women over life stage transitions', *Australian and New Zealand Journal of Public Health,* vol. 28, no. 4, pp. 330-5.

McDermott, L, Russell, A & Dobson, A 2002, *Cigarette smoking among women in Australia*, National Tobacco Strategy. Commonwealth Department of Health and Ageing, Canberra.

McLeod, D, Pullon, S & Cookson, T 2003, 'Factors that influence changes in smoking behaviour during pregnancy', *New Zealand Medical Journal,* vol. 116, no. 1173, p. U418.

McLeod, D, Pullon, S, Cookson, T & Cornford, E 2002, 'Factors influencing alcohol consumption during pregnancy and after giving birth', *New Zealand Medical Journal,* vol. 115, no. 1157, p. U29.

Mennella, J 1997, 'Infant's suckling responses to the flavor of alcohol in mothers' milk', *Alcoholism: Clinical and Experimental Research,* vol. 21, no. 4, pp. 581-5.

Mennella, J 1998, 'Short-term effects of maternal alcohol consumption on lactational performance', *Alcoholism: Clinical and Experimental Research,* vol. 22, no. 7, pp. 1389-92.

Mennella, J 2001a, 'Alcohol's effect on lactation', *Alcohol Research and Health,* vol. 25, no. 3, pp. 230-4.

Mennella, J 2001b, 'Regulation of milk intake after exposure to alcohol in mother's milk', *Alcoholism: Clinical and Experimental Research,* vol. 25, no. 4, pp. 590-3.

Mennella, J 2002, 'Alcohol use during lactation: The folklore versus the science', in K Auerbach (ed.), *Current issues in clinical lactation.*, Jones and Bartlett, Boston, pp. 3 - 10.

Mennella, J & Beauchamp, G 1991, 'The transfer of alcohol to human milk', *New England Journal of Medicine,* vol. 325, pp. 981-5.

Mennella, J & Beauchamp, G 1993, 'Beer, breast feeding and folklore', *Developmental Psychobiology,* vol. 26, no. 8, pp. 459-66.

Mennella, J & Beauchamp, G 1998, 'Infant's exploration of scented toys: effects of prior experiences', *Chemical Senses,* vol. 23, no. 11, pp. 11-7.

Mennella, J & Garcia-Gomez, P 2001, 'Sleep disturbances after acute exposure to alcohol in mother's milk', *Alcohol,* vol. 25, pp. 153-8.

Mennella, J & Gerrish, C 1998, 'Effects of exposure to alcohol in mother's milk on infant sleep', *Pediatrics,* vol. 101, no. 2 March 2004, pp. e21-e5 .

Mennella, J, Pepino, M & Teff, K 2005, 'Acute alcohol consumption disrupts the hormonal milieu of lactating women', *The Journal of Clinical Endocrinology and Metabolism,* vol. 90, no. 4, pp. 1979-85.

Miller, M & Wood, L 2001, *Smoking Cessation Interventions. Review of evidence and implications for best practice in health care settings*, National Tobacco Strategy. Commonwealth Department of Health and Ageing, Canberra. http://www.health.gov.au/internet/wcms/publishing.nsf/Content/health-pubhlth-publicat-document-smoking_ces-cnt.htm/$FILE/smoking_ces.pdf

Mills, CA 1950, 'Tobacco smoking: some hints of its biologic hazards', *Ohio State Medical Journal,* vol. 46, pp. 1165-70.

Ministry of Health 2006, *Food and Nutrition Guidelines for Healthy Pregnant and Breastfeeding Women: A background paper*, Ministry of Health, Wellington. http://www.moh.govt.nz/moh.nsf/by+unid/F4F10903136588EFCC25716200123030?Open

Moore, B 1997, in *The Australian concise Oxford Dictionary of current English*, ed. B Moore. Oxford University Press, Melbourne.

Morgan, DL 1993, 'Qualitative Content Analysis: A guide to paths not taken', *Qualitative Health Research,* vol. 3, pp. 112-21.

Moshin, M & Bauman, AE 2005, 'Socio-demographic factors associated with smoking and smoking cessation among 426,344 pregnant women in New South Wales, Australia', *BMC Public Health,* vol. 5, p. 138.

Murillo-Fuentes, L, Artillo, R, Carreras, O & Murillo, L 2001, 'Effects of maternal chronic alcohol administration in the rat: lactation performance and pup's growth', *European Journal of Nutrition,* vol. 40, pp. 147-54.

Najman, JM, Lanyon, A, Andersen, M & Williams, G 1998, 'Socioeconomic status and maternal cigarette smoking before, during and after pregnancy', *Australian and New Zealand Journal of Public Health,* vol. 22, no. 1, pp. 60-6.

National Academy of Sciences 1990, Nutrition during pregnancy. Part I: Weight Gain, Part II: Nutrient Supplements, National Academy Press, Washington, D.C.

National Academy of Sciences 1991, Nutrition During Lactation. Report of the Subcommittee on Nutrition During Lactation of the Committee on Nutritional Status during Pregnancy and Lactation, National Academy Press, Washington, D.C.

National Health and Medical Research Council 1992, *Dietary Guidelines for Australians*, Commonwealth of Australia, Canberra.

National Health and Medical Research Council 2000, *How to use the evidence: assessment and application of scientific evidence*, National Health and Medical Research Council, Canberra.

National Health and Medical Research Council 2001, *Australian Alcohol Guidelines: Health Risks and Benefits*, National Health and Medical Research Council, Canberra.

National Health and Medical Research Council 2003a, *Dietary Guidelines for Australian Adults*, Commonwealth of Australia, Canberra.

National Health and Medical Research Council 2003b, *Dietary Guidelines for Children and Adolescents in Australia*, Commonwealth of Australia, Canberra.

National Institute on Alcohol Abuse and Alcoholism 1990, *Alcohol and women*, National Institute on Alcohol Abuse and Alcoholism (NIAAA), Bethesda. http://pubs.niaaa.nih.gov/publications/aa10.htm

Neifert, MR, McDonough, SL & Neville, MC 1981, 'Failure of lactogenesis associated with placental retention', *American Journal of Obstetrics and Gynecology,* vol. 15, pp. 477-8.

Neville, MC 2001, 'Anatomy and physiology of lactation', *Pediatr Clin North Am,* vol. 48, no. 1, pp. 13-34.

Neville, MC & Morton, J 2001, 'Physiology and endocrine changes underlying human lactogenesis II', *Journal of Nutrition,* vol. 131, pp. 3005S-8S.

New South Wales Department of Health (Ed.) 2006, Background papers to the National clinical guidelines for the management of drug use during pregnancy, birth and the early development years of the newborn., NSW Department of Health, Sydney.

NHMRC 2001, Australian Alcohol Guidelines: Health Risks and Benefits, Canberra.

O'Campo, P & Faden, RR 1992, 'The impact of pregnancy on women's prenatal and postpartum smoking behaviour', *American Journal of Preventive Medicine,* vol. 8, pp. 8-13.

O'Connor, M, Brill, N & Sigman, M 1986, 'Alcohol use in primiparous women older than 30 years of age: relation to infant development', *Pediatrics,* vol. 78, no. 3, pp. 444-50.

O'Leary, C 2004, 'Fetal alcohol syndrome: Diagnosis, epidemiology, and developmental outcomes', *Journal of Paediatrics and Child Health,* vol. 40, pp. 2-7.

Orleans, CT, Barker, DC, Kaufman, NJ & Marx, JF 2000, 'Helping pregnancy smokers quit: meeting the challenge in the next decade', *Tobacco Control,* vol. 9, no. iii6-iii11.

Oyama, L, Couto, R, Damaso, A & Oller do Nascimento, C 2000, 'Ethanol intake during lactation II. Effects on pups' liver and brain metabolism', *Alcohol,* vol. 21, pp. 201-6.

Panjari, M, Bell, RJ, Astbury, J, Bishop, SM, Dalais, F & Rice, GE 1997, 'Women who spontaneously quit smoking in early pregnancy', *Australian and New Zealand Journal of Obstetrics and Gynaecology,* vol. 37, pp. 271- 8.

Parackal, S, Ferguson, E & Harraway, J 2007, 'Alcohol and tobacco consumption among 6-24-months post-partum New Zealand women', *Maternal and Child Nutrition,* vol. 3, no. 1, pp. 40-51.

Peaker, M & Wilde, CJ 1996, 'Feedback control of milk secretion from milk', *Journal of Mammary Gland Biology and Neoplasia,* vol. 1, no. 3, pp. 307-15.

Peat, J, Allen, J, Nguyen, N, Hayen, A, Oddy, W & Mihrshahi, S 2004, 'Motherhood meets epidemiology: measuring risk factors for breast-feeding cessation', *Public Health Nutrition,* vol. 7, no. 8, pp. 1033-7.

Pesa, J & Shelton, M 1999, 'Health-enhancing behaviours correlated with breastfeeding among a national sample of mothers', *Public Health Nursing,* vol. 16, no. 2, pp. 120-4.

Phung, HN, Bauman, AE, Young, L, Tran, MH & Hillman, KM 2003, 'Ecological and individual predictors of maternal smoking behaviour. Looking beyond individual socioeconomic predictors at the community setting', *Addictive Behaviours,* vol. 28, pp. 1333-42.

Pirie, PL, Lando, H, Curry, SJ, McBride, CM & Grothaus, LC 2000, 'Tobacco, alcohol, and caffeine use and cessation in early pregnancy', *American Journal of Preventive Medicine,* vol. 18, pp. 54-61.

Pryor, K 1973, *Nursing your baby*, Harper and Row, New York.

Ramsay, DT, Kent, JC, Owens, RA & Hartmann, PE 2004, 'Ultrasound imaging of milk ejection in the breast of lactating women', *Pedatrics,* vol. 113, no. 2, pp. 361- 7.

Reijneveld, SA, Lanting, CI, Crone, MR & Van Wouwe, J 2005, 'Exposure to tobacco smoke and infant crying', *Acta Paediatrica,* vol. 94, pp. 217-21.

Russell, TV, Crawford, MA & Woodby, LL 2004, 'Measurements for active cigarette smoke exposure in prevalence and cessation studies: Why simply asking pregnant women isn’t enough', *Nicotine and Tobacco Research,* vol. 6, no. Supplement 2 (April 2004), pp. S141–S51.

Sallout, B & Walker, M 2003, 'The fetal origin of adult diseases', *Journal of Obstetrics and Gynaecology,* vol. 23, pp. 555–60.

Sandelowski, M 2000, 'Focus on Research Methods. Whatever happened to qualitative description?' *Research in Nursing and Health,* vol. 23, pp. 334-40.

Scott, J & Binns, C 1998, 'Factors associated with the initiation and duration of breastfeeding: a review of the literature', *Australian Journal of Nutrition and Dietetics,* vol. 55, pp. 51-61.

Scott, J, Binns, C, Graham, K & Oddy, W 2006a, 'Temporal changes in the determinants of breastfeeding initiation', *Birth,* vol. 33, no. 1, pp. 37-45.

Scott, J, Binns, C, Oddy, W & Graham, K 2006b, 'Predictors of breastfeeding duration: evidence from a cohort study', *Pedatrics,* vol. 117, no. 4, pp. e646-e55.

Scott JA, Binns CW, Oddy WH & Graham KI 2006, 'Predictors of breastfeeding duration: evidence from a cohort study', *Pedatrics,* vol. 117, no. 4, pp. e646-e55.

Scott, JA, Aitkin, I, Binns, CW & Aroni, RA 1999, 'Factors associated with the duration of breastfeeding amongst women in Perth, Australia', *Acta Paediatr,* vol. 88, no. 4, pp. 416-21.

Scott, JA, Landers, MC, Hughes, RM & Binns, CW 2001, 'Factors associated with breastfeeding at discharge and duration of breastfeeding', *J Paediatr Child Health,* vol. 37, no. 3, pp. 254-61.

Scott, JA, Shaker, I & Reid, M 2004, 'Parental attidtudes toward breastfeeding: Their association with feeding outcome at hospital discharge', *Birth,* vol. 31, no. 2, pp. 125-31.

Severson, HH, Andrews, JA, Lichtenstein, E, Wall, M & Zoref, L 1995, 'Predictors of smoking during and after pregnancy: a survey of mothers of newborns', *Preventive Medicine,* vol. 24, pp. 23-8.

SPSS 2002, *SPSS-for Windows, Version 11.*, SPSS Inc., Chicago, Illinois.

Stockwell, T, Donath, S, Cooper-Standbury, M, Chikritzhs, T, Catalano, P & Mateo, C 2004, 'Under-reporting of alcohol consumption in household surveys: a comparison of quantity-frequency, graduated frequency and recent recall', *Addiction,* vol. 99, pp. 1024-33.

Streissguth, A, Darby, B, Barr, H, Smith, J & Martin, D 1983, 'Comparison of drinking and smoking patterns during pregnancy over a six-year interval', *American Journal of Obstetrics and Gynecology,* vol. 145, pp. 716-24.

Subramanian, M 1999, 'Alcohol inhibits suckling-induced oxytocin release in the lactating rat', *Alcohol,* vol. 19, no. 1, pp. 51-5.

Suzuki, J, Kikuma, H, Kawaminami, K & Shima, M 2005, 'Predictors of smoking cessation during pregnancy among the women of Yamato and Ayase municipalities in Japan', *Public Health,* vol. 119, no. 679-685.

Tavares do Carmo, M, Oller do Nascimento, C, Martin, A & Herrera, E 1999, 'Ethanol intake during lactation impairs milk production in rats and affects growth and metabolism of suckling pups', *Alcohol,* vol. 18, no. 1, pp. 71-6.

The Danish National Board of Health 2006, *Public Health/ The National Centre for Health Promotion and Prevention*, Denmark. http://www.sst.dk

Therneau, TM & Grambsch, PM 2000, *Modelilng survival data. Extending the Cox Model*, Springer, New York.

Torrent, M, Sunyer, J, Cullinan, P, Basagana, X, Harris, J, Garcia, O & Anto, JM 2004, 'Smoking cessation and associated factors during pregnancy', *Gaceta Sanitaria,* vol. 18, no. 3, pp. 184-9.

Truswell, AS 2003, 'Limit your alcohol intake if you choose to drink', in National Health and Medical Research Council (ed.), *Food for Health: Dietary Guidelines for Australian Adults*, NHMRC, Canberra.

U.S. Department of Health and Human Services 2000, *HHS Blueprint for Action on Breastfeeding*, U.S. Department of Health and Human Services, Office on Women's Health, Washington, D.C.

U.S. Department of Health and Human Services 2004, *The Health Consequences of Smoking: A Report of the Surgeon General*, U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, Atlanta.

U.S. Department of Health and Human Services and U.S. Department of Agriculture 2005, *Dietary Guidelines for Americans, 2005,* 6th edn, U.S. Government Printing Office, Washington, DC.

U.S. Department of Health and Human Services, SAaMHSA 2006, *SAMHSA Fetal Alcohol Spectrum Disorders Centre for Excellence*, Rockville. http://www.fascenter.samhsa.gov/

US Department of Health and Human Services 2001, *Women and smoking: a report of the Surgeon General - 2001*, Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Washington, DC.

US Department of Health and Human Services, National Institutes of Health & National Institute of Alcohol Abuse and Alcoholism 2004, *Helping Patients with Alcohol Problems. A Health Practitioner's Guide*, National Institute of Alcohol Abuse and Alcoholism, Bethesda. http://www.niaaa.nih.gov/publications/Practitioner/HelpingPatients.htm#introduction

Vilaro, S, Vinas, O, Remesar, X & Herrera, E 1987, 'Effects of chronic ethanol consumption on lactational performance in rat: mammary gland and milk composition and pups' growth and metabolism', *Pharmacology Biochemistry and Behaviour,* vol. 27, pp. 333-9.

Vio, F, Salazar, G & Infante, C 1991, 'Smoking during pregnancy and lactation and its effects on breast-milk volume', *The American Journal of Clinical Nutrition,* vol. 54, pp. 1011-6.

Wakefield, M, Reid, Y, Roberts, L, Mullins, R & Gillies, P 1998, 'Smoking and smoking cessation among men whose partners are pregnant: a qualitative study', *Social Science and Medicine,* vol. 47, pp. 657-64.

Wakefield, MA & Jones, WR 1991, 'Cognitive and social influences on smoking behaviour during pregnancy', *Australian and New Zealand Journal of Obstetrics and Gynaecology,* vol. 31, no. 3, pp. 235-9.

Waterson, EJ & Murray-Lyon, IM 1989, 'Drinking and smoking patterns amongst women attending an antenatal clinic - II. During pregnancy', *Alcohol and Alcoholism,* vol. 24, no. 2, pp. 163-73.

Women's Health Australia, *Australian Longitudinal Study on Women's Health.* http://www.newcastle.edu.au/centre/wha/

Woodward, A, Douglas, R, Graham, N & Miles, H 1990, 'Acute respiratory illness in Adelaide children: breast feeding modifies the effect of passive smoking', *Journal of Epidemiology and Community Health,* vol. 44, no. 224-230.

World Health Organization 1991, Indicators for assessing breastfeeding practices., WHO, Geneva.

World Health Organization 2001, The optimal duration of exclusive breastfeeding. Report of an expert consultation, WHO, Geneva.

Worsley, A 2002, 'Nutrition knowledge and food consumption: can nutrition knowledge change food behaviour?' *Asia Pacific Journal of Clinical Nutrition,* vol. 11, no. Suppl, pp. S579–S85.

Yang, Q, Wen, S, Dubois, L, Chen, Y, Walker, M & Krewski, D 2004, 'Determinants of breast-feeding and weaning in Alberta, Canada', *Journal of Obstetrics and Gyanecology Canada,* vol. 26, no. 11, pp. 975-81.

Chapter 11 Conclusions and Recommendations

11.1 Alcohol Conclusions

Drinking alcohol is an accepted cultural practice of Australian men and women. With time and continued public health education there has been a cultural shift away from drinking alcohol during pregnancy. However drinking during lactation remains a grey area of public knowledge, public health policy and public health education.

Alcohol enters the breastmilk by passive diffusion and reflects maternal blood alcohol levels (or higher) within 30 – 60 minutes. In both animal and human studies alcohol has been shown to disrupt the hormonal control of lactation by decreasing the milk ejection reflex through the inhibition of oxytocin.

At intakes as low as 0.3g/kg body weight (equivalent to 1.5 Australian drinks) alcohol has been reported to have an inhibitory effect on milk let-down effect with a subsequent decrease in milk intake in infants. With chronic alcohol consumption an infant could experience a significant decrease in milk intake and experience a decline in body weight, growth and other vital developmental indices.

Contrary to popular folklore, exposure to small amounts of alcohol through the breastmilk can cause disruptions to an infant's sleep patterning resulting in significantly less time spent in active sleep (see Chapter 2 for detailed discussion).

11.1.1 Australian women do consume alcohol during pregnancy and lactation

Nationally, the majority of pregnant and lactating women are low risk consumers of alcohol, consuming up to two standard drinks per week during pregnancy and lactation. This is in accordance with Guideline 11 of the NHMRC alcohol intake recommendations for pregnant and lactating women.

There has been a trend to a decreased intake in alcohol during pregnancy between the 1995 and 2001 National Health Surveys (NHS). However there remained a small proportion of pregnant women from both the 1995 and 2001 NHS (16.4% and 1.3%, respectively) who consumed more than seven standard drinks per week, the maximum recommended in Guideline 11.

With regard to lactating women, the trend between the 1995 and 2001 NHS indicates a slight but apparent increase in the proportion of women consuming alcohol during the reference week (57.5% and 52.2%, respectively; 95% CI 1.0 to 8.4). There were 13% and 16.8% (95% CI -6.5 to -1.1) of lactating mothers from the 1995 NHS and 2001 NHS respectively, consuming in excess of Guideline 11.

These national patterns of alcohol intake during pregnancy and lactation are reflected at the local level in results from the Perth Infant Feeding study (PIFSII), Western Australia. This research also showed the majority of women abstaining from alcohol during pregnancy with 82.2% of these consuming two or fewer standard drinks per week.

Less than half the sample of PIFSII breastfeeding women consumed alcohol at 4, 6 and 12 months postpartum. Not unlike their national counterparts the most common intake of these women was up to two standard drinks per week. However once again there was a small proportion of both pregnant and lactating women who were exceeding the national guideline of seven standard drinks per week.

11.1.2 Australian women are not aware of the dangers of consuming alcohol during lactation

There is considerable public awareness of the effect of alcohol on the developing foetus and the resulting condition of foetal alcohol syndrome. Unfortunately the level of knowledge about the effect of alcohol on the breastfed infant amongst lactating women is variable. Concurrently lactating women report a lack of information and available resources about drinking alcohol during lactation.

11.1.3 Alcohol consumption during lactation may negatively affect the public health gains associated with breastfeeding

This research study shows that breastfeeding women who consumed alcohol at levels of more than two standard drinks per day were more likely to discontinue breastfeeding earlier than women who drank below these levels (HR 1.9, 95% CI 1.1 to 3.0). If not timed appropriately, continuing to drink alcohol during lactation can have a two fold effect. Firstly, drinking during lactation has the potential to cause detrimental health and developmental outcomes in the infant. Secondly, a possible shortened duration of breastfeeding has negative implications for the optimal health and development of the infant.

11.2 Alcohol Recommendations

Results from this research show a demonstrated need for clear and safe alcohol guidelines during lactation. At present the recommendation for lactating women is obscured in the guideline for pregnant women, which in itself is confusing and in concise.

The following advice provides a starting point for the development of effective public health policy that would begin to address some of the ambiguity associated with alcohol intake during lactation.

i) No alcohol in the first month.

ii) After that – limit alcohol intake.

Preferable 1 – 2 standard drinks per day

Drinking just after breastfeeding

iii) If wanting to drink more than 2 then expressing milk in advance and skipping one feed may be an option to consider.

11.2.1 Recommendations for future research – alcohol

Research into the consumption of alcohol during pregnancy and lactation is limited in Australia and future research will build on finding presented in this study. However future research should take into consideration that the collection of alcohol intake is problematical and there is no 'gold standard' and limitations exist with all the main methodologies used to collect alcohol intake data. The problem of underreporting of alcohol intake may be a particular area of focus in future research given the stigma associated with drinking during pregnancy. Future studies based on a larger sample size of pregnant and breastfeeding women may help overcome these reporting limitations.

More detailed alcohol intake and timing of alcohol intake, in relation to time of breastfeeding, will provide more comprehensive data in future studies.

11.3 Cigarette Smoking Conclusions

It is well documented in the literature that cigarette smoking during pregnancy negatively effects the initiation and duration of lactation. The fact that smoking mothers cease breastfeeding earlier remains an area of continued discussion. In this research a total of 228 (39%) of women were smoking before pregnancy. This decreased to 26% (n=153) during pregnancy and 123 (21%) postnatally.

11.3.1 Factors associated with antenatal and postnatal cigarette smoking

Results from this study show the most significant factor affecting a woman's smoking status during pregnancy is her partner's smoking status (i.e. Father's smoking status). This continues to be the trend once the infant is born.

Mother's who do not attend antenatal class and those that intend to breastfeed for less than four months are also more likely to be smokers during the antenatal period. The factors associated with smoking changed in the postnatal period wherein Caucasian mothers and those with a low attitude towards breastfeeding (Iowa Infant Feeding Attitude Scale), together with a Father who smoked, were more likely to be smokers themselves.

11.3.2 Cigarette smoking during pregnancy negatively effects breastfeeding duration

Results from this study conform with the current literature in that women who smoked during pregnancy were significantly more likely to have a shorter duration of breastfeeding even after adjustment for potential confounders known to affect smoking status and breastfeeding duration (HR 1.6, 95% CI 1.2 to 2.1). Prevalence of breastfeeding at each investigative time point (2 weeks, 2 weeks to 6 months, and longer than 6 months) was lower in women who smoked during pregnancy.

11.3.3 Smoking cessation during pregnancy promotes positive breastfeeding outcomes

In this research 34% of women reported stopping smoking during pregnancy and was more likely to be associated with first time mothers. Stopping smoking during pregnancy was positively associated with breastfeeding for longer than six months OR 3.7, 95% CI 1.6 to 8.8).

11.4 Cigarette Smoking Recommendations

Results from this research show that cigarette smoking during pregnancy is a problem that needs to be addressed during the antenatal period when mothers are highly motivated to make positive health behaviour changes in an effort to provide the best outcome for their unborn foetus. The inclusion of the smoking partner in antenatal cessation programs is paramount to cessation success.

Smoking in the postnatal period has a negative effect on breastfeeding outcomes. Public health focus at this time should emphasise providing smoking mothers with support for extended breastfeeding duration.

11.4.1 Recommendations for future research – cigarette smoking

There has been substantial research into cigarette smoking in the general population which has provided considerable success for those working to promote smoking cessation. Future research into cigarette smoking antenatally and postnatally would provide additional gains given the negative impact it can have on the developing foetus and new born infant. In future studies however, consideration needs to be given to the self-reporting of cigarette smoking, particularly during the antenatal and postnatal period when there is an increased stigma associated with smoking. Future studies should consider the inclusion of alternative methods of detailing cigarette smoking.

Mothers are highly motivated to provide the best care for their unborn foetus and developing infant. Future research which is based on a larger sample size may provide additional clues as to why some mothers stop smoking antenatally and postnatally, and others do not. Ensuring a study design which continues well into the postpartum period may provide further evidence for the high prevalence of smoking cessation relapse for those women who quit smoking during pregnancy.

Appendix 1 Publications

Alcohol and lactation: A systematic review

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REVIEW

Alcohol and lactation: A systematic review

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Abstract

The aim of the present paper is to critically review the current literature on the effect of alcohol intake during lactation on the hormonal control of lactogenesis; breast milk and infant blood alcohol concentration; and on the breastfeeding infant. The databases PubMed, CINAHL, Proquest Health and Medical Complete, ScienceDirect and ISI Web of Knowledge were searched for articles published between 1990 and 2005. We found limited research investigating the effect of alcohol intake on the infants of lactating women, with most being conducted using animal models. Results consistently show a decrease in lactational performance in both animal and human studies of alcohol intake and breastfeeding. Alcohol intake by lactating mothers in amounts recommended as 'safe' for non-lactating women may have a negative effect on infant development and behaviour. Clear guidelines for alcohol consumption are required for lactating women and health professionals to guide breast-feeding mothers to make educated choices regarding alcohol intake during this critical period of infant development.

Key words: alcohol, breastfeeding, lactation.

INTRODUCTION

Breastfeeding is the safest and best method for nurturing and optimising infant growth and health. In 2001 the World Health Organization Expert Consultation recommended exclusive breastfeeding for six months, with continued breastfeeding until two years of age together with complementary foods, a position now adopted in Australia.[1,2] Alcohol is an important part of most human societies and mothers need advice on its use during lactation. The term 'alcohol' describes a series of organic chemical compounds; however, only one type, *ethyl alcohol* or *ethanol*, is found in significant quantities in drinks intended for human consumption.

Alcoholic beverages are a source of great enjoyment in many societies, but alcohol problems are an important public health concern.[3] Considerable research has been conducted into the effects of alcohol on the developing embryo, and foetal alcohol syndrome has become recognised as the foremost preventable, non-genetic cause of intellectual impairment.[4] The literature regarding foetal alcohol syndrome will not be addressed in the present paper, but it is important to note that there are well documented recommendations to restrict or limit alcohol intake during pregnancy.[3,5] Many studies report a reduced maternal alcohol intake during pregnancy and a return to prepregnancy levels, or at least higher intakes than during pregnancy, shortly following birth.[6–8]

A report from the United States Institute of Medicine National Academy of Sciences concluded that alcohol consumption by lactating women in excess of 0.5 g/kg of maternal weight may be harmful to the infant, partly because of a potential reduction in milk volume.[9] Without giving specific recommendations, the American Academy of Pediatrics stated that alcohol intake is 'compatible with breastfeeding'. However, the following effects are noted on the infant: 'with large amounts, drowsiness, diaphoresis, deep sleep, weakness, decrease in linear growth, abnormal weight gain; and maternal ingestion of 1 g/kg daily decreases milk ejection reflex' (p. 780).[10]

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The Health Council of the Netherlands states in their most recent report that alcohol use during breastfeeding has adverse effects on the infant. The Council recommends that mothers who have consumed a standard measure (10 g ethanol) of an alcoholic beverage can avoid exposing the nursing child to ethanol by abstaining from breastfeeding for a period of three hours from when the alcohol was consumed or using expressed milk. If the mother has consumed a higher amount, the Council suggests that the period until the next breastfeed should be longer, and can be calculated by multiplying the three-hour period by the number of standard measures of alcohol consumed.[11]

The United States Department of Health and Human Services recommends that on the basis of alcohol being transferred into the breast milk, alcohol intake should be limited to protect the health of the mother and infant.[12]

The most recent Australian alcohol guidelines published by the National Health and Medical Research Council (NHMRC)[3] provide a guideline for alcohol consumption for pregnant, or soon to be pregnant women (Guideline 11).

Guideline 11 states 'Women who are pregnant or might soon become pregnant (11.1) may consider not drinking at all; (11.2) most importantly, should never become intoxicated; (11.3) if they choose to drink, over a week, should have less than 7 standard drinks (spread over at least two hours); should note that the risk is highest in the earlier stages of pregnancy, including the time from conception to the first missed period' (p. 16).

An appendage to this guideline is some 'prudent' advice for lactating women not to exceed the levels of drinking recommended during pregnancy, and to consider not drinking at all.

The aim of the present paper is to review the literature on the physiological process and hormonal control of lactogenesis, the milk ejection reflex ('let down'), and the effect of alcohol on these processes in both the short term and long term. These three questions will be addressed:

1 What is the effect of alcohol intake on the hormonal control of lactogenesis?
2 What effect do blood alcohol levels have on the breast milk concentration of alcohol and subsequent infant blood alcohol levels?
3 What is the effect of alcohol intake on the breastfeeding infant?

METHODS

A systematic literature review was conducted using the electronic databases PubMed, CINAHL, Proquest Health and Medical Complete, ScienceDirect and ISI Web of Knowledge from 1990 to 2005. The search terms were 'breastfeeding', 'breast feeding', 'breastmilk', 'breast milk', 'lactation', 'alcohol' and 'ethanol'. The search was limited to English language journals.

The US Department of Health and Human Services defines a standard drink as containing approximately 14 g (approximately 0.6 fluid ounces) of pure alcohol.[13] The NHMRC standard drink contains 10 g (12.5 mL) of alcohol.[3] All references to alcohol volumes in the present paper have been converted to Australian standard drink equivalents (unless stated otherwise).

References used in the present paper (at first use) have been classified using the NHMRC guide, 'How to use the evidence: assessment and application of scientific evidence' (Table 1).[14] Although originally developed for clinical guidelines, the guidelines can be used in public health assessments recognising that in research on maternal and infant alcohol intakes, ethical restraints on human experimentation limit the types of research that can be undertaken. In the present review paper expert consensus statements and evidence from experimental studies with animals and/or cells may provide valuable adjunct information and are given a rating of level V.

Table 1 NHMRC levels of evidence

	NHMRC level of evidence
I	Evidence obtained from a systematic review of all relevant randomised controlled trials.
II	Evidence obtained from at least one properly designed randomised controlled trial.
II-1	Evidence obtained from well-designed pseudo-randomised controlled trials (alternate allocation or some other method).
III-2	Evidence obtained from comparative studies (including systematic reviews of such studies) with concurrent controls and allocation not randomised, cohort studies, case–control studies, or interrupted time series with a control group.
III-3	Evidence obtained from comparative studies with historical control, two or more single arm studies, or interrupted time series without a parallel control group.
IV	Evidence obtained from case series, either post-test or pretest/post-test.
V	Evidence provided by expert consensus statements, experimental animal and cell studies.

Source: National Health and Medical Research Council (NHMRC).[14]

THE PHYSIOLOGY OF LACTATION

Lactogenesis

Specialised glands that secrete breast milk are already present at birth. However, it is not until puberty that they develop further and during pregnancy they become fully functional. The development of these mammary glands and the initiation of milk secretion from the numerous alveoli containing the milk secreting cells within the gland are regulated by hormonal control. The commencement of this secretory differentiation during pregnancy is referred to as 'lactogenesis stage I'. However, the gland will remain inactive until activated hormonally, initiating 'lactogenesis stage II', the onset of milk secretion occurring during the first four days postpartum.[15]

The most important hormones for the initiation and maintenance of lactation are prolactin and oxytocin. Prolactin levels rise throughout pregnancy controlling the final development of the mammary gland secretory mechanism. At the same time high levels of placental progesterone prevent the prolactin from initiating lactation. It is not until the baby is born and the placenta delivered that levels of progesterone fall allowing prolactin to exert its effects on the mammary tissue and initiating stage II of lactogenesis.[16]

Once lactation has been established, prolactin is also essential for the maintenance of lactation. In response to the infant's suckling, prolactin is released from the anterior pituitary gland and enables the mammary gland to produce milk before the next feed. Oxytocin, also released in response to the suckling stimulus, promotes the milk ejection reflex and emptying of the breast; however, it is the actual removal of milk from the breasts, in a constant favourable hormonal environment, which controls milk production.[17,18] The lactating mammary gland exercises a local feedback inhibitory control over milk synthesis, autocrine control, based on a supply = demand feedback loop of control. The frequency or completeness of milk removal from the breast regulates the rate of milk secretion and there does not appear to be a direct relationship between prolactin and milk yield as the autocrine control 'downregulates' milk synthesis to match the mother's supply of milk to the infant's appetite.[19]

Milk ejection reflex

The 'milk ejection reflex' or 'milk let down' is responsible for expelling the milk from the alveoli into small ducts leading to the nipple. It is under the hormonal control of oxytocin, which is secreted into the blood stream from the posterior pituitary gland.[20] Like prolactin, oxytocin is released in response to suckling or other stimuli (e.g. hearing the baby cry) and ensures effective emptying of the breast by the infant.[21,22] Ultrasound imaging of milk ejection indicates that infant milk intake is positively related to the number of milk ejections.[23]

THE EFFECT OF ALCOHOL ON THE MOTHER

Maternal blood alcohol concentration

Alcohol enters breast milk by passive diffusion and reflects levels in maternal blood within 30–60 minutes after ingestion (evidence level Lawton; Kesaniemi—NHMRC IV; evidence level Mennella and Beauchamp—NHMRC III-1).[24–26] Factors that influence the blood alcohol concentration of the mother include body weight, amount of adipose tissue, stomach contents at the time of alcohol ingestion, rate at which alcohol beverages are consumed, and the amount and strength of alcohol in the drink (evidence level—NHMRC V, expert authority).[27]

Ho and colleagues (evidence level—NHMRC V, experimental) developed a nomogram (Table 2) to guide lactating women who drink alcohol on how to avoid exposure of their infant to ethanol through breast milk.[28] Taking into account total body water, blood alcohol concentration and body weight, the average maximal elimination rate of 15 mg/dL/hour ($V_{max} \times V_d$) was used. Time is calculated from the beginning of drinking, alcohol metabolism is assumed constant at 15 mg/dL, height of the woman is 162.5 cm and one drink is a standard Australian drink serve of 10 g of alcohol. At the end of each time period it is proposed that the alcohol content of the milk will be zero.

Effect of alcohol on lactogenesis and lactational performance

Milk ejection reflex

In many parts of the world folklore suggests that women should drink alcohol (particularly beer) to enhance breast milk supply and promote breastfeeding success. For example in Germany women drink malt beer. In Mexico women are encouraged to drink a local plant fermented juice called pulque daily during pregnancy and lactation, and Indochinese women in California drink wine steeped in herbs to promote successful lactation (evidence level—NHMRC V, review).[22] However, it seems the evidence to support this enhanced effect of any source of alcohol on breastfeeding is limited and unsupported.[26]

Table 2 Alcohol and breastfeeding: time (hour:minute) until the zero level in milk is reached for women at different body weights

	No. standard drinks									
Maternal weight (kg)	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
45	1:54	3:50	5:45	7:40	9:36	11:31	13:27	15:22		
47	1:52	3:44	5:37	7:29	9:22	11:14	13:07	14:59		
50	1:51	3:43	5:35	7:27	9:18	11:11	13:03	14:54	16:52	
52	1:48	3:37	5:26	7:15	9:05	10:53	12:42	14:31	16:47	
54	1:46	3:32	5:19	7:05	8:52	10:38	12:25	14:11	16:21	
57	1:45	3:31	5:17	7:02	8:48	10:34	12:20	14:05	15:58	
59	1:42	3:26	5:09	6:52	8:36	10:19	12:02	13:45	15:52	
61	1:40	3:21	5:02	6:43	8:24	10:05	11:46	13:28	15:29	16:50
63	1:38	3:17	4:56	6:34	8:13	9:52	11:30	13:10	15:09	16:27
66	1:37	3:15	4:53	6:31	8:10	9:48	11:26	13:04	14:48	16:20
68	1:35	3:12	4:47	6:24	8:00	9:36	11:12	12:48	14:42	16:00
70	1:33	3:07	4:41	6:15	7:50	9:24	10:57	12:31	14:24	15:40

Adapted from the study by Ho *et al.*[26]

The effect of alcohol in suppressing lactation through its effect on oxytocin was first identified in early studies in rats and later humans (evidence level Fuchs—NHMRC V, animal study; Cobo—NHMRC II).[29,30] In a study of 40 women Cobo found that ethanol blocks the release of oxytocin and that the degree of inhibition is dose-dependent with ethanol doses between 0.5 and 2 g per kilogram of body weight.[29] (Note: 1 g/kg is six standard drinks for a 60-kg woman and results in a blood alcohol level of 0.15 if consumed in one hour.)

Cobo postulates that it is possible that doses higher than 2 g/kg (equivalent to approximately 12 standard drinks) in a 60-kg woman could completely inhibit the suckling-induced oxytocin release in humans. This is a central effect of ethanol as the mammary gland response to exogenous oxytocin was not changed by ethanol. On the basis of comparative studies both Fuchs and Subramanian suggest an inhibitory dose of 1.1–1.5 g/kg ethanol for women (evidence level Subramanian—NHMRC V, animal study).[29–31]

Beer in quantities ranging from 800 mL to 1 L has been shown to increase serum prolactin secretion in normal men and non-lactating women as beer is reported to have different effects as a galactagogue, unlike ethanol alone (evidence level Carlson *et al.*—NHMRC IV; DeRosa *et al.*—NHMRC IV).[32,33] However, it has been demonstrated in both human and animal studies that the effect of alcohol regardless of the source (e.g. beer) is at the posterior pituitary, through the effect of oxytocin on milk ejection from the mammary gland in response to suckling, rather than prolactin levels, which are responsible for milk biosynthesis (evidence level Heil and Subramanian—NHMRC V, animal study; Mennella *et al.*—NHMRC II).[26,31,34,35]

Lactational performance

Lactational performance has been shown to decrease in both animal and human studies of alcohol intake and breastfeeding. Animal model research demonstrates a graded inverse response between alcohol intake and milk yield in alcohol-treated dams (evidence level Tavares do Carmo *et al.*—NHMRC V, animal study; Murillo-Fuentes *et al.*—NHMRC V, animal study).[31,34,36,37]

Using a within-subjects study design where lactating women are tested with or without alcohol, on two days separated by one week, Mennella and colleagues have consistently shown a diminished milk yield in response to alcohol consumption in lactating mothers (evidence level Mennella and Beauchamp 1991—NHMRC III-1; Mennella 1998—NHMRC III-1).[26,35,38–40]

Effect of alcohol on breastfeeding initiation and duration

Howard and Lawrence present data on drug use during pregnancy and breastfeeding from the United States 1988 National Maternal and Infant Health Survey (evidence level—NHMRC V, review article).[41*] Drinking alcohol more than six times per week was equally associated with breast or formula feeding, whereas consuming less than six drinks per week doubled the likelihood of a mother breastfeeding. Early cessation of breastfeeding was most often reported by women with the highest frequency of all drinking patterns, including binge

*The data analysis presented on the National Maternal and Infant Health Survey is part of the review paper by Howard and Lawrence.

drinking, at three months postpartum than women who were continuing to breastfeed, even after preconception habits were taken into account.

A study by Little *et al.* (evidence level—NHMRC III-2) investigated the relationship between levels of maternal smoking and drinking of 463 women at preconception, during pregnancy, and in the postpartum period.[8] Approximately 80% reported drinking some alcohol in the month before conception, with alcohol use dropping after conception, and only 40% of subjects reporting drinking in the last trimester. After delivery, drinking rose and by the end of the third month postpartum, 69% of the total sample reported some drinking, however, not to the level reported at preconception. Breastfeeding at three months postpartum was generally associated with less drinking, especially less binge drinking (Table 3).

THE EFFECT OF ALCOHOL ON THE INFANT

Infant alcohol absorption

Ethanol is a water-soluble non-polar compound that easily passes through biological membranes to be distributed proportionally throughout the water compartments of the body. The average water content of breast milk is 87.5% and that of blood is 85%. For this reason it is expected that the ethanol concentration at equilibrium would be slightly higher in breast milk.[24]

The rate of absorption and elimination of alcohol in the breast milk, and level attained in the baby's blood through extrapolation from maternal blood alcohol levels, was investigated by Lawton.[24] Eight mothers consumed amounts of alcohol between 0.56 g and 1.5 g per kilogram of body weight. With moderate-to-high intakes, alcohol levels were higher in breast milk than in blood. At lower alcohol intakes, blood and milk alcohol levels were similar. The rate of elimination of alcohol from breast milk and blood were similar. The level of alcohol in breast milk falls as blood alcohol levels fall because retrograde diffusion of alcohol from the milk back to the blood stream occurs. Any alcohol present in milk stored in the breast returns to the blood supply to maintain equilibrium during elimination, regardless of emptying the breasts.[24,25]

Using the baby of 'subject one' from the Lawton study as an example, the maximum blood alcohol value of the baby can be calculated.[24] This baby was six months old and weighed 6.5 kg. This is equivalent to the fifth percentile for boys and the 25th percentile for girls. During the experiment, if the infant consumed 180 mL of breast milk while the mother was near her maximum blood alcohol level (119 mg alcohol/dL blood, 0.119%) the baby would have consumed 245 mg of alcohol (37 mg/kg body weight). However, taking into consideration the body water content of approximately 0.60 g per kilogram of body weight then the blood alcohol level would rise to approximately 6 mg alcohol/dL blood (0.006%).[24]

Maternal alcohol intake and infant development

For ethical reasons there are limited human intervention studies on the effect of alcohol on the behavioural state of infants; however, observational studies provide some information in this area. Most research has been performed using small amounts of alcohol consumed by the mother and the subsequent behavioural effect on the infant is then evaluated.

A case report by Binkiewicz *et al.* (evidence level—NHMRC V, case report) documents the effect of chronic excessive alcohol intake by a breastfeeding mother on her four-month-old baby.[42] A random sample of expressed breast milk contained 100 mg/dL of alcohol and her reported intake was approximately 10 Australian standard alcoholic drinks per day, over a one-week period.

Symptoms evident in the infant at four months were an increased weight gain and a simultaneous slowing in rate of growth. Her length for age was below the third percentile, she was obese, and her facial appearance was 'balloon shaped'. Alcohol increases cortisol levels in the blood and can give rise to a clinical pattern that closely resembles Cushing syndrome. Confirmation of the condition was established by impaired suppressibility of cortisol secretion by dexamethasone and increased excretion of cortisol in the urine. With no other problems she was eventually diagnosed with pseudo-Cushing syndrome, subsequently reversed with the removal of alcohol from the mother's diet.

In a landmark epidemiological study by Little *et al.* (evidence level—NHMRC III-2) 400 infants were investigated to determine the relationship between the mother's use of alcohol during breastfeeding and the infant's development at one year of age.[43] The Bayley Mental Development Index was used to measure mental development and the Psychomotor Development Index (PDI) measured motor development. There was a strong inverse linear relationship between chronic exposure to ethanol in breast milk and the PDI. At a clinical level the motor effect was small (4–5% decrease in test scores) with moderate alcohol intake of 1.4–2.8 standard Australian drinks per day. In the small number of infants whose mothers were heavy drinkers (≥8.4 standard Australian drinks) there was a 15% decrease in PDI test scores. At a

Table 3 Key articles evidence table; the effect of alcohol on the mother

NHMRC level	*Reference*	*Key findings*
Effect on blood alcohol		
IV	Kesaniemi (1974)[25]	Ethanol reaches human milk in almost the same concentration as in the blood at 30 minutes after administration.
IV	Lawton (1985)[24]	Alcohol appeared in both fore- and hind-breast milk at a level equivalent to or higher than the corresponding blood samples within an hour.
Effect on lactational performance		
V Animal study (rat)	Fuchs (1969)[29]	Lactating dams alcohol intake • 1.0 g/kg body weight—no effect on milk removal. • 2.0 g/kg body weight—significant reduction on milk removal. • >2.0 g/kg body weight further reductions in milk yield. • 5 g/kg body weight—complete inhibition of the milk ejection reflex. Ethanol inhibits oxytocin release in the rat.
II	Cobo (1973)[30]	Maternal alcohol intake • <0.5 g/kg body weight—no effect on milk ejection reflex. • 0.5–1 g/kg body weight—varying individual effect from no effect to complete block of milk ejection reflex. • 1.5–2 g/kg body weight—decreased milk ejection reflex (average decrease 80%). • >2 g/kg body weight—complete inhibition of the milk ejection reflex.
III-1	Mennella and Beauchamp (1991)[38]	Maternal alcohol intake of 0.3 g/kg body weight (in orange juice) decreases milk intake in infants and is proposed to be a result of a decrease in the milk ejection reflex.[a]
III-1	Mennella and Beauchamp (1993)[26]	Maternal alcohol intake of 0.3 g/kg body weight (in beer) decreases milk intake in infants and is proposed to be a result of a decrease in the milk ejection reflex.
III-1	Mennella (1998)[39]	Maternal alcohol intake of 0.3 g/kg body weight (in orange juice) resulted in decreased expressed breast milk yield.
V Animal study (rat)	Subramanian (1999)[31]	Alcohol administration in lactating dams (1.0 g/kg body weight and 2.0 g/kg body weight) inhibited the suckling-induced oxytocin release. All pups from alcohol-treated dams had reduced milk intakes.
V Animal study (rat)	Tavares do Carmo *et al.* (1999)[36]	Lactating dams alcohol intake • Alcohol treated, 20% ethanol diluted in drinking water and food ad lib—decreased milk yield lower than pair fed. • Pair fed, nutritional control receiving a solid diet per day and per 100 g body weight to give an equivalent daily caloric intake as the alcohol rats—decreased milk yield.
V Animal study (rat)	Heil and Subramanian (2000)[34]	Alcohol administration in lactating dams (1.0 g/kg body weight and 2.0 g/kg body weight). Pups of the 2.0 g/kg groups reduced milk intakes despite elevated suckling-induced prolactin release suggesting alcohol's primary impact is through oxytocin.
V Animal study (rat)	Murillo-Fuentes *et al.* (2001)[37]	Three experimental nutritional treatments with ethanol concentration increasing 5% each week over a four-week period starting at 5% week 1. 1. Pups exposed to ethanol during gestation only 2. Pups exposed to ethanol during lactation only 3. Pups exposed to ethanol only during lactation All alcohol-exposed pups had decreased milk intake compared with controls.
III-1	Mennella (2001)[40]	Maternal alcohol intake of 0.3 g/kg body weight (in orange juice). Infants consumed approximately 20% less breast milk compared with control conditions. Compensatory intake was observed during the period 8–16 hours after exposure when mothers refrained from drinking alcohol.
II	Mennella *et al.* (2005)[35]	Maternal alcohol intake of 0.4 g/kg body weight (in orange juice) decreased oxytocin levels and increased prolactin levels. The result was a decrease in milk yield and milk ejection.

Table 3 *Continued*

NHMRC level	*Reference*	*Key findings*
Effect on breastfeeding initiation and duration		
Review article	Howard and Lawrence (1998)[41]	United States 1988 National Maternal and Infant Health Survey. Women who drink less than six alcohol drinks per week almost twice as likely to choose breastfeeding (odds ratio 1.9; $P < 0.05$). Women who weaned early reported the highest frequency of all drinking patterns, and more likely to report binge drinking (RR = 4.1; 99% CI 1.72–9.62), at three months postpartum than women who were still nursing. Women who never breastfed tended to be intermediate or more likely to be nursing women.
III-2	Little *et al.* (1990)[8]	Investigated levels of maternal drinking and smoking (n = 463) women prior to, during and post pregnancy. Women breastfeeding at three months postpartum reported less drinking, and less binge drinking than women who never breastfed or breastfed for less than one month.

[a] This amount of alcohol approximates the ethanol content of approximately 1.5 standard drinks.
NHMRC = National Health and Medical Research Council; RR = relative risk.

population level these effects could have a considerable impact on community vitality and development. The association persisted even after controlling for over 100 potentially confounding variables (including maternal tobacco, marijuana and heavy caffeine use). No relation was apparent between the infant's exposure to ethanol and the Bayley Mental Development Index.

With the intake of six Australian standard drinks by a 60-kg lactating mother, in one sitting, the ingestion of ethanol through the breast milk is estimated (using the Kesaniemi method)[25] to be 232 mg in a 5-kg infant and can be harmful.[43] Little *et al.* propose that the ethanol is detrimental possibly because the developing brain is extremely sensitive to ethanol even in very small quantities; or the small quantities ingested during lactation are accumulated in the infant because it is metabolised or excreted more slowly than in adults.[43] The authors suggest that serial doses of ethanol accumulate in the infant as supported by the association between an 'absolute alcohol' score (representing the average daily exposure that could accumulate in the infant) and the PDI found in the study by Little *et al.* There was no significant association between the infant's exposure to maternal binges during lactation (which would be less likely to result in an accumulation of ethanol in the infant) and the PDI.

Lawton suggests that occasional exposure of a six-month-old 6.5-kg infant to 245 mg of alcohol (119 mg/dL in mother's blood resulting 37 mg/kg body weight in the infant) is unlikely to have an effect even after taking into account the body water content and low alcohol dehydrogenase activity of the infant.[24]

Kesaniemi[25] concurs with Lawton[24] as to the level of maternal alcohol intake suggested not to cause harm to the infant. Kesaniemi states that mothers receiving approximately 0.6 g/kg body weight ethanol orally would result in maternal blood and milk ethanol levels of 18.2 ± 2.5 μmol/mL (83.7 mg/dL blood) and 16.9 ± 2.5 μmol/mL, respectively. At these levels a 5-kg infant receiving 200 mL of milk would receive approximately 180 mg of ethanol or approximately 36 mg/kg body weight, which Kesaniemi states is 'unlikely to have harmful effects on the infant' (p. 84).[25] However, both studies used small numbers of women and the alcohol was given very rapidly after fasting conditions.

Despite Lawton and Kesaniemi stating that these levels would not affect the infant, it should be noted that these levels are higher than that in many of the studies found to inhibit the milk ejection reflex[16,30,38–40] (evidence level Mennella[40]—NHMRC III-1), higher than the level at which motor development in the infant was affected,[43] and higher than that recommended by the Institute of Medicine (evidence level—NHMRC V, expert authority).[9]

Maternal alcohol intake and infant (feeding and sleeping) behaviour

The effect of alcohol-flavoured expressed breast milk and unaltered breast milk on the suckling response of infants was tested. The milk was bottle-fed to infants on demand and the pattern of suckling, the amount of milk consumed, and the suckling responses were recorded (evidence level—NHMRC IV).[44] The alcohol-flavoured breast milk contained 32 mg ethanol/100 mL, the average concentration detected in human milk approximately one hour after lactating women drank an acute dose of 0.3 g/kg alcohol.

Results showed that infants consumed significantly more and sucked more frequently when drinking the alcohol-flavoured milk. This is inconsistent with the diminished intake by infants of breast milk immediately following mother's exposure to alcohol as reported previously;[28,38,40] however, in the study by Mennella infants were able to bottle-feed on demand and may have been stimulated by the sweet flavour of the ethanol in the milk to consume and suck more. Mennella's study indicates that infants can readily detect flavours in breast milk and show a distinct preference for the alcohol-flavoured milk over and above the unaltered milk.[44]

Using a within-subject study design described previously,[38] Mennella demonstrated a compensatory increase in the number of demand breastfeedings by infants that occurred post exposure to alcohol.[40] Consistent with previous findings,[28,38] the infants consumed approximately 20% less breast milk during the first four hours after exposure to alcohol in the mother's milk and then compensated for this diminished intake during the 8–12 hours by increasing the number of breastfeedings that occurred in this time.

Mennella and Beauchamp tested the effect of alcohol ingestion by lactating women, on the odour of breast milk and the subsequent behaviour of the infant.[38] The ingestion of alcohol (0.3 g/kg body weight; equivalent to 1.5 Australian standard drinks) significantly altered the odour of breast milk as perceived by a panel of adults. Results demonstrated that the infants sucked significantly more frequently during the first few minutes of an alcohol-exposed breastfeed, and slept for shorter periods and more often, on the day when their mothers consumed alcohol.

Because of the common folklore belief that maternal alcohol consumption can promote sleep in breastfeeding infants, Mennella and Gerrish (evidence level—NHMRC III-1) further tested the effect of exposure to alcohol in breast milk on infants' sleep and activity levels in the short term.[7] Exposure to alcohol through expressed breast milk (32 mg/100 mL) resulted in definite changes in infant's sleep–wake patterning. All infants slept for the same number of times during each test session; however, there was a significant reduction in the length of time spent sleeping after they consumed the alcohol-flavoured milk compared with the breast milk alone. The reduction in sleep was attributable to a shortening in the longest sleeping bout and the amount of time spent in active sleep. There was no significant difference in the amount of time spent in active sleep during the first half of the 3.5-hour testing session; however, infants spent significantly less time in active sleep during the second half of the testing session (i.e. 1.75–3.5 hours) following alcohol exposure. There was no significant difference in the number of times the infants breastfed or the amount of milk consumed during these breastfeeds after alcohol exposure.

These results build on previous findings[38] in which exposure to alcohol in breast milk altered the infants' sleep–wake patterning such that the infants slept for shorter periods but more often during the day when exposed to alcohol.

To determine if these effects on infant sleep behaviour were a result of the experience to the flavour of the breast milk the authors repeated the study on another group of breastfed infants using non-alcohol-based vanilla in place of alcohol.[7] However, results show that there was no significant difference in the amount of time the infants spent in active sleep during the 3.5-hour testing session in which they ingested their mothers' breast milk flavoured with vanilla compared with breast milk alone. Nor were there significant differences in the number of sleeping bouts, amount of time spent in quiet or total sleep, latency to sleep, longest sleep bout, or activity levels during wakefulness after exposure to the vanilla-flavoured milk. This suggests that it is not the flavour per se that is responsible for the disruptions in the sleep–wake patterning exhibited after alcohol exposure in breast milk.

Mennella and Garcia-Gomez (evidence level—NHMRC III-1) repeated the alcohol and sleep patterning study by Mennella and Gerrish,[7] with the exception of extending the monitoring period to 24 hours.[45]

During the first half of the centre 3.5-hour testing session there was no significant difference in the amount of time spent in active sleep. However, during the second half of this session (1.75–3.5 hours) infants exposed to alcohol in the mother's milk spent less time in active sleep, compared with the control condition. Infants then compensated for such decreases in the following 20.5 hours when mothers refrained from drinking alcohol, by exhibiting an increase in active sleep.

Mothers were unaware of changes in their infants' behaviour following exposure to alcohol and it is likely that the decrease in active sleep would go unnoticed as infants tended to fall asleep immediately following alcohol exposure but then woke up shortly afterwards resulting in a decrease in the amount of time spent in active sleep in the hours immediately following exposure to alcohol in the mother's milk.

Together these studies demonstrate that exposure to small amounts of alcohol in the mothers' milk has a direct, although subtle effect, on infant sleep patterning and the infants' ability to modulate behaviours in response to acute ethanol exposure.[7,38,45] The mechanism for this effect on sleep patterning remains to be explained;[7,38,45] however, Mennella and Gerrish[7] propose based on their results and that of others[43,46] that the slight deficit identified in the motor development of the children exposed to chronic alcohol intake may be a result of continued disruption of active sleep subsequent to regular alcohol intake (evidence level Ioffe and Chernick—NHMRC III-2).

Animal model studies and experimental studies in humans suggest that pre- and postnatal experiences with the smell and taste of ethanol can affect later responsiveness to ethanol. Breastfed infants (6–13 months old) exposed to ethanol (determined from questionnaires about maternal and paternal alcoholism and alcohol intake) exhibited different behaviours in the presence of ethanol-scented toys compared with less exposed infants. Exposed infants demonstrated increased 'mouthing' of the scented toy (evidence level—NHMRC IV).[47] Whether mouthing the flavour scented toy indicates familiarity with the flavour of ethanol, which in turn leads to a greater willingness to accept ethanol-flavoured substances remains to be investigated.

Growth indices

For ethical reasons animal studies are the only way to determine the long-term effect of alcohol intake on infant development, body weight and metabolism.

The effects of maternal alcohol intake in lactating dams on the development of their offspring were studied using a rat model by Detering *et al.* (evidence level—NHMRC V, animal study).[48] Results from the study conclusively show that those pups whose dams received ethanol during either the pre- and postnatal period or only in the postnatal period had retarded physical growth that was more severe than that observed as a result of simple malnutrition.

These results are supported in a study by Vilaro *et al.* (evidence level—NHMRC V, animal study) in which the pups of alcohol-treated dams demonstrate a significant reduction in combined weight compared with control pups.[49] This decrease is associated with reduced milk production in the alcohol-fed dams despite their milk having a higher energy content due to a greater lipid concentration.

In a later study the physical activities, physical growth and the histological appearance of the cerebellum control pups nursed by non-alcohol consuming dams were compared with pups nursed by alcohol-consuming dams (evidence level—NHMRC V, animal study).[50] Pups exposed to alcohol opened their eyes several days later than pups in the control groups and had a lower average litter weight and brain weight that was evident until alcohol was removed from the diet. These degenerative changes were independent of the pups' weight. That study highlights the considerable growth and developmental problems occurring in pups as a result of alcohol intake in the lactating dams and the potential similar harm that could take place in humans with continued alcohol intake during lactation.

Lactational performance, brain and liver composition, circulating metabolites, plasma nutrients and metabolites were investigated in pups fed by ethanol-treated lactating dams.[36] The dams in the alcohol-treated group had a decreased milk yield that was associated with a decreased collective weight gain of their pups. These pups also exhibited a decreased brain weight and brain protein. The amount of DNA indirectly reflects the number of cells, and when expressed as DNA per total brain weight the alcohol-exposed pups had reduced values, possibly indicating a lower number of brain cells. This was also apparent in the liver of the alcohol-exposed pups, who also experienced a lower liver weight, lower liver protein and liver glycogen concentration than the control pups.

It is proposed that these lower levels of protein and glycogen are metabolic adaptations in response to the malnutrition being experienced by the alcohol-exposed pups. It is known that the lipid content increases in the milk of alcohol-treated rats.[49] This high lipid content partially compensates for the alcohol-induced malnutrition occurring in the alcohol-exposed pups and allows the proper metabolic adaptations to prevent severe hypoglycaemia and maintain minimum liver stores of glycogen. However, these adaptations are not enough to protect against impaired brain development, evident in the alcohol-exposed pups.[36]

These results are supported in a later study by Oyama *et al.* (evidence level—NHMRC V, animal study) who found that pups suckled by alcohol lactating dams (5%, 10% and 20% ethanol) had significantly lower body weights compared with controls.[51] However, only pups of lactating dams exposed to higher alcohol levels experienced a significant decrease in brain weight suggesting a preservation of the pups' brain or a profound reduction in overall body growth as possible hypotheses for the difference between alcohol groups.

Liver weight of the 5% and 10% alcohol-exposed pups was significantly decreased. ATP-citrate lyase activity is indicative of liver lipogenesis and affected by the composition of the diet. Similar to previous results,[36] all alcohol-exposed pups experienced a decrease in liver weight, and there was a decrease in ATP-citrate lyase activity, which could be related to an increased milk lipid content in the alcohol-treated rats.[49]

Results from that study indicate that the effects of maternal alcohol intake on pups' development and metabolism are dose-dependent and although the low

Table 4 Key articles evidence table; the effect of alcohol on the infant

NHMRC level	*Reference*	*Key findings*
Effect on infant alcohol absorption		
III-1	Mennella and Beauchamp (1993)[26]	Estimated by multiplying the milk intake by the concentration of ethanol detected in breast milk and taking into account infant body weight. Estimated dose ranged from 2.3 to 8.4 mg/kg, which is approximately 0.8–2.8% of the maternal dose (0.3 g/kg body weight).
Effect on infant development		
Case study	Binkiewicz *et al.* (1978)[42]	Long-term high-level alcohol intake causes pseudo–Cushing syndrome in an infant, subsequently reversed with alcohol withdrawal.
III-2	Little *et al.* (1989)[43]	Maternal alcohol intake of approximately 0.8 g/kg body weight has detrimental effect on infant motor development.
Effect on infant (feeding and sleeping) behaviour		
III-1	Mennella and Beauchamp (1991)[38]	Maternal alcohol intake of 0.3 g/kg body weight (in orange juice). Infants initially sucked more frequently when mothers had consumed alcohol ($P < 0.008$). No significant difference between the total number of sucks on the two days of testing (control vs alcohol: 856.7 ± 103.4 vs 877.2 ± 102.3). The number of times the infants slept increased on the days when the mother consumed alcohol (6.6 ± 0.7 vs 7.8 ± 0.9, paired t (11 df) = 2.31, $P < 0.05$).
IV	Mennella (1997)[44]	Infants consumed significantly more and sucked more frequently when drinking alcohol-flavoured breast milk compared with unaltered breast milk.
III-1	Mennella and Gerrish (1998)[7]	Infants bottle-fed the mother's milk alone (control condition) on one test day and the mother's milk containing 32 mg of ethanol per 100 mL on the other, and sleep and activity patterning monitored for next 3.5 hours using an actigraph. Alcohol ingested by the infants was estimated to range from 4.0 to 6.41 mg/kg (mean 5.24 ± 0.2), which is similar to what would be experienced at the breast after the consumption of 0.3 g/kg dose by the mother. All infants slept for the same number of times during each test session; however, there was a significant reduction in the length of time spent sleeping after they consumed the alcohol-flavoured milk compared with the breast milk alone (on average a 25% reduction; 78.2 minutes compared with 56.8 minutes after feeding with alcohol in breast milk). No significant difference in the amount of time spent in active sleep during the first half of the 3.5-hour testing session (control vs alcohol, 18.2 ± 3.8 vs 17.0 ± 4.2 minutes; $P = 0.84$), however, infants spent significantly less time in active sleep during the second half of the testing session (i.e. 1.75–3.5 hours) following alcohol exposure (control vs alcohol, 25.2 ± 5.5 vs 8.6 ± 2.6 minutes; $P = 0.09$).
III-1	Mennella and Garcia-Gomez (2001)[45]	Study design as previous[7] with testing time extended to 24 hours. During the first half of the centre 3.5-hour testing session there was no significant difference in the amount of time spent in active sleep. During the second half of this session (1.75–3.5 hours) infants exposed to alcohol in the mother's milk spent less time in active sleep, compared with the control condition. Infants exposed to alcohol then compensated for such decreases in the following 20.5 hours when mothers refrained from drinking alcohol, by exhibiting a 22.4 ± 7.0% increase in active sleep.
III-1	Mennella (2001)[40]	Maternal alcohol intake of 0.3 g/kg body weight (in orange juice). For the following four hours infants were videotaped during breastfeeding and were weighed immediately before and after each feeding. Infants demonstrated a compensatory increase in the number of demand breastfeedings.
Effect of alcohol on growth indices		
V Animal study (rat)	Detering *et al.* (1979)[48]	Dams were fed a regular stock diet (control), liquid diet containing 35% of the energy as ethanol (50 g/L resulting in a blood alcohol level of 61 ± 6 mg%), or a liquid diet containing dextrin substituted for the calories supplied by ethanol (isoenergetic = IE). Pups whose dams received ethanol during either the pre- and postnatal period or only in the postnatal period had retarded physical growth that was more severe than that observed as a result of simple malnutrition (the IE diet alone).

Table 4 *Continued*

NHMRC level	*Reference*	*Key findings*
V Animal study (rat)	Hekmatpanah *et al.* (1994)[50]	Four groups of lactating dams: (I) control with limited food; (II) receiving 5% alcohol and limited food; (III) receiving 10% alcohol and limited food; (IV) control with unlimited food. Pups exposed to alcohol opened their eyes several days later than pups in control groups and had a lower average litter weight and brain weight independent of malnutrition. Myelin formation and the appearance of the Purkinje cells[a] was delayed and failed to be as prolific as that of the controls at day 30.
V Animal study (rat)	Tavares do Carmo *et al.* (1999)[36]	Three groups of lactating dams: (I) alcohol treated, received 20% ethanol and food ad lib (AL); (II) pair fed, as a nutritional control received an equivalent daily caloric intake as group I (PF); (III) control rats received a solid diet and tap water ad lib (C). The AL pups had a decreased collective weight gain. The brain weight was significantly reduced in the AL and PF animals ($P < 0.05$) compared with the C group and the brain protein content was decreased in AL pups compared with the other two groups ($P < 0.05$). When corrected for body weight (g/100 g body weight), the brain was heavier in the AL and PF litters than in the controls. The amount of DNA indirectly reflects the number of cells and when expressed as DNA per total brain weight the AL pups had lower values than those of the C or PF pups ($P < 0.05$), possibly indicating a lower number of brain cells. This was also apparent in the liver of the AL pups with the total amount of DNA per liver being significantly ($P < 0.05$) lower in the pups of both the AL and PF dams, suggesting that the liver of these animals had less cells than the C group despite the cell size being the same. The AL and PF pups had a lower liver weight ($P < 0.05$), a lower liver protein ($P < 0.05$) and liver glycogen ($P < 0.05$) concentration than the control pups.
V Animal study (rat)	Vilaro *et al.* (1987)[49]	Ethanol-treated dams received ethanol diluted in drinking water with ethanol concentration increasing 5% each week over a four-week period starting at 10% week 1. Pups of alcohol-treated dams demonstrate a significant reduction in combined weight compared with control pups.
V Animal study (rat)	Heil and Subramanian (2000)[34]	Lactating dams alcohol intake of 1.0 kg/kg body weight and 2.0 kg/kg body weight. Pups of the 2.0 g/kg groups exhibit lower body weights.
V Animal study (rat)	Oyama *et al.* (2000)[51]	Pups suckled by alcohol-treated lactating dams (5%, 10%, 20% ethanol solution groups) had significantly lower body weights compared with controls ($P < 0.05$). Only pups of lactating dams exposed to higher alcohol levels (10% and 20%) experienced a significant decrease in brain weight ($P < 0.05$). Liver weight of the 5% and 10% alcohol-exposed pups was significantly decreased ($P < 0.05$). The ingestion of the 5% ethanol solution by the dams decreased pups' brain lipogenesis rate from glucose.
V Animal study (rat)	Chen and Nyomba (2004)[52]	Offspring of rats exposed to alcohol (36%) during lactation exhibit insulin resistance regardless of having normal birth weight and growth pattern.

[a] A specific type of nerve cell that carries each and every piece of information outputted by the cerebellum. These cells possess a great deal of control over the refinement of motor activities.
NHMRC = National Health and Medical Research Council.

intake of ethanol (5%) did not have an effect on brain or liver weight it did have an effect on brain metabolism.

The phenomenon of insulin resistance has more recently been an area of investigation with regard to alcohol intake during lactation. In a study by Chen and Nyomba (evidence level—NHMRC V, animal study) maternal alcohol consumption during lactation and its effect on glucose homeostasis in rat pups was investigated.[52] Results demonstrate that the offspring of rats exposed to alcohol during lactation exhibit insulin resistance regardless of having normal birth weight and growth pattern. Despite a lack of clarity in determining the mechanism for this effect, the study highlights the importance of lactation as a vulnerable period for the future metabolic homeostasis of the infant (Table 4).

CONCLUSION

Alcohol is almost ubiquitous in Australian society and is commonly consumed, including during lactation. The evidence available to give advice to lactating mothers is less than ideal and must rely on a combination of experiments, observational studies and animal data. The evidence supporting severe limitations on the consumption of alcohol during pregnancy is abundant[4] and robust guidelines outlining recommendations for alcohol intake during this time are well documented.[3] However, there is a paucity of scientific information about the effect during lactation making it harder to give definitive recommendations.

In animal and human studies alcohol has been shown to disrupt the hormonal control of lactation by decreasing the milk ejection reflex through the inhibition of oxytocin. Doses as low as 0.3 g/kg body weight (equivalent to 1.5 standard Australian drinks) have been reported to have an inhibitory effect with a subsequent decrease in milk intake by infants. Most often undetected, this decrease in intake with regular low-level alcohol consumption over an extended period of time could contribute to a significant decrease in milk intake and a resulting decline in infant body weight, growth and other vital developmental indices.

Ethanol is water-soluble and enters the breast milk by passive diffusion, reflecting maternal blood levels (or higher) within 30–60 minutes. The removal of alcohol from breast milk and blood are similar and the level of alcohol in breast milk will fall as blood alcohol levels fall because of retrograde diffusion of alcohol from the milk back into the blood stream.

Despite the popular folklore belief that consuming alcohol when breastfeeding will promote lactation,[53] and relax the infant and mother, the available research provides evidence to the contrary. Exposure to small amounts of alcohol in the mothers' milk has a direct effect on infant sleep patterning resulting in significantly less time spent in active sleep immediately after exposure to alcohol in breast milk. It is important for mothers to establish sound breastfeeding patterns in the first month and if a mother has a restless baby (as most are in the first few weeks) the introduction of alcohol may exacerbate this restlessness, prompting her to discontinue breastfeeding at this critical time. The authors advise nursing mothers to restrict all alcohol intake during this first month in an effort to provide the most optimal environment to support continued breastfeeding.

Table 5 Suggested advice for alcohol intake of breastfeeding mothers

1. No alcohol in the first month.
2. After that—limit alcohol intake.
    a. Preferable 1–2 standard drinks per day
    b. Drinking just after breastfeeding
3. If wanting to drink more than 2 then expressing milk in advance and skipping one feed may be an option to consider.

Early cessation of breastfeeding has been associated with a high frequency of alcohol consumption during lactation, even after controlling for confounders. Promoting a recommendation to reduce or eliminate alcohol intake during lactation would help foster the mindset of abstinence that appears to be so easily maintained during pregnancy. By preparing women for a continued abstinence of alcohol following pregnancy, women may be more inclined and mentally prepared to maintain this behaviour throughout lactation therefore possibly promoting prolonged breastfeeding duration.

Based on the available evidence the authors suggest the prudent use of alcohol and strongly recommend that lactating mothers consume only one to two standard drinks after breastfeeding. Advice restricting alcohol consumption during the first month of breastfeeding and providing direction on levels of consumption and timing of intake will enable lactating women to consume alcohol in quantities and conditions conducive to the optimal development of their young infant while supporting successful breastfeeding (Table 5).

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REFERENCES

1 World Health Organization. *The Optimal Duration of Exclusive Breastfeeding*. Report of an expert consultation. Geneva: WHO, 2001. Report No: WHO/NHD/01.09, WHO/FCH/CAH/01.24, 2 April 2001.

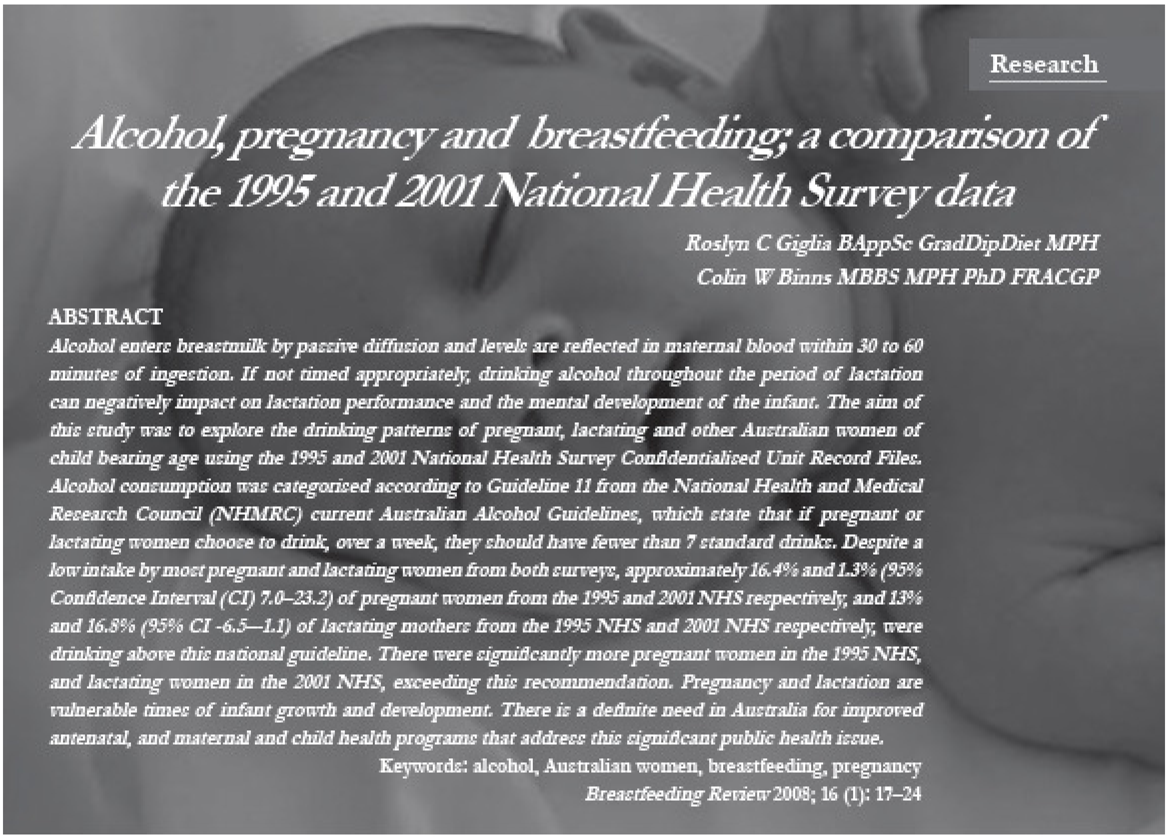
2 National Health and Medical Research Council. *Dietary Guidelines for Australian Adults*. Canberra: Commonwealth of Australia, 2003.

3 National Health and Medical Research Council. *Australian Alcohol Guidelines: Health Risks and Benefits*. Canberra: National Health and Medical Research Council, 2001. (Cited 19 Aug 2003.) Available from URL: http://www.nhmrc.gov.au/publications/_files/ds9.pdf

4 O'Leary C. Fetal alcohol syndrome: diagnosis, epidemiology, and developmental outcomes. *J Pediatr Child Health* 2004; 40: 2–7.
5 National Academy of Sciences. *Nutrition during Pregnancy. Part I: Weight Gain, Part II: Nutrient Supplements.* Washington, DC: National Academy Press, 1990.
6 O'Connor M, Brill N, Sigman M. Alcohol use in primiparous women older than 30 years of age: relation to infant development. *Pediatrics* 1986; 78: 444–50.
7 Mennella JA, Gerrish CJ. Effects of exposure to alcohol in mother's milk on infant sleep. *Pediatrics* 1998; **101**: e21–5. (Cited 2 Mar 2004.) Available from URL: http://pediatrics.aappublications.org/cgi/content/full/101/5/e2
8 Little R, Lambert M, Worthington-Roberts B. Drinking and smoking at 3 months postpartum by lactation history. *Paediatr Perinatal Epidemiol* 1990; 4: 290–302.
9 National Academy of Sciences. *Nutrition During Lactation.* Report of the Subcommittee on Nutrition During Lactation of the Committee on Nutritional Status during Pregnancy and Lactation. Washington, DC: National Academy Press, 1991; 15.
10 American Academy of Pediatrics. The transfer of drugs and other chemicals into human milk. *Pedatrics* 2001; **108**: 776–89.
11 Health Council of the Netherlands. *Risks of Alcohol Consumption Related to Conception, Pregnancy and Breastfeeding.* Hague: Health Council of the Netherlands, 2005. Publication no. 2004/22. (Cited 31 Oct 2005.) Available from URL: http://www.gr.nl/referentie.php?ID=1171
12 US Department of Health and Human Services. *HHS Blueprint for Action on Breastfeeding.* Washington, DC: US Department of Health and Human Services, Office on Women's Health, 2000. (Cited 31 Oct 2005.) Available from URL: http://www.4woman.gov/Breastfeeding/bluprntbk2.pdf
13 US Department of Health and Human Services, National Institutes of Health, National Institute of Alcohol Abuse and Alcoholism. *Helping Patients with Alcohol Problems. A Health Practitioner's Guide.* Bethesda: National Institute of Alcohol Abuse and Alcoholism, 2004.
14 National Health and Medical Research Council. *How to Use the Evidence: Assessment and Application of Scientific Evidence.* Canberra: National Health and Medical Research Council, 2000.
15 Neville MC, Morton J. Physiology and endocrine changes underlying human lactogenesis II. *J Nutr* 2001; **131**: 3005S–8S.
16 Neifert MR, McDonough SL, Neville MC. Failure of lactogenesis associated with placental retention. *Am J Obstet Gynecol* 1981; 15: 477–8.
17 Peaker M, Wilde CJ. Feedback control of milk secretion from milk. *J Mammary Gland Biol Neoplasia* 1996; 1: 307–15.
18 Akre J. Infant feeding: the physiological basis. *Bull World Health Organ* 1989; 67 (Suppl.): 1–108.
19 National Health and Medical Research Council. *Dietary Guidelines for Children and Adolescents in Australia.* Canberra: Commonwealth of Australia, 2003.
20 Clement C, Glaster A, McNeilly A. Endocrine control of lactation. In: Picciano MF, Lonnerdal B, eds. *Mechanisms Regulating Lactation and Infant Nutrient Utilization.* New York: Wiley-Liss, 1992; 34–42.
21 Neville MC. Anatomy and physiology of lactation. *Pediatr Clin North Am* 2001; 48: 13–34.
22 Mennella J. Alcohol's effect on lactation. *Alcohol Res Health* 2001; 25: 230–34.
23 Ramsay DT, Kent JC, Owens RA, Hartmann PE. Ultrasound imaging of milk ejection in the breast of lactating women. *Pedatrics* 2004; **113**: 361–7.
24 Lawton M. Alcohol in breastmilk. *Aust N Z J Obstet Gynaecol* 1985; 25: 71–3.
25 Kesaniemi YA. Ethanol and acetaledhyde in the milk and peripheral blood of lactating women after ethanol administration. *J Obstet Gynaecol* 1974; **81**: 84–6.
26 Mennella JA, Beauchamp GK. Beer, breast feeding and folklore. *Dev Psychobiol* 1993; **26**: 459–66.
27 National Institute on Alcohol Abuse and Alcoholism. *Alcohol and Women.* National Institute on Alcohol Abuse and Alcoholism No. 10 PH 290 October 1990. Bethesda: National Institute on Alcohol Abuse and Alcoholism (NIAAA), 1990. (Cited 2 Nov 2005.) Available from URL: http://pubs.niaaa.nih.gov/publications/aa10.htm
28 Ho E, Collantes A, Kapur B, Moretti M, Koren G. Alcohol and breast feeding: calculation of time to zero level in milk. *Biol Neonate* 2001; **80**: 219–22.
29 Fuchs A. Ethanol and the inhibition of oxytocin release in lactating rats. *Acta Endocrinologica* 1969; **62**: 546–54.
30 Cobo E. Effect of different doses of ethanol on the milk-ejecting reflex in lactating women. *Am J Obstet Gynecolol* 1973; **115**: 817–21.
31 Subramanian M. Alcohol inhibits suckling-induced oxytocin release in the lactating rat. *Alcohol* 1999; 19: 51–5.
32 Carlson HE, Wasser HL, Reidelberger RD. Beer-induced prolactin secretion: a clinical and laboratory study of the role of salsolinol. *J Clin Endocrinol Metab* 1985; 60: 673–7.
33 DeRosa G, Corsello SM, Ruffilli MP, Della Casa S, Pasargiklian E. Prolactin secretion after beer. *Lancet* 1981; 2: 934.
34 Heil S, Subramanian M. Chronic alcohol exposure and lactation. Extended observations. *Alcohol* 2000; **21**: 127–32.
35 Mennella JA, Pepino MY, Teff KL. Acute alcohol consumption disrupts the hormonal milieu of lactating women. *J Clin Endocrinol Metab* 2005; 90: 1979–85.
36 Tavares do Carmo M, Oller do Nascimento C, Martin A, Herrera E. Ethanol intake during lactation impairs milk production in rats and affects growth and metabolism of suckling pups. *Alcohol* 1999; **18**: 71–6.
37 Murillo-Fuentes L, Artillo R, Carreras O, Murillo L. Effects of maternal chronic alcohol administration in the rat: lactation performance and pup's growth. *Eur J Nutr* 2001; 40: 147–54.
38 Mennella JA, Beauchamp GK. The transfer of alcohol to human milk. *N Engl J Med* 1991; **325**: 981–5.

39 Mennella JA. Short-term effects of maternal alcohol consumption on lactational performance. *Alcohol Clin Exp Res* 1998; 22: 1389–92.
40 Mennella JA. Regulation of milk intake after exposure to alcohol in mother's milk. *Alcohol Clin Exp Res* 2001; 25: 590–93.
41 Howard C, Lawrence R. Breast-feeding and drug exposure. *Obstet Gynecol Clin North Am* 1998; 25: 195–217.
42 Binkiewicz A, Robinson M, Senior B. Pseudo-Cushing syndrome caused by alcohol in breast milk. *J Pediatr* 1978; 93: 965–7.
43 Little R, Anderson K, Ervin C, Worthington-Roberts B, Clarren S. Maternal alcohol use during breast-feeding and infant mental and motor development at one year. *N Engl J Med* 1989; 321: 425–30.
44 Mennella JA. Infant's suckling responses to the flavor of alcohol in mothers' milk. *Alcohol Clin Exp Res* 1997; 21: 581–5.
45 Mennella JA, Garcia-Gomez PL. Sleep disturbances after acute exposure to alcohol in mother's milk. *Alcohol* 2001; 25: 153–8.
46 Ioffe S, Chernick V. Prediction of subsequent motor and mental retardation in newborn infants exposed to alcohol in utero by computerized EEG analysis. *Neuropediatrics* 1990; 21: 11–17.
47 Mennella J, Beauchamp GK. Infant's exploration of scented toys: effects of prior experiences. *Chem Senses* 1998; 23: 11–17.
48 Detering N, Reed W, Ozand P, Karahasan A. The effects of maternal ethanol consumption in the rat on the development of their offspring. *J Nutr* 1979; 109: 999–1009.
49 Vilaro S, Vinas O, Remesar X, Herrera E. Effects of chronic ethanol consumption on lactational performance in rat: mammary gland and milk composition and pups' growth and metabolism. *Pharmacol Biochem Behav* 1987; 27: 333–9.
50 Hekmatpanah J, Haghighat N, Adams C. Alcohol consumption by nursing rats and its effect on the cerebellum of the offspring. *Alcohol Alcohol* 1994; 29: 535–47.
51 Oyama L, Couto R, Damaso A, Oller do Nascimento C. Ethanol intake during lactation II. Effects on pups' liver and brain metabolism. *Alcohol* 2000; 21: 201–6.
52 Chen L, Nyomba B. Whole body insulin resistance in rat offspring of mothers consuming alcohol during pregnancy or lactation: comparing prenatal and postnatal exposure. *J Appl Physiol* 2004; 96: 167–72.
53 Mennella JA. Alcohol use during lactation: the folklore versus the science. In: Auerbach K, ed. *Current Issues in Clinical Lactation*. Boston: Jones and Bartlett, 2002; 3–10.

Alcohol, pregnancy and breastfeeding; a comparison of the 1995 and 2001 National Health Survey data



Alcohol, pregnancy and breastfeeding; a comparison of the 1995 and 2001 National Health Survey data

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ABSTRACT

Alcohol enters breastmilk by passive diffusion and levels are reflected in maternal blood within 30 to 60 minutes of ingestion. If not timed appropriately, drinking alcohol throughout the period of lactation can negatively impact on lactation performance and the mental development of the infant. The aim of this study was to explore the drinking patterns of pregnant, lactating and other Australian women of child bearing age using the 1995 and 2001 National Health Survey Confidentialised Unit Record Files. Alcohol consumption was categorised according to Guideline 11 from the National Health and Medical Research Council (NHMRC) current Australian Alcohol Guidelines, which state that if pregnant or lactating women choose to drink, over a week, they should have fewer than 7 standard drinks. Despite a low intake by most pregnant and lactating women from both surveys, approximately 16.4% and 1.3% (95% Confidence Interval (CI) 7.0–23.2) of pregnant women from the 1995 and 2001 NHS respectively, and 13% and 16.8% (95% CI -6.5—1.1) of lactating mothers from the 1995 NHS and 2001 NHS respectively, were drinking above this national guideline. There were significantly more pregnant women in the 1995 NHS, and lactating women in the 2001 NHS, exceeding this recommendation. Pregnancy and lactation are vulnerable times of infant growth and development. There is a definite need in Australia for improved antenatal, and maternal and child health programs that address this significant public health issue.

Keywords: alcohol, Australian women, breastfeeding, pregnancy
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INTRODUCTION

Alcohol has a major role in Australian society and alcoholic beverages are consumed by the majority of Australians. The 2001 National Health Survey (NHS) (Australian Bureau of Statistics 2003) showed that 56.5% of women in the 18–44 year age group had consumed alcohol in the past week. Over 8% of women aged 18 years or more consumed alcohol at a level that created a health risk for them and many of these women were in the age group for pregnancy or for breastfeeding.

Breastfeeding is the normal way to feed infants and is recommended for every infant in Australia, exclusively for six months and on to twelve months of age, together with complementary foods (Binns & Davidson 2003). The World Health Organization (WHO) recommends extending the breastfeeding period until two years of age together with solid foods (World Health Organization 2001). The most recent research in Australia conducted by our research team shows that despite 75.6% of women exclusively breastfeeding on hospital discharge, less than 1% of infants are exclusively breastfed at six months of age. At 12 months of age, only 19.2% of infants were receiving any breastmilk (Scott et al 2006).

The benefits of breastfeeding are well known and for the infant, these include nutritional, immunological and psychological benefits. Health benefits for lactating women include lactation amenorrhea, maternal weight or fat loss, protection against premenopausal breast cancer and ovarian cancer, bone remineralisation to levels exceeding those present before lactation, and more optimal blood glucose profiles in women with gestational diabetes (Dobson & Murtaugh 2001). Exclusive breastfeeding provides the greatest gains for infant development, protection against childhood obesity and the prevention of chronic disease later in adult life (Binns & Davidson 2003; Leon-Cava 2002; Martorell, Stein & Schroeder 2001).

Women of an age to breastfeed often consume alcohol (Australian Bureau of Statistics 2003). It has been commonly recommended that alcohol should be avoided during pregnancy and during breastfeeding. In Australia, the National Health and Medical Research Council (NHMRC) provide a guideline for alcohol consumption for pregnant or soon to be pregnant women (see Box 1) (National Health and Medical Research Council 2001). Despite this recommendation, a review of the literature does not reveal any Australian published papers on alcohol consumption and breastfeeding.

International recommendations for alcohol intake during pregnancy and breastfeeding vary considerably and many countries only provide a recommendation for pregnancy (see Box 2). In Australia, the NHMRC recommends that breastfeeding women follow the same guideline given to pregnant women

(National Health and Medical Research Council 2001) (see Box 1).

Box 1. Guideline 11, Australian Alcohol Guidelines

Guideline 11: Women who are pregnant or might soon become pregnant

11.1 may consider not drinking at all;

11.2 most importantly, should never become intoxicated;

11.3 if they choose to drink, over a week, should have less than 7 standard drinks, AND, on any one day, no more than 2 standard drinks (spread over at least two hours);

11.4 should note that the risk is highest in the early stages of pregnancy, including the time from conception to the first missed period.

Women who are breastfeeding are advised not to exceed the levels of drinking recommended during pregnancy, and may not consider drinking at all.

(National Health and Medical Research Council 2001)

Alcohol enters breastmilk by passive diffusion and levels are reflected in maternal blood within 30 to 60 minutes of ingestion (Kesaniemi 1974; Lawton 1985; Mennella & Beauchamp 1993). In many countries and cultures there is the belief that alcohol can actually promote breastmilk production and aid in settling the infant (Mennella 2001). Contrary to these beliefs, research shows that drinking alcohol during lactation can result in a decrease in breastmilk production (through its effect on oxytocin), disturbed sleep patterns and altered gross motor development (Little et al 1989; Mennella 2001; Mennella, Pepino & Teff 2005). There is limited research data available, either nationally or internationally, which outlines the prevalence of alcohol intake during lactation. A Norwegian study by Avlik, Haldorsen and Lindemann (2006) reports that 80% of breastfeeding women were consuming alcohol and breastfeeding at six months or longer, postpartum.

The objective of this paper is to estimate and compare the proportion of pregnant, lactating women and non-mothers consuming alcohol by analysing unpublished data from the 1995 and 2001 NHS (Australian Bureau of Statistics 1995, 2003).

METHODS

Sample

The 1995 NHS was conducted on a multistage area sample of private dwellings and a list sample of non-private dwellings in all States and Territories of Australia (Australian Bureau of Statistics 1995). The final sample size was 21,787 households. Information was obtained by personal interview with each adult member of the selected household. The unit record data file contains detailed information on each person in the sample, but identifying data has been removed to preserve confidentiality. For each child under the age of four years, a number of questions relating to breastfeeding were asked. Responses were provided on behalf of the child by an adult, generally a parent, and the mother in approximately 80% of cases.

The 2001 NHS was conducted in 17,918 private dwellings selected throughout non-sparsely settled areas of Australia (Australian Bureau of Statistics 2003). Information was obtained by personal interview with one adult, all children aged 6 years or less, and one child aged 7 to 17 years in each selected household. Data on each person in the unit record file has been de-identified to maintain confidentiality. A parent or guardian was asked to answer questions on behalf of their children aged less than 18 years. This person was referred to as the child proxy.

In addition to the 1995 and 2001 NHS standard interview questionnaires, adult female respondents were invited to complete a Women's Health Supplementary questionnaire relating to specific aspects of women's health, which included information on pregnancies and breastfeeding. It was completed by the respondent in writing and returned to the interviewer in a sealed envelope. This approach was adopted in recognition of the potential sensitivity of the topics covered.

Box 2. International Alcohol Recommendations for Pregnancy and Breastfeeding

	Country	Reference
Pregnancy		
Complete abstinence	Canada	Health Canada 1996
	Netherlands	Health Council of the Netherlands 2005
	New Zealand	Ministry of Health 2006
	United States	US Department of Health and Human Services and US Department of Agriculture 2005
Occasional drinking of low/moderate amounts	United Kingdom	Department of Health 2006
Lactation		
Complete abstinence	United States	US Department of Health and Human Services and US Department of Agriculture 2005
Scheduled occasional drinking of low/moderate amounts	Canada	Best Start Resource Centre 2005
	Netherlands	Health Council of the Netherlands 2005
	New Zealand	Ministry of Health 2006
	United Kingdom	Department of Health 2006

In the 1995 NHS, 'core sections' of the survey were administered to all respondents; however due to time and cost constraints certain sections of the survey were administered to only half the sample (e.g. General Health and Well-Being [SF-36] questionnaire, Women's Health Supplementary Form, Alcohol consumption).

The sub-samples of lactating mothers for each NHS were defined as women who stated they had ever breastfed and lived in a household where there was a child aged four years or less in the same household. The level of breastfeeding was not ascertained from respondents in the NHS and the response 'ever breastfed' is interpreted as partial breastfeeding (Labbok & Krasovec 1990).

For both surveys, non-mothers were aged between 18–44 years and reported not having children. Pregnant women were those women who reported that they were currently pregnant at the time of the survey interview.

In the 1995 survey, 'not applicable' responses are a result of only half of the adult sample receiving any questionnaire on alcohol consumption, as some sections of the survey were administered to half the sample only. However, special weights are provided such that estimates can be produced relating to the total population. In the 2001 NHS, 'not applicable' responses are a result of respondents not consuming alcohol in the reference week and therefore not being able to respond to subsequent follow-on questions, such as main drink type consumed in the reference week (Australian Bureau of Statistics 2001).

Alcohol consumption measures

Adult respondents were asked how long ago (within the last 12 months or longer) they last had an alcoholic drink. Those who reported they had a drink within the previous week were asked the days in that week on which they had consumed alcohol (excluding the day on which the interview was conducted), and for each of the last three days on which they drank, the types and quantities of drinks they had consumed. The methodology used to collect information regarding alcohol intake was essentially the same in both the 1995 and 2001 NHS and is considered by the Australian Bureau of Statistics to be directly comparable (Australian Bureau of Statistics 2001). Reported quantities of drinks were converted to millilitres of alcohol.

The alcohol intakes of the pregnant and lactating women were compared with Guideline 11 from the NHMRC Australian Alcohol Guidelines (National Health and Medical Research Council 2001) (see Box 1). Alcohol intakes of the non-mothers are presented but as is appropriate, are not compared to this guideline. One Australian standard drink contains 10 g of alcohol (equivalent to 12.5 ml of pure ethanol).

Data Analysis

The data have been analysed using frequency analysis. Ninety five percent confidence intervals (95% CI) are presented and have been calculated using Excel (version 2003) by estimating the difference between two proportions (e.g. 1995 NHS lactating mothers and pregnant women) by assuming the samples are independent and have been taken from a binomial distribution (success and failure).

Estimation Procedure

In the unit record data, the Australian Bureau of Statistics provides a weighting for each person to be used when estimating parameters for the Australian population. All proportions in this paper were calculated using the weighted estimates and are presented together with the sample population.

Methodological considerations

This paper draws attention to the methodology used in the 1995 and 2001 NHS. The methodology used in these surveys is different to that used in the National Drug Survey Household Strategy (NDSHS) and for this reason it is difficult to make direct comparisons (Clemens, Donath & Stockwell 2006). Despite this limitation the data extracted in this analysis provides valid and statistically comparable data (Australian Bureau of Statistics 2006).

Ethics

Utilisation of the 1995 and 2001 Basic Confidentialised Unit Record Files was undertaken in accordance with the conditions of use provided by the Australian Bureau of Statistics. The study was approved by the Curtin University Human Research Ethics Committee.

RESULTS

There were a total of 1461 lactating mothers in the 1995 NHS and 1248 lactating mothers in the 2001 NHS. The majority of lactating mothers (62.4%) and pregnant women (64.8%) in the 1995 NHS were in the 25–34 age groups. The majority of non-mothers fall within the 20–34 age group (65.5%). In the 2001 NHS the majority of lactating mothers (58.4%) and pregnant women (73.6%) were also in the 25–34 age groups. Approximately 55% of the non-mothers were in the 35–44 year age group (see Table 1).

Table 2 outlines the prevalence and period of drinking by all women from the 1995 and 2001 NHS. The majority of women did not consume alcohol during the reference week. The most common volume of alcohol consumed in the reference week from both the 1995 and 2001 NHS was two standard drinks (see Table 3).

There were significantly more lactating women and non-mothers consuming alcohol in the 2001 NHS compared to these sub samples in the 1995 NHS. Significantly fewer pregnant women were consuming alcohol in the 2001 NHS compared to the 1995 NHS (see Table 3).

Most women from both surveys who were consuming alcohol did so on one day of the reference week (see Table 4). Table 5 shows that the most popular drink type for all women from both the 1995 and 2001 NHS was wine, followed by spirits then full strength beer.

DISCUSSION

The consumption of alcohol in Australia is part of the cultural norm, however it appears from this analysis that most mothers reduce their alcohol intake during pregnancy and lactation compared to women of child bearing age who are neither pregnant nor breastfeeding. Figures

Table 1: Age of lactating mothers, pregnant women and non-mothers in the 1995 and 2001 NHS

Age (yr)	1995 Lactating mothers		1995 Pregnant women		1995 Non-mothers		2001 Lactating mothers		2001 Pregnant women		2001 Non-mothers	
	n	%	n	%	n	%	n	%	n	%	n	%
18–19	15	1.3			81	5.6	11	.8	3	**2.2**	65	**4.2**
20–24	166	11.5	14	13.2	379	26.6	144	10.9	13	9.2	181	7.2
25–29	385	26.2	27	35.7	335	21.9	304	**24.4**	49	35.2	336	11.4
30–34	528	36.2	22	29.1	259	17.0	405	34.0	52	38.4	618	22.4
35–39	251	16.7	12	15.1	215	14.1	283	21.6	18	13.8	818	28.3
40–44	94	6.1	8	6.7	220	14.8	87	7.1	2	1.2	746	26.5
45–49	22	2.0	1	0.2			14	1.3				
Total	1461	100	84	100	1489	100	1248	100	137	100	2764	100

Table 2: Prevalence of alcohol consumption (%)

	In the last week	In the last 12 months[a]	>12mths/ Never	Not known	Not applicable[b]
1995 NHS					
Lactating mothers	42.5	76.6	22.1	1.3	—
Pregnant women	40.3	91.3	8.7	0	—
Non-mothers	28.8	43.3	3.5	0.4	52.7
2001 NHS					
Lactating mothers	47.8	80.9	18.3	0.7	—
Pregnant women	26.6	78.6	20	1.4	—
Non-mothers	53.7	82.2	16.9	0.8	—

[a] including the last week.
[b] in the 1995 survey, not applicable responses are a result of only half of the adult sample receiving any questionnaire on alcohol consumption.

from the 2001 NDSHS show that 36% of pregnant women and 28% of lactating women did not drink at all in the previous 12 month period (Australian Institute of Health and Welfare 2003). Similarly in the 2004 NDSHS 38% of pregnant women and 30% of breastfeeding women had abstained from consuming alcohol in the previous 12 month period (Australian Institute of Health and Welfare 2005). These figures are higher than those found in this analysis of the National Health Surveys and can most likely be attributed to the methodological differences between these two national data collection surveys.

The majority of pregnant women and lactating mothers in both the 1995 and 2001 NHS were from the 25–34 year age group. Non-mothers surveyed were generally older in the 2001 NHS than in the 1995 NHS, reflecting Australia's ageing population (Australian Bureau of Statistics 2004).

The majority of all women had not consumed alcohol in the reference week, with the exception of non-mothers from the 2001 NHS. Significantly more pregnant women reported abstaining from alcohol intake in the previous week, in the 2001 NHS than in the 1995 NHS (see Table 3). This finding is most likely attributable to the greater public health awareness of the risk of alcohol intake during pregnancy in recent years (National Health and Medical Research Council 2001).

All women who did drink alcohol from both the 1995 and 2001 NHS most commonly consumed two standard drinks in the reference week. Despite this overall low level of alcohol consumption, lactating mothers from the 2001 NHS and pregnant women in the 1995 NHS were consuming 10–15 drinks during the reference week as the next most common volume of alcohol (following two standard drinks). This consumption would equate to approximately 1.4 to two standard drinks per day.

Results from this analysis show that 16.4% and 1.3% of pregnant women from the 1995 and 2001 NHS, respectively were

Table 3: Number of standard drinks consumed during the reference week of the 1995 and 2001 NHS

Standard drinks	1995 Lactating mothers (95% CI)[a]		2001 Lactating mothers (95% CI)		1995 Pregnant women (95% CI)		2001 Pregnant women (95% CI)		1995 Non-mothers (95% CI)		2001 Non-mothers (95% CI)	
	n	%	n	%	n	%	n	%	n	%	n	%
Nil	818	57.5	638	52.2	46	59.7	98	73.4	1052	71.2	1254	46.3
		(1.0 to 8.4)*				(-26.5 to -0.9)*				(21.9 to 27.9)*		
1	91	7.2	72	5.5	6	6.5	8	4.2	36	2.8	150	5.8
		(0.0 to 3.6)				(-4.0 to 8.6)				(-4.2 to -1.8)*		
2	118	7.8	131	11.6	8	9.1	14	10.1	49	3.2	279	10.7
		(-6.0 to -1.6)*				(-9.0 to 7.0)				(-9.0 to -6.0)*		
3	99	5.8	73	5.2	3	2.6	5	3.1	61	3.5	180	6.0
		(-0.9 to 2.5)				(-5.0 to 4.0)				(-3.8 to -1.2)*		
4	52	3.5	48	3.1	3	3.0	5	4.4	35	2.2	112	3.9
		(-0.1 to 1.6)				(-6.4 to 3.6)				(-2.7 to -0.7)*		
5	38	2.6	40	2.7	2	1.8	2	1.6	26	1.6	103	3.7
		(1.2 to -1.2)				(-3.3 to 3.7)				(-3.0 to -1.2)*		
6	43	2.7	35	3.0	1	1.1	3	1.9	32	1.9	88	3.1
		(-1.9 to 0.7)				(-4.0 to 2.4)				(-2.1 to -0.3)*		
7	27	1.7	25	1.9	—		—		22	1.5	66	2.3
		(-1.2 to 0.8)								(-1.6 to 0.0)		
8	36	2.3	28	2.6	1	.6	—		26	1.7	66	2.2
		(-1.6 to 0.8)								(-1.4 to 0.4)		
9	18	1.4	24	2.1	5	5.1	—		10	.8	66	2.4
		(-1.6 to 0.4)								(-2.3 to -0.9)*		
10–15	70	4.6	76	5.7	1	8.2	2	1.3	17	4.5	217	7.2
		(-2.7 to 0.7)				(0.7 to 1.3)*				(-4.1 to -1.3)*		
> 15	50	3.0	58	4.5	8	2.5	—		123	5.0	183	6.3
		(-2.7 to 0.1)								(-2.7 to 0.1)		
Total	1460[b]	100	1248	100	84	100	137	100	1489	100	2764	100

[a] 95% CI for the difference in weighted percentages between the 1995 and 2001 NHS samples are presented in brackets. Positive values indicate a higher percentage in the 1995 NHS sample of women.
[b] one missing value.
*$p<0.05$

consuming more than that recommended in Guideline 11 (that is, greater than seven standard drinks per week) (National Health and Medical Research Council 2001). Furthermore they are consuming much more than that recommended by other leading national and international authorities who advise complete abstinence at this time (Health Canada 1996; Ministry of Health 2006; US Department of Health and Human Services and US Department of Agriculture 2005).

Breastfeeding women in this analysis were exceeding national and international guidelines for alcohol intake during lactation (Health Council of the Netherlands 2005; Ministry of Health 2006; National Health and Medical Research Council 2001; US Department of Health and Human Services 2000). There were also significantly more lactating mothers consuming alcohol in the 2001 NHS than the 1995 NHS. An appendix to Guideline 11 from the NHMRC guidelines gives some 'prudent' advice for lactating women 'not to exceed the levels of drinking recommended during pregnancy, and to consider not drinking at all' (National Health and Medical Research Council 2001, p16). Some lactating mothers (13% from the 1995 NHS and 16.8% from the 2001 NHS) were consuming more than seven standard drinks of alcohol in the reference week, thus exceeding this recommendation.

As under-reporting of alcohol consumption is common, both in terms of persons identifying as having drank alcohol in the reference week, and in the quantities reported (Australian Bureau of Statistics

Table 4: Total days of alcohol consumption in the 1995 and 2001 NHS

Number of days	1995 Lactating mothers (95% CI)[a]		2001 Lactating mothers (95% CI)		1995 Pregnant women (95% CI)		2001 Pregnant women (95% CI)		1995 Non-mothers (95% CI)		2001 Non-mothers (95% CI)	
	n	%	n	%	n	%	n	%	n	%	n	%
n/a	818	57.5	638	52.2	46	**59.7**	98	73.4	1052	71.2	1254	46.3
		(1.0 to 8.4)*				(-26.5 to -0.9)*				(21.8 to 28.0)*		
1	309	21.4	328	25.8	20	24.1	26	17.4	166	11.1	702	25.6
		(-7.3 to -0.9)*				(-4.4 to 78.0)				(-16.8 to -12.2)*		
2	160	9.6	105	8.1	5	5.3	10	7.4	117	7.5	285	10.1
		(-0.3 to 3.9)				(-8.6 to 4.4)				(-4.3 to -0.9)*		
3	72	4.8	81	6.6	7	6.9	3	1.8	79	5.4	223	7.7
		(-3.3 to 0.1)				(-0.8 to 11.0)				(-3.85 to –0.8)*		
4	23	1.3	32	2.3	2	.4			26	1.7	89	3.3
		(-2.0 to 0.0)								(-2.5 to -0.7)*		
5	19	1.2	14	1.0	1	1.1			9	.4	42	1.3
		(-0.6 to 1.0)								(-1.4 to -0.4)*		
6	14	1.0	9	.6	2	1.4			8	.5	20	.7
		(-0.3 to 0.9)								(-0.6 to 0.2)		
7	46	3.3	41	3.4	1	1.1			32	2.3	149	5.1
		(-1.7 to 1.1)								(-3.9 to –1.7)*		
Total	1461	100	1248	100	84	100	137	100	1489	100	2764	100

[a] 95% CI for the difference in weighted percentages between the 1995 and 2001 NHS samples are presented in brackets. Positive values indicate a higher percentage in the 1995 NHS sample of women.
*$p<0.05$

Table 5: Main drink type consumed for the 1995 and 2001 NHS

Drink type	1995 Lactating mothers		1995 Pregnant women		1995 Non-mothers		2001 Lactating mothers		2001 Pregnant women		2001 Non-mothers	
	n	%	n	%	n	%	n	%	n	%	n	%
Not applicable[a]							638	52.2	98	73.4	1254	46.3
Low strength beer	21	1.3	2	2.2	9	0.6	15	1.4	1	0.4	41	1.7
Mid strength beer	44	3.1	3	3.8	28	1.8	13	1.0	1	0.1	32	1.1
Full strength beer	116	7.7	9	10.7	118	8.1	64	4.9	2	1.6	137	4.6
Wine	383	24.2	25	24.5	273	17.8	**306**	24.9	22	17.3	794	28.2
Spirits	194	13.1	10	11.4	161	11.0	188	14.0	11	6.3	445	16.2
Fortified wine	19	1.0	2	2.5	14	0.8	9	0.7	1	0.7	23	0.8
Other	38	2.5	—	—	44	2.2	15	1.1	1	0.3	38	1.2
Total[b]	815	52.9	51	55.1	647	42.3	1248	100.0	137	100.0	2764	100.0

[a] Only relevant to 2001 NHS sample.
[b] Multiple response question in the 1995 NHS only.

2001; Carruthers & Binns 1992; Chikritzhs et al 2003; Kaskutas & Graves 2001), these volumes may potentially be greater. Thus true risk levels of alcohol consumption may be higher than presented here.

Drinking alcohol while pregnant increases the risk of fetal problems developing. Fetal Alcohol Syndrome Disorder (FASD) describes the range of effects that can occur in an individual whose mother drank alcohol during pregnancy. These effects may include physical, mental, behavioral, and/or learning disabilities with possible lifelong implications. FASD refers to conditions such as fetal alcohol syndrome (FAS), fetal alcohol effects (FAE), alcohol-related neurodevelopmental disorder (ARND), and alcohol-related birth defects (ARBD) (US Department of Health and Human Services 2006).

Existing evidence currently fails to determine any adverse effect on pregnancy outcome with low to moderate levels of prenatal alcohol consumption. However it is not necessarily safe for women to drink at these levels during pregnancy (Henderson, Gray & Brocklehurst 2007). Given that over 40% of pregnant women in the 1995 NHS and over a quarter of pregnant women in the 2001 NHS were consuming alcohol at any level during the reference week, there remains the potential for considerable public health risk of FASD in the Australian community.

Alcohol consumption at a level of two standard drinks per day during lactation can result in a deficit in an infant's motor development (Little et al 1989). Consuming this amount of alcohol shortly before the beginning of a breastfeed may also inhibit lactation and negatively disrupt an infant's sleep-wake behavioural patterns (Mennella & Garcia-Gomez 2001; Mennella, Pepino & Teff 2005). In addition, women who consume alcohol during lactation have been shown to have a shorter duration of breastfeeding (Little, Lambert & Worthington-Roberts 1990).

Lactating women from both surveys in this analysis are therefore at risk of contributing to developmental, growth and behavioural problems in their infants. They are also at risk of the early cessation of breastfeeding which in itself is associated with its own negative health implications.

Although non-mothers were the group most often to report nil alcohol intake during the reference week of the 1995 NHS, their most common alcohol intake was greater than 15 standard drinks. This finding is in contrast to the non-mothers in the 2001 NHS who were the least likely to abstain from alcohol in the reference week but were most likely to drink two standard drinks if they did consume alcohol that week. It is likely that public education programs regarding safe drinking levels were responsible for the reduction in risk levels seen in the 2001 survey (National Health and Medical Research Council 2001).

The most favoured drink types of all women were wine followed by spirits for both surveys. Most often all women from both surveys drank alcohol on only one day during the reference week.

There has previously been criticism that a seven-day retrospective diary was not used to collect alcohol intake in the 1995 NHS and that the three-day method used is less accurate (Clemens, Donath & Stockwell 2006; Donath 1999). Despite this concern, the three-day method was again used in the 2001 NHS and the Australian Bureau of Statistics considers that the results for the two surveys are directly comparable (Australian Bureau of Statistics 2006).

CONCLUSION

The current Australian Alcohol Guidelines state that if pregnant or lactating women choose to drink that they should have less than seven standard drinks over a week, and no more than two standard drinks on any one day (spread over at least two hours). Data from this analysis of the 1995 and 2001 NHS indicate that the majority of mothers and pregnant women were low risk consumers of alcohol; however there was a small proportion of pregnant women and lactating mothers who were drinking above this national guideline (National Health and Medical Research Council 2001). Since the 1995 NHS there has been a slight but significant increase in the proportion of lactating women consuming alcohol.

From this analysis, it appears that pregnant women have become more aware of the dangers associated with alcohol intake at this vulnerable time and have reduced their alcohol intake since the 1995 NHS. It is most likely that health promotion campaigns highlighting the dangers of antenatal drinking have prompted this timely decline in alcohol consumption. Despite the negative health effects of drinking during breastfeeding a similar decline in drinking alcohol over this period has not occurred and the reverse appears to have taken place.

The information in this paper prompts health professionals working in maternal and child health to consider engaging in client discussions regarding alcohol intake and providing education on low risk alcohol intakes at this time. Currently, the Australian Alcohol Guidelines are under revision; however, as illustrated in this paper, there is a strong need for the pregnancy, and including lactation, guideline to be more directive and provide concise information on a minimum safe level during these critical stages of life.

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References

Australian Bureau of Statistics 1995, *National Health Survey, Australia 1995, Basic Confidentialised Unit Record File*, ABS, Canberra.

Australian Bureau of Statistics 2001, *National Health Survey: Users' Guide*, 2001 Cat No 4363.0.55.001. ABS, Canberra.

Australian Bureau of Statistics 2003, *National Health Survey, Australia (2001), Basic Confidentialised Unit Record File* Cat No 4324.0.30.001. ABS, Canberra.

Australian Bureau of Statistics 2004, *2004 Year Book Australia* Cat No 1301.0. ABS, Canberra.

Australian Bureau of Statistics 2006, *Review of Strategic Statistical Issues for Future National Health Surveys*. Final Report. ABS, Canberra.

Australian Institute of Health and Welfare 2003, *Statistics on Drug Use in Australia 2002* Cat No PHE 43. AIHW, Canberra.

Australian Institute of Health and Welfare 2005, *Statistics on Drug Use in Australia 2004* Cat No PHE 62. AIHW, Canberra.

Avlik A, Haldorsen T, Lindemann R 2006, Alcohol consumption, smoking and breastfeeding in the first six months after delivery. *Acta Paediatr* 95: 686–693.

Best Start Resource Centre 2005, *Drinking Alcohol While Breastfeeding*. Best Start & Motherisk URL: http://www.beststart.org/resources/alc_reduction/pdf/brstfd_alc deskref_eng.pdf Accessed 25/09/2006.

Binns CW, Davidson GP 2003, Infant feeding guidelines for health workers. In National Health & Medical Research Council (ed) *Food for Health: Dietary Guidelines for Children and Adolescents in Australia*. NHMRC, Canberra.

Carruthers SJ, Binns CW 1992, The standard drink and alcohol consumption. *Drug Alcohol Rev* 11: 363–370.

Chikritzhs T, Catalano P, Stockwell T, Donath S, Ngo H, Young, D, Matthews S 2003, *Australian Alcohol Indicators, 1990–*

2001. Curtin University of Technology URL: http://www.ndri.curtin.edu.au/pdfs/naip/naipaaifullreport.pdf Accessed 25/09/2006.

Clemens S, Donath S, Stockwell T 2006, *Alcohol Consumption in Australia; National Surveys from 1989 to 2001*, Curtin University of Technology.

Department of Health 2006, *The Pregnancy Book: 2006 Edition*, Department of Health URL: http://www.dh.gov.uk/PublicationsAndStatistics/Publications/PublicationsPolicyAndGuidance/PublicationsPolicyAndGuidanceArticle/fs/en?CONTENT_ID=4136417&chk=saaOhH Accessed 04/10/2006.

Dobson B, Murtaugh M 2001, Position of the American Dietetic Association: breaking the barriers to breastfeeding. *J Am Diet Assoc* 101: 1213–1220.

Donath S 1999, Estimated alcohol consumption in the 1995 National Health Survey: some methodological issues. *Aust N Z J Public Health* 23(2): 131–134.

Health Canada 1996, *Prevention of Fetal Alcohol Syndrome and Fetal Alcohol Effects in Canada*. Health Canada, Ottawa.

Health Council of the Netherlands 2005, *Risks of Alcohol Consumption Related to Conception*, Pregnancy and Breastfeeding. Health Council of the Netherlands, The Hague.

Henderson J, Gray R, Brocklehurst P 2007, Systematic review of effects of low-moderate prenatal alcohol exposure on pregnancy outcome. *BJOG* 114: 243–252.

Kaskutas LA, Graves K 2001, Pre-pregnancy drinking: how drink size affects risk assessment. *Addiction* 96: 1199–1209.

Kesaniemi YA 1974, Ethanol and acetaldehyde in the milk and peripheral blood of lactating women after ethanol administration. *J Obstet Gynaecol Br Commonw* 81: 84–86.

Labbok M, Krasovec K 1990, Toward consistency in breastfeeding definitions. *Stud Fam Plan* 21: 226–230.

Lawton M 1985, Alcohol in breast milk. *Aust N Z J Obstet Gynaecol* 25: 71–73.

Leon-Cava N 2002, *Quantifying the Benefits of Breastfeeding*: A Summary of the Evidence. Pan American Health Organization, Washington.

Little R, Anderson K, Ervin C, Worthington-Roberts B, Clarren S 1989, Maternal alcohol use during breast-feeding and infant mental and motor development at one year. *N Engl J Med* 321: 425–430.

Little R, Lambert M, Worthington-Roberts B 1990, Drinking and smoking at 3 months postpartum by lactation history. *Paediatr Perinat Epidemiol* 4: 290–302.

Martorell R, Stein A, Schroeder D 2001, Early nutrition and later adiposity. *J Nutr* 131: 874S–880S.

Mennella J 2001, Alcohol's effect on lactation. *Alcohol Res Health* 25: 230–234.

Mennella J, Beauchamp G 1993, Beer, breast feeding and folklore. *Dev Psychobiol* 26: 459–466.

Mennella J, Garcia-Gomez P 2001, Sleep disturbances after acute exposure to alcohol in mother's milk. *Alcohol* 25: 153–158.

Mennella J, Pepino M, Teff K 2005, Acute alcohol consumption disrupts the hormonal milieu of lactating women. *J Clin Endocrinol Metab* 90: 1979–1985.

Ministry of Health 2006, *Food and Nutrition Guidelines for Healthy Pregnant and Breastfeeding Women: A Background Paper*. Ministry of Health, Wellington.

National Health and Medical Research Council 2001, *Australian Alcohol Guidelines: Health Risks and Benefits*. NHMRC, Canberra.

Scott JA, Binns CW, Oddy WH, Graham KI 2006, Predictors of breastfeeding duration: evidence from a cohort study. *Pediatrics* 117: e646-e655.

US Department of Health and Human Services 2000, *HHS Blueprint for Action on Breastfeeding*, US Department of Health and Human Services, Washington.

US Department of Health and Human Services and US Department of Agriculture 2005, *Dietary Guidelines for Americans, 2005*. 6th edn. US Government Printing Office, Washington.

US Department of Health and Human Services 2006, SAMHSA *Fetal Alcohol Spectrum Disorders Centre for Excellence*. US Department of Health and Human Services URL:http://www.fascenter.samhsa.gov/documents/WYNKFASDCenter3newad1.pdf Accessed 10/03/2006.

World Health Organization 2001, *The Optimal Duration of Exclusive Breastfeeding*. WHO, Geneva.

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Professor Colin Binns is an internationally recognised expert in breastfeeding epidemiology and has worked to promote breastfeeding in Australia through continued research, advocacy and authorship. Most recently, he has contributed to the Dietary Guidelines for Children and Adolescents and the companion Infant Feeding Guidelines for Health Workers.

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The effect of alcohol intake on breastfeeding duration in Australian women

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REGULAR ARTICLE

The effect of alcohol intake on breastfeeding duration in Australian women

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Abstract

Aim: This study investigated the relationships between alcohol consumption and breastfeeding initiation and duration.

Methods: *Design and Setting:* A 12-month longitudinal study was conducted in two public hospitals in Perth, Australia between September 2002 and July 2003.

Intervention: Participating mothers completed a self-administered baseline questionnaire. Follow-up telephone interviews were conducted at 4, 10, 16, 22, 32, 40 and 52 weeks.

Main outcome measures: Association of the relationships between alcohol consumption and breastfeeding initiation and duration.

Results: After 6 months of follow-up, women who consumed alcohol at levels of more than two standard drinks per day were almost twice as likely to discontinue breastfeeding than women who drank below these levels (HR 1.9, 95% CI 1.1, 3.0).

Conclusion: Consuming alcohol in excess of two standard drinks per day during lactation was found to be independently associated with shorter breastfeeding duration, even after consideration of previously identified predictors of breastfeeding duration. Guidelines that provide direction on safe alcohol consumption for lactating mothers may help support extended breastfeeding duration.

INTRODUCTION

Breastfeeding initiation and duration are influenced by a myriad of factors, both modifiable and non-modifiable. Maternal age, ethnicity, social class, marital status, educational attainment and parity are all non-modifiable factors shown to influence breastfeeding initiation and duration (1). Deciding to breastfeed prior to pregnancy, family and partner support for breastfeeding, early return to work and smoking are modifiable factors shown to be associated with breastfeeding initiation and duration (2–4).

In Australia, alcohol is an accepted part of the culture and is widely consumed. Australian females commonly consume alcohol, with approximately 6% on a daily basis and 35%, at least weekly (5). Many of these women are of childbearing age. Drinking alcohol during pregnancy is clearly implicated in the development of Foetal Alcohol Syndrome (FAS) and adverse pregnancy outcomes (6). A review of the literature found that alcohol in the breastmilk can result in a deficit in motor development, reduced lactational performance and disrupted sleep-wake behavioural patterning of the infant (7). However, research on the relationship between alcohol consumption and breastfeeding initiation and duration is limited.

METHODS

Sample

The second Perth Infant Feeding Study (PIFSII) was conducted between mid September 2002 and mid July 2003. The study was conducted in the same hospitals using the same methodology as the first PIF Study (PIFSI) (4,8–10). There were no differences between the two hospitals with regard to antenatal education and breastfeeding policies.

Mothers were contacted within the first three days following the birth of their infant. Those women agreeing to participate in the study completed the self-administered baseline questionnaire while in hospital or shortly after discharge. Women declining to participate were asked to provide some basic socio-demographic data in order to determine the representativeness of the sample.

In the baseline questionnaire, women were asked if they consumed alcohol before and during pregnancy. If they responded in the affirmative they were asked how often (days/week) they usually drank alcohol and how many standard drinks they usually consumed at each drinking occasion. Participants were asked the type of alcohol they consumed most frequently and were provided with a list of standard drink sizes.

All women regardless of their chosen infant feeding method were followed up by trained telephone interviewer at 4, 10, 16, 22, 32, 40 and 52 weeks postpartum. At each postpartum follow up interview participants were asked if they were drinking alcohol at present, how often they had consumed alcohol in the previous 2 weeks and how many standard drinks and the type of alcoholic beverage they had on these drinking occasions. Participants were prompted with standard drink serve sizes (volumes and measures) by the interviewer for different alcoholic beverages. Unusual responses (e.g. very high alcohol intake) were noted and followed up at a subsequent interview.

One Australian standard drink is equivalent to 10 g (12.5 mL) alcohol (11). Questions relating to alcohol intake were modelled on the 1989/1990 National Health Survey (NHS) (12).

Statistical analysis

Data were entered and analysed using the Statistical Package for Social Sciences, Version 14.0 (SPSS for Windows, SPSS Inc., Chicago, IL, USA). Estimation of odds ratios was performed by univariate analysis to examine the crude association between sociodemographic, biomedical and psychosocial characteristics of the mother and drinking alcohol at 4, 16, 22 and 40 weeks postpartum.

The relationship between drinking alcohol before and during pregnancy with breastfeeding initiation was initially investigated using univariate analysis. Variables previously identified by the research team as being associated with breastfeeding initiation for this sample population were included in the development of the multivariate statistical models (10). These included; mother's education level, when the feeding method was decided, maternal Iowa Infant Feeding Attitude Scale (IIFAS) score, parity and father's feeding method preference. These factors were controlled for in the multivariate logistic regression models developed to evaluate the relationship between alcohol intake before, and during pregnancy with breastfeeding initiation.

Alcohol intake in the postpartum period was defined using the NHMRC guidelines for risk of harm in the long term for the general population. For this categorisation it was assumed that 'per occasion' consumption of alcohol corresponded to 'per day' consumption of alcohol. A number of drinks were categorised as 'low risk' (up to two standard drinks per day); 'risky' (three to four standard drinks per day) and 'high risk' (five or more standard drinks per day). The categories of risky and high-risk consumption were combined for ease of comparison with Guideline 11, which is recommended for 'women who are pregnant or might soon become pregnant' as well as breastfeeding women (11) (see Box 1) (It should be noted that at the present time there are new NHMRC guidelines for alcohol consumption in draft, however, these have not yet been endorsed and are therefore not considered in this article). Missing values were not recoded as zero as this would falsely elevate the number of women who reported not drinking.

Analysis of the relationship between breastfeeding duration and the level of postpartum alcohol intake, using follow-up data to 6 months, was investigated in a regression analysis using a Cox Hazards model with repeated measures for alcohol consumption. In order to allow that participants may change their alcohol consumption over time, this variable was introduced in the model as a time-dependent variable in the analysis. Additional variables included in the final model were level of alcohol intake, breastfeeding problems at or before 4 weeks, age of the infant at which a pacifier was introduced, smoking during pregnancy and maternal IIFAS score. These have previously been found to be significant by the research team (4) when investigating fully breastfeeding to 6 months and 'any breastfeeding' to 12 months. Intended duration was not in the multivariate model as it has been argued that intended duration of breastfeeding lies directly on the causal decision-making pathway and should not be included in any multivariate model investigating the duration of breastfeeding (1).

The 6-month time period was chosen for analysis in an effort to capture the majority of breastfeeding women as previous research and national monitoring has shown that the majority of women will have ceased breastfeeding by this time (4,13). The IIFAS is a 17-item scale, which measures attitudes towards both breast and formula feeding with regards to the health and nutritional benefits, and the cost and convenience of each method. It has been shown previously to be a valid and reliable measure of infant feeding attitudes among women in the USA (14) and Scotland (15). Each item is measured on a 5-point scale and total scores could range from 17 (reflecting positive formula feeding attitudes) to a high of 85 (indicating attitudes that favour breastfeeding).

Only women reporting 'any breastfeeding' were included in the univariate and multivariate analysis. 'Any breastfeeding' included those infants who received both breastmilk and other milk feeds or solid foods (16). This level of breastfeeding was chosen in order to capture the majority of breastfeeding women throughout the study period.

Box 1 | Guideline 11; Australian Alcohol Guidelines

Guideline 11 Women who are pregnant or might soon become pregnant

11.1 may consider not drinking at all;
11.2 most importantly, should never become intoxicated;
11.3 if they choose to drink, over a week, should have less than seven standard drinks, and, on any one day, no more than two standard drinks (spread over at least 2 hours);
11.4 should note that the risk is highest in the early stages of pregnancy, including the time from conception to the first missed period.

Women who are breastfeeding are advised not to exceed the levels of drinking recommended.

Ethical considerations

The PIFSII was approved by the Human Ethics Committee of Curtin University and the Research Ethics Committees of the two participating hospitals. Signed informed consent was obtained from participants.

RESULTS

Overall, of the 1068 women eligible to participate 870 were contacted and 587 completed baseline questionnaires and were followed up, representing 68% of women contacted. No significant differences were found in the age or level of education of participants compared with non-participants.

Table 1 Percentage and univariate odds ratios (95% confidence intervals) for drinking at 4 and 16 weeks postpartum among breastfeeding women

	Week 4				Week 16			
		Drinking				Drinking		
	n	Yes	No	OR	n	Yes	No	OR
Maternal age (year)								
< 25	**104**	**27.5**	**29.2**	**1**	**69**	**21.3**	**24.4**	**1**
> 25	289	72.5	70.8	1.4 (0.9–2.3)	216	78.7	75.6	1.3 (0.8–2.3)
Maternal education level								
Did not complete high school	120	30.6	30.5	1	85	30.9	29.1	1
Completed high school or trade	216	56.3	54.1	1.0 (0.7–1.6)	150	50.7	54.7	0.9 (0.5–1.5)
Bachelor degree or higher	57	13.1	15.5	0.8 (0.4–1.6)	49	18.4	16.2	1.1 (0.5–2.2)
Family income level (AUD)								
<$15000	82	13.9	26.1	1	50	11.2	24.0	1
$15000–$ 25 000	116	25.9	32.6	1.5 (0.8–2.8)	87	28.4	35.6	1.8 (0.9–3.8)
$ 25 000–$ 40000	74	18.4	19.6	1.8 (0.9–3.5)	56	20.1	19.9	2.2 (1.0–4.8)
>$ 40 000	116	41.8	21.7	3.6 (2.0–6.6)	87	40.3	22.6	3.8 (1.8–8.0)
Mother's occupation								
Admin/manager/professional/ paraprofess	84	25	18.9	1	70	26.5	25.0	1
Clerical/sales/personal services	230	59.4	57.9	0.8 (0.5–1.3)	146	57.4	45.9	1.1 (0.6–1.9)
Trades/labourer/plant operator	43	9.4	12.0	0.6 (0.3–1.3)	37	9.6	16.2	0.5 (0.2–1.2)
Other[a]	36	6.3	11.2	0.4 (0.2–1.0)	31	6.6	14.9	0.4 (0.2–1.0)
Marital status								
Single/divorced/separated/widow	23	3.1	7.7	1	12	4.4	6.8	1
Married/defacto	370	96.9	92.3	2.6 (0.9–7.1)	268	95.6	93.2	1.6 (0.6–4.4)
Mother's country of birth								
Australia /New Zealand	276	73.8	69.0	1	205	77.9	67.4	1
UK/Ireland	36	12.5	7.0	1.7 (0.8–3.4)	24	9.6	7.6	1.1 (0.5–2.5)
Asia	45	3.1	17.5	0.2 (0.06–0.4)	28	2.9	16.7	0.2 (0.05–0.5)
Other[b]	32	10.6	6.6	1.5 (0.7–3.2)	25	9.6	8.3	1.0 (0.4–2.3)
Maternal alcohol intake during pregnancy								
Non-drinker	237	17.2	82.8	1	158	79.1	34.1	1
Drinker	160	72.5	27.5	12.7 (7.8–20.7)	126	20.9	65.9	8.7 (5.1–15.0)
Attend antenatal classes for this or a previous pregnancy								
No, never	115	21.4	34.9	1	80	21.6	34.5	1
Yes	276	78.6	65.1	2.0 (1.2–3.1)	202	78.4	65.5	1.9 (1.1–3.2)

[1]Significant at $p \leq 0.05$. Significant figures in bold.
[a]Includes self-employed, disabled/invalid pension, student, home duties, unemployed, other pensions.
[b]Includes women from Europe, Africa, South America, North America and small island nations.

A total of 551 women reported 'any breastfeeding' at discharge. This represents 94% of the 587 women who participated in the PIFSII. Throughout the study period the number of women reporting 'any breastfeeding' decreased as did the number of women reporting alcohol intake. Approximately 94% (95% CI, 91.9–95.7) of women reported 'any breastfeeding' at discharge from hospital, however, numbers had declined to 78.2% (95% CI, 74.8–81.6) at 4 weeks, 58.9% (95% CI, 54.8–63.0) at 16 weeks, 51.5% (95% CI, 47.3–51.9) at 22 weeks and 33% (95% CI, 30.0–37.0) at 40 weeks postpartum.

The association between drinking alcohol before and during pregnancy, and initiating breastfeeding was explored using multivariate logistic analysis. Drinking during pregnancy was significantly associated with initiating breastfeeding, however this was no longer significant after adjusting for potential confounding covariates (crude OR 3.6, 95% CI 1.4, 9.5, adjusted OR 2.3, 95% CI 0.8, 6.4).

Weeks 4, 16, 22 and 40 were chosen arbitrarily to outline the characteristics of the women who drank alcohol and reported 'any breastfeeding'. These results are presented in Tables 1 and S1. Women who consumed alcohol during pregnancy were significantly more likely to consume alcohol during lactation. A greater proportion of women who drank alcohol and breastfed were from a higher income family. Alcohol consumption was also associated with attendance at antenatal classes. Women least likely to consume alcohol in the postpartum period were of Asian origin, and more

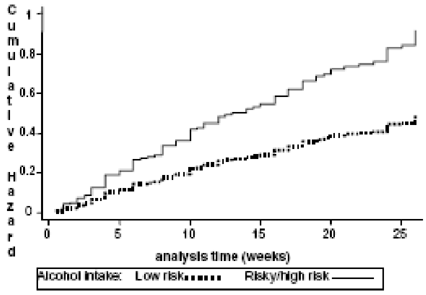

Figure 1 Adjusted incidence of stopping breastfeeding by alcohol risk.

likely to be self-employed, unemployed, receiving a pension, studying or carrying out home duties.

Table S2 shows the regression analysis of breastfeeding duration as a continuous variable in the Cox Hazards model. Women who consumed alcohol at risky to high-risk levels were almost twice as likely to discontinue breastfeeding (HR 1.9, 95% CI 1.1, 3.0) than women who drink at low-risk levels, even after adjustment for potential confounders (Fig. 1). Cross-tabulation show that a greater proportion of mothers who drank at low-risk levels intended to breastfeed for more than 6 months (59.7%), compared to mothers who drank at risky (38.5%) and high-risk levels (37.5%) ($\chi^2 = 6.64$, $df = 2$, $p = 0.034$).

DISCUSSION

This study shows that alcohol intake above levels recommended by the NHMRC during lactation is associated with a shorter duration of breastfeeding in accordance with previous research (17,18).

The shortened duration of breastfeeding with intakes above two standard drinks per day may potentially be explained by a number of factors. Firstly, exposure to small amounts of alcohol in the mother's milk has been shown to disrupt infant sleeping patterns (19). This in turn may prompt the mother to commence formula feeding and discontinue breastfeeding at this critical time in an effort to placate the infant. Secondly, alcohol is known to decrease the milk ejection reflex through the inhibition of oxytocin. This results in a diminished milk yield in lactating mothers and a decrease in the volume of milk received by the infant, which may further exacerbate their unsettled behaviour (20,21). Thirdly, mothers may be wary of the health risks associated with drinking alcohol and breastfeeding. In an effort to reduce these risks and continue to consume alcohol, they may voluntarily stop breastfeeding.

Finally is the possibility that mothers who drink at high levels are generally more likely to make poorer health and lifestyle choices. A mother's intention to breastfeed has previously been shown to predict breastfeeding initiation and duration (22,23). Therefore mother's intention to breastfeed may be considered as an indicator of her own health enhancing behaviours, and a mother who is concerned with her own health is more likely to be concerned with the health of her infant (24), and intend to breastfeed for an extended duration and adhere to recommended or safer alcohol drinking practices. This final theory was tested using a simple cross-tab analysis in which mothers' level of drinking at 4 weeks postpartum was correlated with mothers' intention to breastfeed (baseline questionnaire). A greater proportion of mothers who intended to breastfeed for more than 6 months drank at low-risk levels compared to mothers who drank at risky and high-risk levels.

The literature is limited with regard to the characteristics of women consuming alcohol during lactation. However, evidence from previous studies on alcohol intake during pregnancy and lactation support our finding that alcohol intake was more common in women from higher income and employment levels (25,26). There was also a predominance of drinkers who had attended antenatal classes. Together, the characteristics of these women do not fit the stereotype of women at risk of high alcohol intake and consequently providing information on alcohol intake and optimum breastfeeding outcomes during antenatal classes would be an excellent opportunity for educating women on alcohol intake during lactation.

This study is the first Australian study to assess the relationship between drinking alcohol before, during and after pregnancy and the associated effect on breastfeeding initiation and duration. However, it needs to be replicated to verify our results, as several limitations of this study exist.

A limitation of this study, as in any study investigating drinking habits, is the method used to collect data on alcohol intake during pregnancy and lactation. Collection of alcohol intake data is problematical and there is no 'gold standard' with limitations associated with all of the main methodologies commonly employed. All alcohol intake data were self-reported during a telephone interview and drinking alcohol may have been underreported particularly during the antenatal period when there is an increased stigma associated with drinking. In addition, research shows reported alcohol intake declines with increasing recall period (27). As women in this study were asked about antenatal alcohol intake following the birth of their infant it is likely that alcohol intake in this study is under-reported and a limitation of this study.

Furthermore, alcohol volume may be underestimated and true risk levels of alcohol consumption may be higher than presented here as under-reporting of alcohol consumption is common, both in terms of persons identifying as having drank alcohol in the defined time period, and in the quantities reported (28). Future prospective studies should include more detailed and descriptive questions to ascertain more comprehensive data on alcohol intake at this time, particularly time of alcohol intake in relation to time of breastfeeding.

Although we have statistically adjusted for known confounders, as with all observational studies, the possibility of residual confounding cannot be completely excluded. Future research should examine additional potential factors that may help further explain the relationship between alcohol consumption during lactation and breastfeeding duration. Nevertheless, despite this limitation the results reported are consistent with the limited data previously reported (17,18), which suggests that alcohol consumption at risky levels is negatively associated with breastfeeding duration. This finding is supported also by a number of biologically plausible arguments.

The small number of women reporting 'any breastfeeding' towards the end of the 12 month follow-up period made it difficult to compare the characteristics of drinking and non-drinking women during week 40. 'Exclusive breastfeeding' rates of 80% at 6 months of age has been set as an objective for Australia and would help foster future research in this area (29).

Overall, alcohol intake in the postnatal period of more than two standard drinks per day was significantly associated with shorter breastfeeding duration. Many Australian women are unaware of the appendage to the NHMRC's Guideline 11 (see Box 1), which urges lactating women to drink at the same levels of pregnant women (up to 2 standard drinks/day) or to consider not drinking at all (30). Furthermore, they may not be aware of the health risks to their infant or the long-term consequence of shortened breastfeeding duration associated with drinking above this level.

CONCLUSIONS

Breastfeeding women who continue to consume alcohol at levels above those recommended are potentially at risk of not meeting their optimal breastfeeding outcomes and of compromising their own health and the growth and development of their infant. Considerable public health gains can be achieved by developing alcohol intake guidelines specific to lactating women, which support safe alcohol intake that in turn promote extended breastfeeding. Providing information on lactation and alcohol intake as part of antenatal education programs will support women to make informed choices regarding alcohol intake while breastfeeding.

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COMPETING INTERESTS

The authors have no financial or other competing interests to disclose.

References

1. Peat J, Allen J, Nguyen N, Hayen A, Oddy W, Mihrshahi S. Motherhood meets epidemiology: measuring risk factors for breast-feeding cessation. *Public Health Nutr* 2004; 7: 1033–7.
2. Giglia R, Binns C, Alfonso H. Maternal cigarette smoking and breastfeeding duration. *Acta Paediatr* 2006; 95: 1370–4.
3. Scott JA, Landers MC, Hughes RM, Binns CW. Factors associated with breastfeeding at discharge and duration of breastfeeding. *J Paediatr Child Health* 2001; 37: 254–61.
4. Scott J, Binns C, Oddy W, Graham K. Predictors of breastfeeding duration: evidence from a cohort study. *Pedatrics* 2006; 117: e646–e55.
5. Australian Institute of Health and Welfare. 2004 *National drug strategy household survey: first results.* Catalogue no. PHE 57. Canberra: AIHW, 2005.
6. New South Wales Department of Health, editor. *Background papers to the National clinical guidelines for the management of drug use during pregnancy, birth and the early development years of the newborn.* Sydney: NSW Department of Health, 2006.
7. Giglia RC, Binns CW. Alcohol and lactation: a systematic review. *Nutr Dietet* 2006; 63: 103–16.
8. Scott JA, Aitkin I, Binns CW, Aroni RA. Factors associated with the duration of breastfeeding amongst women in Perth, Australia. *Acta Paediatr* 1999; 88: 416–21.
9. Graham KI, Scott JA, Binns CW, Oddy WH. National targets for breastfeeding at hospital discharge have been achieved in Perth. *Acta Paediatr* 2005; 94: 352–6.
10. Scott J, Binns C, Graham K, Oddy W. Temporal changes in the determinants of breastfeeding initiation. *Birth* 2006; 33: 37–45.
11. National Health and Medical Research Council. *Australian alcohol guidelines: Health risks and benefits.* Canberra: National Health and Medical Research Council, 2001.
12. Australian Bureau of Statistics. *National health survey questionnaire 1989–1990.* Canberra, 1991.
13. Donath S, Amir L. Breastfeeding and the introduction of solids in Australian infants: data from the 2001 National Health Survey. *Aust N Z J Public Health* 2005; 29: 171–5.
14. De la Mora A, Russell D, Dungy C, Losch M, Dusdieker L. The Iowa infant feeding attitude scale: analysis of reliability and validity. *J Appl Soc Psychol* 1999; 29: 2362–80.
15. Scott JA, Shaker I, Reid M. Parental attitudes toward breastfeeding: their association with feeding outcome at hospital discharge. *Birth* 2004; 31: 125–31.
16. World Health Organization. *Indicators for assessing breastfeeding practices.* Geneva: WHO, 1991.
17. Little R, Lambert M, Worthington-Roberts B. Drinking and smoking at 3 months postpartum by lactation history. *Paediatr Perinat Epidemiol* 1990; 4: 290–302.
18. Howard C, Lawrence R. Breast-feeding and drug exposure. *Obstet Gynecol Clin North Am* 1998; 25: 195–217.
19. Mennella J, Garcia-Gomez P. Sleep disturbances after acute exposure to alcohol in mother's milk. *Alcohol* 2001; 25: 153–8.
20. Mennella J, Pepino M, Teff K. Acute alcohol consumption disrupts the hormonal milieu of lactating women. *J Clin Endocrinol Metab* 2005; 90: 1979–85.
21. Mennella J. Regulation of milk intake after exposure to alcohol in mother's milk. *Alcohol Clin Exp Res* 2001; 25: 590–3.
22. Donath S, Amir L, The ALSPAC Study Team. Relationship between prenatal infant feeding intention and initiation and duration of breastfeeding: a cohort study. *Acta Paediatr* 2003; 92: 352–6.
23. Forster D, McLachlan H, Lumley J. Factors associated with breastfeeding at six months postpartum in a group of Australian women. *Int Breastfed J* 2006; 1.
24. Pesa J, Shelton M. Health-enhancing behaviours correlated with breastfeeding among a national sample of mothers. *Public Health Nurs* 1999; 16: 120–4.
25. McLeod D, Pullon S, Cookson T, Cornford E. Factors influencing alcohol consumption during pregnancy and after giving birth. *N Z Med J* 2002; 115: U29.

26. Parackal S, Ferguson E, Harraway J. Alcohol and tobacco consumption among 6–24-months post-partum New Zealand women. *Matern Child Nutr* 2007; 3: 40–51.
27. Ekholm O. Influence of the recall period on self-reported alcohol intake. *Eur J Clin Nutr* 2004; 58: 60–3.
28. Kaskutas LA, Graves K. Pre-pregnancy drinking: how drink size affects risk assessment. *Addiction* 2001; 96: 1199–209.
29. Binns CW, Davidson GP. Infant feeding guidelines for health workers. In: NHMRC, editor. *Food for health: Dietary guidelines for children and adolescents in Australia.* Canberra: NHMRC, 2003: 452.
30. Giglia RC, Binns CW. Alcohol and breastfeeding: what do Australian mothers know? *Asia Pac J Clin Nutr* 2007; 16: 473–7.

Supplementary material

The following supplementary material is available for this article:

Table S1 Percentage and univariate odds ratios (95% confidence intervals) for drinking at 22 and 40 weeks postpartum among breastfeeding women

Table S2 Breastfeeding duration of at least 6 months and drinking alcohol during lactation

This material is available as part of the online article from: http://www.blackwell-synergy.com/doi/abs/10.1111/j.1651-2227.2007.00760.x
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Patterns of alcohol intake of pregnant and lactating women in Perth, Australia

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Patterns of alcohol intake of pregnant and lactating women in Perth, Australia

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Abstract

Introduction and Aims. *Australian alcohol consumption data for women during the period of pregnancy and lactation is limited. The purpose of this paper is to provide current alcohol consumption data for pregnant and lactating women in Perth, Western Australia (WA). Data were collected from 587 women between mid-September 2002 and mid-July 2003.* ***Design and Methods.*** *Women from two public hospitals with maternity wards in the Perth metropolitan area completed a self-administered baseline questionnaire while in hospital or shortly after discharge. All women, regardless of their chosen infant feeding method, were followed-up by telephone interview at 4, 10, 16, 22, 32, 40 and 52 weeks postpartum. Data were analysed to determine alcohol use patterns of the women during the period of pregnancy and lactation and results were compared to national guidelines for alcohol consumption.* ***Results.*** *Approximately 32% of women stopped drinking alcohol during pregnancy. A remaining 35% of pregnant women consumed alcohol during pregnancy, with 82.2% of these women consuming up to two standard drinks per week. At 4, 6 and 12 months postpartum, 46.7%, 47.4% and 42.3% of breastfeeding women were consuming alcohol, respectively.* ***Discussion and Conclusions.*** *The majority of breastfeeding women consumed up to two standard drinks per week, which is within levels recommended by national authorities. There is, however, a small proportion of women consuming alcohol at levels above national recommendations for pregnancy and lactation. The development of 'safe' alcohol intake practices, within national recommendations, during the postnatal period would remove any potential health risks to the infant from alcohol exposure at this vulnerable growth stage.* [Giglia RC, Binns CW. Patterns of alcohol intake of pregnant and lactating women in Perth, Australia. *Drug Alcohol Rev* 2007;26:493–500]

Key words: alcohol, breastfeeding, lactation, pregnancy.

Introduction

Alcohol is a teratogen, which in pregnant women may affect the developing fetus. Alcohol passes through the placenta to the fetus and can reach concentrations as high as those in the mother. The ability of the fetus to metabolise alcohol is minimal. Alcohol and its metabolite, acetaldehyde, can damage developing fetal cells [1]. Fetal alcohol syndrome disorder (FASD) describes the range of effects that can occur in an individual whose mother drank alcohol during pregnancy. These effects may include physical, mental, behavioural and/or learning disabilities with possible lifelong implications. FASD refers to conditions such as fetal alcohol syndrome (FAS), fetal alcohol effects (FAE), alcohol-related neurodevelopmental disorder (ARND) and alcohol-related birth defects (ARBD) [2].

The adverse effects of alcohol consumption during pregnancy are well documented; however; there is limited information available on the postpartum effect of alcohol in the breastmilk on the developing human infant. In a review of the literature by Giglia & Binns [3], alcohol consumption at a level of two standard drinks per day during lactation resulted in a deficit in motor development [4]. However, results of this study failed to be replicated with a different but comparable population [5]. The review also concluded that consuming this amount of alcohol shortly before the beginning of a breastfeed can inhibit lactational performance and negatively disrupt an infant's sleep–wake behavioural patterns [6,7]. In addition, women who consume alcohol during lactation have been shown to have a shorter duration of breastfeeding [3,8]. One Australian standard drink is equivalent to 10 g (12.5 ml) alcohol [9].

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Because of the high level of public interest in FAS, alcohol intake during pregnancy is often recorded as part of the antenatal care, whereas intake in the postpartum period is not. Numerous international studies have documented alcohol consumption of pregnant women [10,11]. However, there is a paucity of information in the literature on alcohol consumption in women during lactation.

In Australia it is recommended for lactating women 'not to exceed the levels of drinking recommended during pregnancy, and to consider not drinking at all'. That is, 'if they choose to drink, over a week, should have less than 7 standard drinks (spread over at least two hours)' (Guideline 11, p. 16) [9].

Despite the existence of this guideline there are few or no detailed contemporary Australian data on alcohol use during pregnancy or lactation with which to evaluate the risk level of maternal alcohol consumption. The most recent studies of drinking patterns of Australian women in the pre- and postnatal period include:

(i) an investigation into the incidence of smoking and alcohol consumption during pregnancy in Tasmania [12];
(ii) the change in alcohol and nicotine usage during pregnancy in a 2-year longitudinal study of pregnant women in South Australia [13];
(iii) the use of the 1985 Victorian Perinatal Morbidity Statistics to document cigarette smoking and alcohol consumption during pregnancy [14]; and
(iv) the 'traditional' population-based Australian health surveys [15–19] which have been designed for men and women of all ages and are limited in scope with regard to the pre- or postnatal period.

This study documents the alcohol use patterns of women living in Perth, Australia during the period of pregnancy and lactation. In particular, the time of alcohol intake with regard to breastfeeding and number of drinks consumed on a typical drinking occasion is reported. Alcohol intake levels are compared with national guidelines for pregnant and lactating women.

Methods

Sample

The second Perth Infant Feeding Study (PIFSII) was conducted between September 2002 and July 2003. The study used the same methodology (and sites) as the first PIFS study, details of which can be found in Scott *et al.* [20]. Initial results from the PIFSII have been reported elsewhere [21–23].

Mothers were contacted within the first 3 days following the birth of their infant. Women were considered eligible for the study if they had delivered a live infant free of any serious health conditions requiring transfer to the neonatal intensive care unit at Perth's major maternity hospital.

Those women agreeing to participate in the study completed the self-administered baseline questionnaire while in hospital or shortly after discharge. Women declining to participate were asked to provide some basic socio-demographic data in order to determine the representativeness of the sample. All women, regardless of their chosen infant feeding method, were followed-up by telephone interview at 4, 10, 16, 22, 32, 40 and 52 weeks postpartum.

In the baseline questionnaire women were asked if they consumed alcohol before pregnancy. If they responded in the affirmative they were asked how often (days/week) they usually drank alcohol and how many standard drinks they usually consumed at each drinking occasion. Participants were asked the type of alcohol they consumed most frequently and were prompted with standard drink sizes. As part of the baseline questionnaire these same questions were asked for the period of their pregnancy.

At each postpartum follow-up telephone interview participants were asked if they were drinking alcohol at present, how many days they had consumed alcohol in the previous 2 weeks and how many standard drinks and the type of alcoholic beverage they had each time (drinking occasion). In addition respondents were asked at what time they consumed alcohol in relation to feeding the baby or time of day. Questions were modelled on the 1989 National Health Survey (NHS) [24].

One standard drink unit was defined as 10 g of alcohol, in accordance with the NHMRC Australian alcohol guidelines [9]. Two methods of categorising alcohol intake were used. First, standard drinks consumed per week were calculated by multiplying the usual frequency of consumption with the usual volume of alcohol consumed per occasion (each time). Results were then compared to Guideline 11 [9].

Secondly, the number of standard drinks per day consumed in the previous 2-week period were categorised into the NHMRC guidelines for risk of harm in the long term for the general population. For this categorisation it was assumed that 'per occasion' or 'each time' of alcohol consumption corresponded to 'per day' consumption of alcohol. The number of drinks were categorised for 'low risk' (up to two standard drinks per day); 'risky' (three to four standard drinks per day); and 'high risk' (five or more standard drinks per day). The NHMRC does not recommend these levels of consumption for pregnant women. Missing values were not recoded as zero, as this would elevate falsely the number of women who reported not drinking.

Only the alcohol data of women reporting 'any breastfeeding' were analysed. Any breastfeeding includes those infants who receive both breastmilk and other milk feeds or solid foods [25]. This level of breastfeeding was chosen in order to capture the majority of breastfeeding women throughout the study period.

Statistical analysis

Statistical analyses were performed using the Statistical Package for Social Sciences, version 11.0 (SPSS for Windows; SPSS Inc., Chicago, IL, USA). Data were analysed and described using frequency distributions, means and medians. Where confidence intervals are presented these have been calculated by estimating the difference between two proportions by assuming the samples are independent and have been taken from a binomial distribution (success and failure).

Ethical considerations

The PIFSII was approved by the Human Ethics Committee of Curtin University and the Research Ethics Committees of the two participating hospitals. Signed informed consent was obtained from participants.

Results

Overall, in the PIFSII 870 women of the 1068 contacted were eligible to participate and 587 completed baseline questionnaires, representing 68% of women contacted. No significant differences were found in the age or level of education of participants compared with non-participants.

Table 1 outlines the characteristics of the women who drank alcohol during pregnancy. Comparison with Western Australian (WA) perinatal demographic statistics [26] suggests that the PIFSII sample was representative of new mothers in WA, with the exception of those who smoke during pregnancy. In 2003 in WA the average age of mothers was 29.3 years compared to 28.4 years in this study. Thirty-seven per cent of mothers in the PIFSII study were primiparous, compared to 41% for the whole state. Caesarean section births were 30.9% for WA compared to 29.3% in this study.

Table 1 shows that women who consumed alcohol in pregnancy were more likely to be aged 30 years and over and from a higher-income family (54.3%, $p = 0.001$). A greater proportion of Caucasian women drank during pregnancy (92.3%, $p < 0.001$). Alcohol consumption was also associated with attendance at antenatal classes (72.9%, $p = 0.003$).

Table 2 presents the amount of alcohol consumed before pregnancy, during pregnancy and during the postpartum period. Three hundred and ninety-five women (67.3%) reported drinking alcohol before pregnancy. This decreased to 208 women (35.4%) during pregnancy, with almost a third of women (31.9%) discontinuing drinking at this time.

Before pregnancy median alcohol intake was two standard drinks on each occasion (mean = 2.9 standard drinks/occasion). After recognition of pregnancy the median alcohol intake was one standard drink per occasion (mean = 1.5 standard drinks/occasion). Alcohol intake before pregnancy ranged from half a standard drink to 19.5 standard drinks. This range decreased to half a standard drink to 9.5 standard drinks during pregnancy. The number of days that women consumed alcohol also decreased from a mean of 1.7 days per week before pregnancy (median = 1.0 day/week) to a mean of 1 day per week (median = 1.0 days/week) during pregnancy.

Prior to pregnancy 47.8% of women consumed less than two standard drinks per week; however, this increased to 82.2% during pregnancy. Prior to pregnancy approximately 25% of women were drinking above national recommendations for pregnancy; however, this decreased to approximately 4% during pregnancy. Less than 7% of pregnant women were drinking at levels considered 'risky' and/or 'high risk' for harm in the long term for the general population.

The majority of breastfeeding women who consumed alcohol at 4, 6 and 12 months postpartum reported consuming up to two standard drinks per week. At 4 and 6 months postpartum more than 10% of the sample of breastfeeding women were consuming more than the recommended seven standard drinks per week. At all postpartum time-points a greater proportion of non-breastfeeding women were consuming more than two standard drinks compared to women reporting any breastfeeding.

Using the NHMRC alcohol guidelines for risk in the long term, a small proportion of breastfeeding women were drinking at levels considered risky at 4 (17.9%), 6 (20.2%) and 12 (23.4%) months postpartum. Very few women were drinking at high-risk levels at 4 (4.5%), 6 (5.9%) and 12 (0%) months postpartum.

Of those women who consumed alcohol throughout the study most women reported drinking alcohol before or with the evening meal (46.2%). Two women (1.3%) ever reported drinking alcohol just before a breastfeed (see Table 3). Wine and champagne were the main alcohol types consumed by breastfeeding mothers followed by regular beer or cider (see Table 4).

Table 1. *Characteristics of drinking and non-drinking women during pregnancy (n = 587). Figures are percentages if not otherwise stated*

	n	Percentage drinking	Women who did not drink in pregnancy ($n = 377$)	Women who did drink during pregnancy ($n = 208$)	p^a
Maternal age (years)					
<20	32	15.6	7.2	2.4	0.001
20–24	122	24.6	24.4	14.4	
25–29	169	35.5	28.9	28.8	
30–35	177	44.1	26.3	37.5	
35+	85	41.2	13.3	16.8	
Family income level (AUD)					<0.001
<$15 000	133	19.5	29.0	12.8	
$15 000–25 000	181	30.4	34.1	27.1	
$25 000–40 000	102	44.1	15.4	22.2	
>$40000	156	49.4	21.4	37.9	
Marital status					0.045
Never married	39	20.5	8.2	3.8	
Married/*de facto*	538	37.0	89.8	95.7	
Divorced/separated/married	8	12.5	1.9	0.5	
Education level					0.760
Did not complete high school	210	34.3	36.6	34.6	
Completed high school or trade	306	36.9	51.2	54.3	
Bachelor degree or higher	69	33.3	12.2	11.1	
Mother's occupation					<0.001
Admin/mgr/professional/paraprofessional	113	44.2	16.7	24.0	
Clerical/sales/personal services	327	37.6	54.1	59.1	
Trades/labourer/plant operator	71	33.8	12.5	11.5	
Other[b]	74	14.9	16.7	5.3	
Parity					0.661
Primiparous	215	34.4	37.4	35.6	
Multiparous	370	36.2	62.6	64.4	
Country of birth					<0.001
Australia/New Zealand	427	38.2	71.2	78.4	
UK/Ireland	53	54.7	6.5	13.9	
Asia	59	11.9	14.0	3.4	
Other[c]	40	22.5	8.4	4.3	
Smoking in pregnancy					0.824
Non-smoker	427	35.6	73.9	26.1	
Smoker	153	36.6	73.1	26.9	
Timing of pregnancy					0.341
Planned	279	38.7	47.5	52.7	
Mistimed	181	32.0	34.2	28.3	
Unplanned	105	37.1	18.3	19.0	
Mother attend antenatal classes for this or previous pregnancy					0.003
No	203	27.5	39.1	27.1	
Yes	380	39.7	60.9	72.9	

[a]χ^2 test. [b]Includes self-employed, disabled/invalid pension, student, home duties, unemployed, other pensions. [c]Includes women from Europe, Africa, South America, North America and small island nations.

Discussion

This prospective study provides information about the alcohol consumption patterns of a cohort of women during pregnancy and after giving birth. A total of 35.4% of women reported drinking alcohol during pregnancy in this study, with 3.8% drinking above national recommendations for pregnancy [9]. The proportion of women consuming alcohol is lower than reported in earlier Australian research [12–14], and this decrease is due most probably to a greater public health awareness of consuming alcohol during pregnancy [27].

The National Drug Strategy Household Surveys (NDSHS) asks respondents about their alcohol

Table 2. *Alcohol use before and during pregnancy; and in lactating women reporting 'any breastfeeding' at 4, 6 and 12 months postpartum (%)*

	Before pregnancy ($n=587$)	During pregnancy ($n=587$)	4 months postpartum $n=587$		6 months postpartum		12 months postpartum	
Any breastfeeding			Yes ($n=287$)	No ($n=199$)	Yes ($n=251$)	No ($n=232$)	Yes ($n=111$)	No ($n=344$)
Any alcohol	395 (67.3)	208 (35.4)	134 (46.7)	86 (43.2)	119 (47.4)	120 (51.7)	47 (42.3)	174 (50.6)
Standard drinks/week								
0–2.0	189 (47.8)	171 (82.2)	80 (59.7)	42 (48.8)	68 (57.1)	59 (49.2)	30 (63.8)	74 (42.5)
2.1–6.9	109 (18.6)	29 (13.9)	40 (29.9)	26 (30.2)	32 (26.9)	37 (30.8)	13 (27.7)	61 (35.1)
7.0 or more	97 (24.6)	8 (3.8)	14 (10.4)	18 (20.9)	19 (16.0)	24 (20.0)	4 (8.5)	39 (22.4)
NHMRC risk levels[a]								
Up to 2 standard drinks	233 (59.0)	192 (92.3)	104 (77.6)	52 (60.5)	88 (73.9)	66 (55.0)	36 (76.6)	88 (50.6)
3–4 standard drinks	99 (25.1)	13 (6.3)	24 (17.9)	26 (13.1)	24 (20.2)	39 (16.8)	11 (23.4)	73 (21.2)
More than 5 standard drinks	63 (15.9)	3 (0.2)	6 (4.5)	8 (9.3)	7 (5.9)	15 (6.5)	0	13 (3.8)

[a]NHMRC risk levels: low risk: up to two standard drinks/day; risky: three to four standard drinks/day; high risk: more than five standard drinks/day.

consumption in the previous 12 months. Results from our study differ considerably from the NDSHS, in which 64% and 62% of pregnant women reported drinking in the 2001 and 2004 NDSHS, respectively [15,16]. The difference in results is due most probably to the difference in methodology between the NDSHS survey and the PIFSII questions. The quantity–frequency (QF) method used in the NDSHS involves asking respondents the volume of alcohol they usually consume and how frequently they consume alcohol (with responses ranging from daily, several times a week, weekly, monthly and less often); whereas the questions in the PIFSII were based on the NHS, which uses a Exact Recall method and involves asking respondents to recall the quantities of alcohol they consumed over a specific time-period, typically the last 7 days [28].

Internationally figures range from 41.6% in New Zealand [11] to 62% in the United Kingdom [29] of women drinking during pregnancy. In America, the Centers for Disease Control and Prevention (CDC) Behavioral Risk Factor Surveillance System (BRFSS) have reported figures of any alcohol use by pregnant women in the previous 30 days of 12.4% in 1991, 16.3% in 1995 and 10.1% in 2002 [30].

Nevertheless, comparisons of alcohol consumption levels between studies should be interpreted with caution due to differences in research methodology and reporting of alcohol intake [31].

Wine was the most popular beverage choice for pregnant women in this study, which is not dissimilar to previous research from England and America [29,32]. Prior to pregnancy, wine and spirits were equally popular; however, spirit consumption decreased dramatically during pregnancy. It is likely that spirits are perceived as being a stronger drink and are therefore avoided during pregnancy.

As in other studies [11,12,14,33], our study also showed a predominance of drinkers in the older age groups, higher income and employment levels, in married women and in those of Caucasian origin. These women do not fit the stereotype of women at risk of adverse pregnancy outcomes, and consequently practitioners need to bear this in mind when developing and targeting screening and intervention programmes.

It is possible that drinking may be more acceptable among women from higher socio-economic groups and that these women attend more social occasions where alcohol is available. Alternatively, these women may have a greater amount of disposable income to spend on alcohol [11].

The proportion of lactating women consuming alcohol was 46.7% at 4 months postpartum, 47.4% at 6 months postpartum and 42.3% at 12 months postpartum. Although there were slightly less women drinking and breastfeeding at 12 months postpartum than at 4 months (95% CI: −0.154–0.066) and

Table 3. *Time of alcohol consumption of breastfeeding mothers (%)*

Time	1 month (n = 158)	4 months (n = 134)	6 months (n = 119)	12 months (n = 47)
Just before or with evening meal	73 (46.2)	82 (61.2)	86 (72.3)	36 (76.6)
Just after breastfeeding	39 (24.7)	28 (20.9)	9 (7.6)	4 (8.5)
In between breastfeeds	26 (16.5)	10 (7.5)	11 (9.2)	4 (8.5)
No particular time	15 (.5)	10 (7.5)	8 (6.7)	–
Just before breastfeeding	2 (1.3)	–	–	–
Various	3 (1.9)	4 (3.0)	5 (4.2)	3 (6.4)

Table 4. *Main alcohol type of breastfeeding mothers (%)*

	1 month	4 months	6 months	12 months
Wine/champagne	76 (48.1)	59 (44.0)	61 (51.3)	22 (46.8)
Beer/cider reg	24 (15.2)	23 (17.2)	12 (10.1)	2 (4.3)
Beer/cider light	13 (8.2)	15 (11.2)	11 (9.2)	6 (12.8)
Spirits	19 (12)	22 (16.4)	20 (16.8)	13 (27.7)
Premix/Alcopops[b]	13 (8.2)	8 (6.0)	10 (8.4)	3 (6.4)
Others[a]	13 (8.2)	7 (5.2)	5 (4.2)	1 (2.1)
Total	158 (100)	134 (100)	119 (100)	47 (100)

[a]Includes fortified wine, liquers, cocktails, non-specified drinks. [b]Premix refers to pre-mixed spirits sold in either a can or bottle. Alcocops refers to alcoholic sodas most often sold in a bottle.

6 months postpartum (95% CI: −0.165 – 0.063), this difference in intake was not significant. In contrast, the 2001 and 2004 NDSHS reported 72% and 70% of lactating women consuming alcohol during lactation, respectively [15,34]. A figure of 80% of women breastfeeding at 6 months postpartum and consuming alcohol has been reported internationally [35].

The majority of breastfeeding women were consuming alcohol within levels recommended by the NHMRC for lactating women; however, there remained a small proportion that drank above this level. Almost a quarter of the lactating women drank at levels considered 'risky' and/or 'high risk' for harm in the long term throughout the period of lactation, whereas less than 7% drank at this level during pregnancy [9]. However, it is a limitation of the study questionnaire that lactating mothers were not asked specifically how many standard drinks they consumed each day as opposed to 'each time' or 'drinking occasion', and future research should endeavour to align more closely with relevant alcohol consumption guidelines for ease of analysis and comparison.

Depending on the timing of consumption, both breastfeeding and non-breastfeeding women may be putting their infant at risk through not being able to exhibit the level of concern or responsiveness required to care for a young infant. More specifically, breastfeeding women may have a lower tolerance to alcohol if they have abstained or reduced their alcohol use during pregnancy. Further to this, the potentially harmful effects of high levels of alcohol conveyed through the breastmilk to the infant are also of concern.

Most women consumed alcohol before or with the evening meal; however, the authors were unable to determine this time in relation to breastfeeding, with only two women ever reported drinking alcohol just before a breastfeed. It appears, therefore, that women in this study may be conscious of not breastfeeding when the alcohol content of their milk is at its peak. In previous research from Canada, 38% of women reported drinking before or during a breastfeed, as advised by health professionals, to relax the mother and aid the letdown reflex [36]. Given that most of the women were not breastfeeding exclusively, it is possible that the women were timing their alcohol intake with formula feeds. Future research should include more detailed data on alcohol intake, feeding timing and type to overcome this limitation.

A further limitation of the study is having less than 60% of eligible women participate. Nevertheless, the sample size is still relatively large (>500), and there was no significant difference in maternal age and level of education between participant and non-participants, suggesting that the sample was representative of the population from which it was drawn.

The study excluded those women with serious health conditions, which may have biased the sample; however, this represented only 5% of the eligible population and hence may be negligible.

This study presents data detailing alcohol consumption during the period of lactation not reported previously in the research literature. In addition, it provides the latest detailed data on alcohol intake during pregnancy on Australian women in almost two decades.

As in most studies of alcohol consumption, all intakes were self-reported during a telephone interview and actual intake may have been under-reported, particularly during the antenatal period when there is an increased stigma associated with drinking. In addition, given the close proximity of the baseline survey to the infant delivery, there may be the potential for recall bias regarding prenatal and antenatal alcohol intake of the mothers. Nevertheless, self-reported alcohol consumption using a telephone interview is considered to be reasonably accurate compared with self-administered questionnaires [37].

Conclusions

The majority of pregnant and breastfeeding women consume alcohol at levels recommended by national authorities. However, there is a small proportion of women who consume alcohol at higher levels. Considerable education opportunities still exist antenatally for promoting 'safe' alcohol consumption, aimed particularly at those with characteristics identified here. The potential health and developmental risks to the infant and mother of drinking alcohol during lactation is a relatively unfamiliar area for lactating women and the development of guidelines for 'safe' alcohol consumption at this time is an area for further public health education.

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References

[1] Hard ML, Einarson TR, Koren G. The role of acetaldehyde in pregnancy outcome after prenatal alcohol exposure. Ther Drug Monit 2001;23:286–92.

[2] US Department of Health and Human Services (SAMHSA). SAMHSA Fetal Alcohol Spectrum Disorders Centre for Excellence. Rockville, MD: SAMHSA, 2006. Available at: http://www.fascenter.samhsa.gov/ (accessed March 2006).

[3] Giglia RC, Binns CW. Alcohol and lactation: a systematic review. Nutr Dietet 2006;63:103–16.

[4] Little R, Anderson K, Ervin C, Worthington-Roberts B, Clarren S. Maternal alcohol use during breast-feeding and infant mental and motor development at one year. N Engl J Med 1989;321:425–30.

[5] Little R, Northstone K, Golding G. Alcohol, breastfeeding, and development at 18 months. Pediatrics 2002;109:e72. Available at: http://pediatrics.aappublications.org/cgi/content/full/109/5/e72 (accessed 22 November 2006).

[6] Mennella JA, Pepino MY, Teff KL. Acute alcohol consumption disrupts the hormonal milieu of lactating women. J Clin Endocrinol Metab 2005;90:1979–85.

[7] Mennella JA, Garcia-Gomez PL. Sleep disturbances after acute exposure to alcohol in mother's milk. Alcohol 2001;25:153–8.

[8] Little R, Lambert M, Worthington-Roberts B. Drinking and smoking at 3 months postpartum by lactation history. Paediatr Perinat Epidemiol 1990;4:290–302.

[9] National Health and Medical Research Council. Australian alcohol guidelines: health risks and benefits. Canberra: National Health and Medical Research Council, 2001.

[10] Ebrahim S, Luman E, Floyd R, Murphy C, Bennett E, Boyle C. Alcohol consumption by pregnant women in the United States during 1988–1995. Obstet Gynecol 1998;92:187–92.

[11] Counsell A, Smale P, Geddis D. Alcohol consumption by New Zealand women during pregnancy. NZ Med J 1994;107:278–81.

[12] Kwok P, Correy J, Newman N, Curran J. Smoking and alcohol consumption during pregnancy: an epidemiological study in Tasmania. Med J Aust 1983;1:220–3.

[13] Condon J, Hilton C. A comparison of smoking and drinking behaviours in pregnant women: who abstains and why. Med J Aust 1988;148:381–5.

[14] Bell R, Lumley J. Alcohol consumption, cigarette smoking and fetal outcome in Victoria, 1985. Commun Health Stud 1989;8:484–91.

[15] Australian Institute of Health and Welfare (AIHW). Statistics on drug use in Australia 2002. Catalogue no. PHE 43 (Drug Statistics Series no. 12). Canberra: AIHW, 2003.

[16] Australian Institute of Health and Welfare (AIHW). Statistics on drug use in Australia 2004. Catalogue no. PHE 62 (Drug Statistics Series no. 15). Canberra: AIHW, 2005.

[17] Adhikari P, Summerill A. 1998 National drug strategy household survey: detailed findings. Report, AIHW Catalogue no. PHE 27 (Drug Statistics Series no. 6). Canberra: Australian Institute of Health and Welfare, 2000.

[18] Australian Bureau of Statistics. National health survey, Australia (1995), basic confidentialised unit record file. Canberra: Australian Bureau of Statistics, 1995.

[19] Australian Bureau of Statistics. National health survey 2001: summary of results. Catalogue no. 4364.0. Canberra: Australia Bureau of Statistics, 2002.

[20] Scott JA, Aitkin I, Binns CW, Aroni RA. Factors associated with the duration of breastfeeding amongst women in Perth, Australia. Acta Paediatr 1999;88:416–21.

[21] Graham KI, Scott JA, Binns CW, Oddy WH. National targets for breastfeeding at hospital discharge have been achieved in Perth. Acta Paediatr 2005;94:352–6.

[22] Scott JA, Binns CW, Oddy WH, Graham KI. Predictors of breastfeeding duration: evidence from a cohort study. Pediatrics 2006;117:e646–55. Available at: http://pediatrics.aappublications.org/cgi/content/abstract/117/4/e646 (accessed 3 July 2006).

[23] Scott JA, Binns CW, Graham KI, Oddy WH. Temporal changes in the determinants of breastfeeding initiation. Birth 2006;33:37–45.
[24] Australian Bureau of Statistics. National health survey questionnaire 1989–1990. Canberra: Australian Bureau of Statistics, 1991.
[25] World Health Organization (WHO). Indicators for assessing breastfeeding practices. Geneva: WHO, 1991.
[26] Laws PJ, Sullivan EA. Australia's mothers and babies 2003. AIHW Catalogue. no. PER 29 (Perinatal Statistics Series no. 16). Sydney: AIHW National Perinatal Statistics Unit, 2005.
[27] National Health and Medical Research Council. Dietary guidelines for Australians. Canberra: Commonwealth of Australia, 1992.
[28] Australian Bureau of Statistics. Alcohol consumption and tobacco smoking discussion paper. Review of strategic statistical issues for future national health surveys. Canberra: Australian Bureau of Statistics, 2006. Available at: http://forums.abs.gov.au/QuickPlace/health_forum/Main.nsf/h_Discussion/147B7856F5E35C85CA2570A0D7B68EF/?OpenDocument (accessed April 2007).
[29] Waterson EJ, Murray-Lyon IM. Drinking and smoking patterns amongst women attending an antenatal clinic—II. During pregnancy. Alcohol Alcohol 1989;24:163–73.
[30] Centers for Disease Control and Prevention. Alcohol use among women of childbearing age—United States, 1991–1999. Atlanta: Centers for Disease Control and Prevention, 2002. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5113a2.htm#fig1 (accessed 28 June 2006).
[31] Stockwell T, Donath S, Cooper-Standbury M, Chikritzhs T, Catalano P, Mateo C. Under-reporting of alcohol consumption in household surveys: a comparison of quantity–frequency, graduated frequency and recent recall. Addiction 2004;99:1024–33.
[32] Streissguth A, Darby B, Barr H, Smith J, Martin D. Comparison of drinking and smoking patterns during pregnancy over a six-year interval. Am J Obstet Gynecol 1983;145:716–24.
[33] Kesmodel U, Kesmodel P, Larsen A, Secher N. Use of alcohol and illicit drugs among pregnant Danish women, 1998. Scand J Public Health 2003;31:5–11.
[34] Australian Institute of Health and Welfare (AIHW). 2004 National drug strategy household survey: first results. AIHW Catalogue no. PHE 57 (Drug Statistics Series no. 13). Canberra: AIHW, 2005.
[35] Avlik A, Haldorsen T, Lindemann R. Alcohol consumption, smoking and breastfeeding in the first six months after delivery. Acta Paediatr 2006;95:686–93.
[36] Davidson S, Alden L, Davidson P. Changes in alcohol consumption after childbirth. J Adv Nurs 1981;6:195–8.
[37] Kesmodel U, Frydenberg M. Binge drinking during pregnancy—is it possible to obtain valid information on a weekly basis? Am J Epidemiol 2004;159:803–8.

Alcohol and breastfeeding: what do Australian mothers know?

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Original Article

Alcohol and breastfeeding: what do Australian mothers know?

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Background: Drinking alcohol during pregnancy can cause many birth defects and developmental disabilities. There is considerable information available for pregnant women regarding the dangers of drinking alcohol during this time. Postpartum many women enter the period of lactation, which can last for several months to years. However information regarding safe levels of alcohol consumption during lactation is limited despite potential harmful effects on infant development and maternal lactational performance.
Methods: A descriptive study using qualitative methods. Data was collected in focus groups interviews conducted from February 2004 to December 2005. Women eligible to participate in the focus groups were currently breastfeeding or had been breastfeeding within the previous 12 months.
Results: Seventeen women aged 28 to 41 years participated in postpartum focus groups. The mothers were largely unaware of the effects of alcohol on breastfeeding performance and the development of the infant. The majority of the women in the focus groups expressed concern at the lack of information available regarding 'safe' alcohol consumption practices during lactation and reported being more diligent during pregnancy with regard to abstaining from alcohol.
Conclusion: There is a variable level of knowledge regarding consuming alcohol and breastfeeding among Australian mothers. The majority of participants were aware of the recommendations regarding alcohol during pregnancy and felt that a similar level of information was required to provide direction and support during lactation.

Key Words: breastfeeding, lactation, alcohol, knowledge, attitudes

Introduction

Alcohol consumed by a lactating mother enters the breastmilk within 30 to 60 minutes after ingestion and depending on the amount consumed, may have detrimental effects on the infant.[1] In a review of the literature a deficit in motor development, reduced lactational performance and disrupted sleep-wake behavioural patterning of the infant are reported at intakes of two standard drinks per day (one Australian standard drink is equivalent to 10g [12.5ml] alcohol).[2] Despite these adverse health effects, available information on the postpartum effect of alcohol in the breastmilk on the developing human infant is limited.

In contrast the potential adverse effects of alcohol consumption on the developing foetus have been well documented.[3] Many studies report a reduced maternal alcohol intake during pregnancy and a return to prepregnancy levels, or at least higher intakes than during pregnancy, shortly following birth.[4-6] Research shows that in some instances physicians, nurses and lactation consultants advocate an increase in alcohol intake by breastfeeding mothers.[7]

Current Australian research shows that the majority of women limit or completely restrict alcohol intake during lactation. In the 2001 National Health Survey approximately 47% of lactating mothers reported any alcohol consumption in the previous week and most often this was two standard drinks.[8] Determining the factors that influence the alcohol consumption behaviours of lactating women is important in developing initiatives aimed at supporting safe drinking practices and continued breastfeeding.[9] The objective of this research was to investigate the level of understanding that Australian women have regarding the relationship between alcohol and lactation.

Methods

A descriptive study using qualitative methods was conducted in the Perth metropolitan area of Western Australia between February 2004 and December 2005.[10] Data was gathered through focus group discussions. Women eligible to participate were currently breastfeeding or had been breastfeeding within the previous 12 months.

Data collection

Participants were recruited from women attending a private antenatal clinic and private hospital postnatal physiotherapy program. Child Health Nurses (CHN) located in the northeastern corridor of the Perth metropolitan area; and lactation consultants, and midwives attending Perth's major maternity hospital, distributed information about the study to eligible clients. All participants self-selected to attend a focus group and informed consent was obtained from participants prior to their involvement.

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The chief investigator moderated three focus groups using open-ended questions, derived from previous research findings, to help structure the discussion.[2] The questions related to general breastfeeding, 'being a new mother' experiences, and alcohol and breastfeeding (see example questions in Box 1). Whilst the focus group schedule of questions guided the discussion, the moderator allowed for the development of emergent themes from the current focus group to be discussed and investigated during subsequent focus groups.

Data analysis

All focus group and interview data were transcribed verbatim immediately following the discussions. Qualitative content analysis[11] was applied to systematically summarise recurring themes.

Results

Of the 17 participating women, all of them were married, Caucasian and ranged in age from 28 to 40 years. The majority of the women had completed a university degree and were currently working part-time. None of the women had returned to full-time employment. Fifteen of the women were primiparous and all of the women had breastfed their most recent child.

Focus groups results are presented thematically with direct quotations recorded in *italics*.

HAVE YOU HEARD OF ANY FOODS THAT PROMOTE BREASTMILK PRODUCTION?

Initially the majority of participants responded that they had not heard of anything specific with the exception of consuming water. However, in all groups at least one woman had heard that alcoholic beverages, in particular stout, could increase breastmilk production. Some of the mothers then concurred but were unable to explain how the potential increase in breastmilk would occur. For some women, family and friends had been the source of this information.

Two women had tried to increase their breastmilk production by drinking stout. These women were unable to confirm how successful consuming stout had been in increasing their breastmilk supply.

'It certainly made me feel better and I felt it did help my breastmilk. It definitely made me feel better.'

'My aunty turned up with a 6 pack for me!'

WHAT IS YOUR OPINION OF ALCOHOL AND BREASTFEEDING?

Some women consumed wine and did this at the evening meal or after the last breastfeed for the evening. Several women expressed that initially when they first commenced breastfeeding they would rarely drink, but as the child matured and they breastfed less they tended to consume more alcohol and on a more regular basis. Some women indicated they did not consume spirits due to the higher alcohol content.

There was a general consensus from the women that they had been more diligent in abstaining from alcohol throughout their pregnancy due to the perception that there was more chance of the alcohol 'getting into the baby's system' than when breastfeeding. In addition, mothers expressed that due to their abstinence during pregnancy they felt entitled to recommence drinking alcohol once the baby had been born.

'More conscientious when I was pregnant because of the developing foetus. You have to give it a chance. Once they're out you can breastfeed them.'

'You spend all that time when you are pregnant trying not to drink and then when you get to breastfeeding – it can be a year and it's like a YES (now I can drink).'

A few mothers consumed alcohol after a breastfeed to minimise the effect on the baby, however babies are often unpredictable in their sleeping patterns when they are young and in two cases the mothers were then required to feed again.

'I did that very similar thing after a wedding where I'd had a couple of drinks and he woke up and I fed him. He slept for 12 hours and I felt terrible like I'd poisoned him…after that I felt like a terrible person because the alcohol had made him go to sleep. But I can see how it happens.'

'I remember going out to a function when she was 6 weeks old and I fed her before we went. When we got there I had one of the pre-dinner drinks, a half a half a glass – like I picked the smallest one on the tray…20 minutes later she's screaming and I had to feed her. I was feeling dreadful and really berating myself being at a big function not knowing what to do… me being in the audience with a screaming baby and I didn't want to feed her but I didn't know what else to do. So you know things like that did happen.'

HAS ANYONE SOUGHT ADVICE ON CONSUMING ALCOHOL DURING LACTATION?

The majority of women in the focus groups had read that consuming alcohol throughout pregnancy could cause Foetal Alcohol Syndrome (FAS). However they indicated they had been unable to find any information about consuming alcohol whilst breastfeeding and that often the information they did find was conflicting. Some had read books in an effort to research the risks to the infant from consuming alcohol during breastfeeding, and a smaller number had asked their obstetrician, GP, child health nurse, Breastfeeding Australia (a breastfeeding support organisation) or searched the internet.

'I don't think I was actively discouraged even from my obstetrician. I wasn't encouraged but I wasn't discouraged put it that way. He never said I shouldn't have any.'

'I find that there seems to be a degree of acceptance of alcohol during breastfeeding from the GPs. My GP was very lackadaisical about it and I have friends who are GPs who like me have the occasional drink with a meal. I wouldn't say they drink a lot but it does seem to be quite accepted by the medical profession.'

'Technically I don't think you should do it but I did. After the paediatrician had said I should have a couple

of beers I thought right…'

The majority of the participants reported a need to have more information about breastfeeding during lactation readily available in the community, particularly information that was correct.

'I didn't quite realise the direct effect it had on the breastmilk. So I guess lack of education did effect my behaviour with it (alcohol).'

'I guess I wish there was more really good literature and good guidelines. One of my friends says ' a stout a day' is good for the baby and she is a 40 year old midwife!! There is so much misinformation. And I know someone who drinks a full glass of wine and then breastfeeds. We are all doing different things. And I think the guilt is hard to deal with.'

WHAT WOULD BE THE EFFECT OF ALCOHOL ON THE BABY?

Mothers were asked about the perceived effect of alcohol on the infant. Those mothers who had personal experience responded that they thought the baby had been more unsettled, however they were unable to tell if this was just a coincidence or if there were other events (e.g. 'teething') that were causing the baby to be unsettled. The participants also discussed the effect on the mother.

'If I didn't know and then I had to feed her I would just feed her. If she slept longer than she was supposed to then I would feel guilty and probably jump on the internet and find out all the crazy stuff about it but I wouldn't be doing it all the time.'

General thoughts regarding the perceived immediate effect of the alcohol on the baby varied between the effect on sleep and the contentedness of the baby. The baby would sleep better and go to sleep quicker were common responses. The baby would be more irritable or suffer from a 'mini' hangover.

'If they [adults] get a headache from it maybe the baby does as well.'

In the long term some mothers thought that there could be long term developmental problems.

Discussion

There was a range of issues emerging from this qualitative study. Perhaps the most pervasive was that among breastfeeding women generally there is a lack of knowledge on the effect of alcohol on the breastfed infant. Coupled with this was the equal desire for more accurate information to be made available in this area through the usual channels of antenatal care.

It is useful to consider the health promotion Theory of Reasoned Action (TRA) and Theory of Planned Behaviour (TPB)[12, 13] when developing recommendations based on this study and to guide future investigations (see Fig 1). Together these theories explore the relationship between

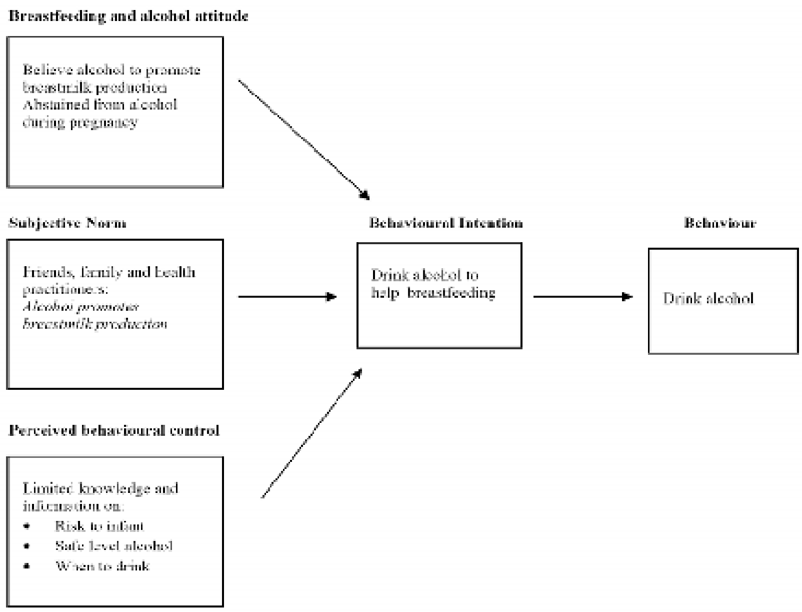

Figure 1. Theory of Planned Alcohol Consumption Behaviour During Lactation

Table 1. An ecological perspective: levels of influence

Concept	Definition/Example
Intrapersonal Level	Individual knowledge, attitudes, beliefs and personality traits.
Interpersonal Level	Interpersonal processes and primary groups. Influence of family, friends and supportive role models.
Community Level Institutional Factors	Policies and information that may promote or constrain recommended behaviours. Information from community health nurse, midwife, GP, obstetrician, paediatrician.
Community Factors	Social networks and norms, which exist as formal or informal among individuals, groups, and organizations. E.g. Women or Mother's group.
Public Policy	Local, state and federal policies and laws that regulate or support healthy actions for breastfeeding. A lack of a federal policy and evidence-based guidelines that outlines safe drinking practices for lactating women.

behavior and beliefs, attitudes, and intentions. A person's behavior is determined by her intention to perform the behavior and this intention is, in turn, a function of her attitude toward the behavior and her subjective norms.

In this study the behavioural intention is to drink (or not drink) alcohol during the period of lactation. This decision is influenced by an individual's attitude towards this behavior. If the mother believes that drinking alcohol can promote breastmilk production then she is more likely to drink alcohol during lactation.

In our study the theme that alcohol is a galactagogue can be identified as a behavioural belief of the target group. In this group of women this belief may translate into the attitude that drinking alcohol can increase breastmilk production.

In addition to the individual's attitudes toward the behavior, is the individual's subjective norms, that is their beliefs about how people they care about will view the behavior in question. The concept that alcohol is a galactagogue can also be investigated as a *subjective norm* of friends, family and some health practitioners of the women, and their motivation to comply with those around them.

Finally, perceived behavioral control influences intentions. Perceived behavioral control refers to people's perceptions of their ability to perform a given behavior. The lack of information available to the women regarding the risks of drinking alcohol during lactation will affect the control the mothers have over the behavioural intention. Mothers have the option of abstaining or not abstaining from alcohol, or timing their alcohol intake to minimise the risk to the infant. However, the results from our study suggest that women are not aware of the risks of drinking alcohol to the infant or the options for 'safe' alcohol consumption and this lack of education/information may limit the control (perceived or otherwise) that women have over this behaviour.

However, as not all the women report drinking alcohol to increase breastmilk production, there must be additional factors that prevent this behaviour. It is possible the profuse availability of health information regarding FAS accessed during pregnancy, may still be influencing the abstinent behaviour of these women and influencing their behavioural beliefs. Alternatively, their lack of knowledge about drinking alcohol and the effect on the infant may be inhibiting this behaviour.

Based on this examination, interventions to promote safe alcohol intake during lactation need to dispel the myths about alcohol and breastmilk production, and expose the risks of drinking alcohol during lactation. Educational material that provides direction for safe drinking practices may help promote the initiation of breastfeeding and support continued breastfeeding duration. This information should be widely disseminated to ensure greater public and professional understanding. In this way, an ecological perspective of the consumption of alcohol during lactation needs to be considered when developing education interventions in the future (see Table 1).

This descriptive study employed a variety of methods to recruit a representative sample of women and to elicit their opinions and experiences with respect to drinking alcohol during lactation. Despite this the study was limited in attracting women from the very disadvantaged socioeconomic groups reflecting the 'hard to reach' groups of health promotion. Notwithstanding the overall low number of women and lack of representativeness of the very disadvantaged socioecomic groups in the sample, we did find that many of the ideas were repeatedly expressed in each of the focus group discussions. Given that alcohol intake during and after pregnancy is related to higher social class[14-18] it is possible that the women in this study reflect those women most likely to be consuming alcohol during lactation.

The authors are unaware of any previous qualitative research in this area and further research that examines women's opinions and experiences with alcohol during lactation is needed. Future research that interviews a greater number of breastfeeding mothers, from a greater distribution of socioeconomic backgrounds, several times during the infant's first year will help provide a better understanding of the issues identified in this study. Clear evidence-based guidelines on alcohol consumption during this period need to be developed and disseminated to practitioners so that the advice given to breastfeeding mothers is consistent, realistic and based on research findings.

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Appendix

Example Focus Group Questions

Let's discuss people's initial breastfeeding experiences.
How did most people find their appetite at this time?
Did anyone find that some foods upset the baby?
What about foods to promote breastmilk production?
Let's talk about alcohol and breastfeeding. What's your opinion?

References

1. Kesaniemi YA. Ethanol and acetaledhyde in the milk and peripheral blood of lactating women after ethanol administration. J Obstet Gynaecol 1974;81:84-86.
2. Giglia RC, Binns CW. Alcohol and lactation: a systematic review. Nutrition and Dietetics 2006;63:103-116.
3. O'Leary C. Fetal alcohol syndrome: Diagnosis, epidemiology, and developmental outcomes. J Paediatr Child Health 2004;40:2-7.
4. Mennella JA, Gerrish CJ. Effects of exposure to alcohol in mother's milk on infant sleep. Pediatrics 1998;101:e21 - e25 .
5. O'Connor M, Brill N, Sigman M. Alcohol use in primiparous women older than 30 years of age: relation to infant development. Pediatrics 1986;78:444-450.
6. Little R, Lambert M, Worthington-Roberts B. Drinking and smoking at 3 months postpartum by lactation history. Paediatr Perinat Epidemiology 1990;4:290-302.
7. Mennella JA. Infant's suckling responses to the flavor of alcohol in mothers' milk. Alcohol Clin Exp Res 1997;21:581-585.
8. Giglia RC, Binns CW. Alcohol, pregnancy and breastfeeding; an analysis of the 1995 and 2001 National Health Survey data. BMC Public Health *in press*.
9. Worsley A. Nutrition knowledge and food consumption: can nutrition knowledge change food behaviour? Asia Pac Journal Clin Nutr 2002;11:S579–S585.
10. Sandelowski M. Focus on Research Methods. Whatever happened to qualitative description? Res Nurs Health 2000;23:334-340.
11. Morgan DL. Qualitative Content Analysis: A guide to paths not taken. Qual Health Res 1993;3:112-121.
12. Azjen I, Fishbein M. Understanding attitudes and predicting social behaviour. Englewood Cliffs: Prentice-Hall; 1980.
13. Azjen I, Driver BL. Prediction of leisure participation from behavioral, normative, and control beliefs: an application of the theory of planned behavior. Leisure Science 1991;13:185–204.
14. Bell R, Lumley J. Alcohol consumption, cigarette smoking and fetal outcome in Victoria, 1985. Community Health Stud 1989;8:484-491.
15. Counsell A, Smale P, Geddis D. Alcohol consumption by New Zealand women during pregnancy. N Z Med J 1994;107:278-281.
16. McLeod D, Pullon S, Cookson T, Cornford E. Factors influencing alcohol consumption during pregnancy and after giving birth. N Z Med J 2002;115:U29.

Which women smoke before, during and after pregnancy?

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Original Research

Which mothers smoke before, during and after pregnancy?

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KEYWORDS
Smoking;
Pregnancy;
Breastfeeding;
Australia

Summary *Objective:* To investigate the sociodemographic factors associated with cigarette smoking in women before, during and after pregnancy.
Study design: A 12-month longitudinal study.
Method: All eligible mothers at two public maternity hospitals in Perth, Australia were asked to participate in a study of infant feeding. While in hospital, participating mothers completed a self-administered baseline questionnaire. Follow-up telephone interviews were conducted at 4, 10, 16, 22, 32, 40 and 52 weeks. Data collected included sociodemographic, biomedical, hospital-related and psychosocial factors associated with the initiation and duration of breastfeeding.
Results: A total of 587 (55%) mothers participated in the study. Thirty-nine percent of mothers reported smoking pre-pregnancy. Mothers who smoked were more likely to have a partner who smoked and to have consumed alcohol prior to pregnancy, and less likely to have attended antenatal classes. They were also less likely to have known how they were going to feed their baby before conception and likely to be more inclined to consider stopping breastfeeding before four months postpartum.
Conclusions: Having a partner (father of the newborn infant) who smoked and maternal alcohol consumption prenatally were factors associated with pre-pregnancy smoking. In addition, if a woman decided how she would feed her infant before the pregnancy occurred and intended to breastfeed for longer than four months she was less likely to smoke in the prenatal period. Having a father (of the newborn infant) who smoked during pregnancy continued to be a factor significantly associated with maternal smoking in the antenatal and postnatal period. Not attending antenatal classes and not intending to breastfeed for longer than four months were also factors associated with maternal smoking. At ten weeks postpartum being of Caucasian origin and having a low Iowa Infant Feeding Attitude Score were factors significantly associated with smoking postnatally.

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Introduction

Smoking has been shown to negatively affect fecundity and fertility, and evidence shows that cigarette smoking is linked to a variety of adverse pregnancy outcomes including low birth weight, spontaneous abortion, and infant death.[1] Upon birth, low birth weight babies have been shown to have difficulty breastfeeding due to an ineffective suck correlated with immaturity, which further compromises their early growth and development.[2] They are disadvantaged in adulthood as evidenced by the association between low birth weight and the development of type 2 diabetes, hypertension and coronary heart disease.[3]

Breastfeeding in the postnatal period enables infants to achieve optimal growth and development,[4,5] however cigarette smoking has been shown to be associated with a decreased initiation and duration of breastfeeding,[6] which further compromises the health and development of an infant already exposed to cigarette smoke. Further to this, maternal smoking in the postnatal period poses an indirect threat to the infant through environmental smoke and a direct threat through the transfer of nicotine in the breast milk.[1]

The physiological mechanism of nicotine in decreasing breastfeeding initiation has been ascribed to nicotine-dependent alterations in prolactin and oxytocin production resulting in a subsequent diminished let-down reflex and decreased breast milk volume.[1] However continued research fails to support this theory.[7] What is supported is that psychosocial factors play an important role in breastfeeding rates among women who smoke.[7]

Current Australian and World Health Organization (WHO) guidelines recommend exclusive breastfeeding for the first six months of life, with continued breastfeeding until two years of age together with complementary foods.[8,9] The Australian breastfeeding initiation rate from the 2001 National Health Survey (NHS) was 83%,[10] however rates as high as 93.8% have been reported in a more recent longitudinal study conducted in Perth, Western Australia.[11] Regardless of these high initiation rates, national levels for infants fully breastfed at three months or less, and six months or less had fallen to 54%, and to 32%, respectively, in the 2001 NHS.[10]

The 2001 NHS identified approximately 27% of women of childbearing age (18–44 years) who are smokers and will potentially smoke during pregnancy and lactation.[12] The National Health and Medical Research Council (NHMRC) sets an Australian target of 80% of infants being breastfed at the age of six months.[9] As smoking is a known risk factor for the early cessation of breastfeeding and with more than a quarter of Australian women of childbearing age smoking, it has become a significant barrier to achieving national breastfeeding goals.

The connection between maternal cigarette smoking and breastfeeding duration warrants further investigation into those factors associated with maternal smoking. This paper describes the pre-pregnancy, during pregnancy and postnatal smoking patterns of a sample of women, and examines the sociodemographic factors that may provide information essential for the development of effective strategies to support continued breastfeeding.

Methods

The second Perth Infant Feeding Study (PIFSII) was conducted between mid-September 2002 and mid-July 2003 to monitor breastfeeding rates and identify changes in breastfeeding practices and the determinants of breastfeeding. The study was conducted using the same methodology as the first Perth Infant Feeding Study (PIFSI). PIFSI was conducted 10 years previously and results have been reported elsewhere.[13]

Mothers were contacted within the first three days following the birth of their infant. Women were considered eligible for the study if they had delivered a live infant free of any serious health conditions requiring transfer to the neonatal intensive care unit at Perth's major maternity hospital. Mothers whose infants were admitted to the special care nurseries (SCN) of the participating hospitals were eligible for recruitment.

Those women agreeing to participate in the study completed the self-administered baseline questionnaire while in hospital or shortly after discharge. Women declining to participate were asked to provide some basic sociodemographic data in order to determine the representativeness of the sample. All women regardless of their chosen infant feeding method were followed up by telephone interview at 4, 10, 16, 22, 32, 40 and 52 weeks postpartum. The study instruments used were essentially the same as those used in PIFSI, with only minor improvements and additions being made to the instruments used in the PIFSII.

Mothers were asked if they had smoked before pregnancy and if they had smoked during pregnancy as part of the baseline questionnaire. Women were classified as smokers or non-smokers during pregnancy according to their self-reported smoking status. At each follow-up interview the mother's smoking status was once again confirmed.

Statistical analysis

In addition to descriptive analysis, univariate-analysis using cross-tabulation and χ^2-statistics, and multivariate logistic regression modeling using the Statistical Package for Social Sciences, version 11.0 (SPSS for Windows, SPSS Inc., Chicago, IL, USA) were used to explore variation in factors influencing smoking before, during and after pregnancy.

We used both findings from the literature and univariate analyses (criterion for inclusion: $P<0.15$) to decide which variables should be entered into the final multivariate logistic model. In the final model all variables were entered simultaneously. All variables were kept in the final model, even those not statistically significant, to illustrate the diminished effect of these factors, which are often considered to be correlated with cigarette smoking (e.g. education and income level).

Presented P values are two-sided, and a 5% significance level was used.

Ethical considerations

The PIFSII was approved by the human ethics committee of Curtin University and the research ethics committees of the two participating hospitals. Signed informed consent was obtained from participants.

Results

In total, 1068 women were eligible to participate in the PIFSII. Of these 870 (81%) were contacted and 587 (55%) completed the baseline questionnaire. There were no significant differences in the age or level of education of participants compared to non-participants.[11] Table 1 outlines the characteristics of the participants by smoking status. Tables 2–4 present the univariate and multivariate results.

Smoking in pre-pregnancy was significantly associated with maternal alcohol intake and a father (partner) who smoked.

Mothers who had decided how to feed their baby during or after pregnancy were more likely to be smokers in pre-pregnancy than women who had decided on their feeding method prior to pregnancy. Similarly women who did not attend antenatal classes were twice as likely to smoke before pregnancy. Intending to breastfeed for less than four months was significantly associated with pre-pregnancy smoking (Table 2).

Father's smoking status remained significantly associated with a mother's likelihood of smoking during pregnancy. Women who had not attended antenatal classes, and those intending to breastfeed for less than four months were more likely to smoke during pregnancy (Table 3).

Postnatally, mothers were more likely to smoke if the father was a smoker. Mother's country of birth was dichotomised into Caucasian and 'other'.

Table 1 Characteristics of the participants prior to, and during pregnancy (%).

	Pre-pregnancy				Pregnancy			
	Non-smoker ($n=358$)		Smoker ($n=228$)		Non-smoker ($n=427$)		Smoker ($n=153$)	
	n	%	n	%	n	%	n	%
Maternal age (yr)								
<20	11	3.1	21	9.2	16	3.7	16	10.5
20–24	63	17.6	59	25.9	89	20.8	31	20.3
25–29	106	29.6	64	28.1	123	28.8	45	29.4
30–35	116	32.4	61	26.8	129	30.2	46	30.1
35+	62	17.3	23	10.1	70	16.4	15	9.8
Maternal education level								
did not complete secondary school	100	27.9	111	48.7	126	29.5	83	54.2
completed secondary school/trade	198	55.3	108	47.4	234	54.8	68	44.4
bachelor degree or higher	60	16.8	9	3.9	67	15.7	2	1.3
Income								
<$25 000	175	48.9	140	61.4	213	49.9	99	64.7
>$25 000	175	48.9	83	36.4	204	47.8	51	33.3

Table 2 Relationship between pre-pregnancy smoking and explanatory variables.

	Smoker before pregnancy % ($n = 228$)	Multivariate Odds ratio (95% CI)	*P*
Maternal alcohol intake			0.010
drank alcohol pre-pregnancy	77.0	2.9 (1.3–6.5)	
did not drink alcohol pre-pregnancy	23.0	1	
Father's smoking status pre-pregnancy			0.000
smoker	75.2	7.0 (3.7–13.2)	
non-smoker	24.8	1	
When first decided how to feed baby			0.001
during/after pregnancy	53.5	3.1 (1.6–6.1)	
before pregnancy	46.5	1	
Attend antenatal			0.026
no, never	46.3	2.1 (1.1–4.1)	
yes, this and/or previous	53.7	1	
Intended duration			0.048
<4 months	26.2	2.2 (1.0–4.8)	
4 months+	73.8	1	

Variables in full models included maternal age (<25 years, >25 years), maternal education level (did not complete secondary education, completed secondary school/trade, bachelor degree or higher), timing of pregnancy (actively trying, mistimed, unplanned), income (<\$25 000, >\$25 000), mother's country of birth (Caucasian, other), maternal Iowa score (IIFAS) (low score, high score).

Table 3 Relationship between smoking during pregnancy and explanatory variables

	Smoking in pregnancy ($n = 153$) %	Multivariate Odds ratio (95% CI)	*P*
Father's smoking status during pregnancy			0.000
Smoker	74.8	5.7 (2.9–11.3)	
Non-smoker	25.2	1	
Attend antenatal classes			0.001
No, never	52.0	3.2 (1.6–6.2)	
Yes, this and/or previous	48.0	1	
Intended duration of breastfeeding			0.012
<4 months	27.5	2.7 (1.2–5.9)	
4 months+	72.5		

Variables in full models included maternal education level (did not complete secondary education, completed secondary school/trade, bachelor degree or higher), when first decided how to feed baby (during/after pregnancy, before pregnancy), timing of pregnancy (actively trying, mistimed, unplanned), income (<\$25 000, >\$25 000), mother's country of birth (Caucasian, other), maternal Iowa score (IIFAS) (low score, high score).

Caucasian women were predominantly from Australia, New Zealand, the UK, North America and Europe, and 'other' women comprised all other nations. Caucasian women were between five and six times more likely to be smokers after the birth of their child (Table 4).

A mother's attitude towards infant feeding was measured by the Iowa Infant Feeding Attitude Scale (IIFAS).[14] The IIFAS is a valid and reliable 17–item scale which measures attitudes towards both breast and formula feeding with regards to the health and nutritional benefits, and the cost and convenience of each method.[15] Mothers with a low maternal Iowa were more likely to be smoking postnatally (Table 4).

Discussions

In our study 39% of women reported smoking prior to pregnancy. Past studies on pre-pregnancy smoking report prevalence levels ranging from

Table 4 Relationship between postnatal smoking (week 10) and explanatory variables.

	Smoking postnatal ($n = 123$) %	Multivariate Odds ratio (95% CI)	P
Father's smoking status during pregnancy			0.000
Smoker	31.6	6.7 (3.0–15.2)	
Non-smoker	68.4	1	
Mother's country of birth			0.044
Caucasian	96.7	5.2 (1.0–25.7)	
Other	3.3	1	
Maternal Iowa score (IIFAS)			0.009
Low score	67.5	2.9 (1.3–6.6)	
High score	32.5	1	

IIFAS, Iowa Infant Feeding Attitude Scale. Variables in full models included maternal education level (did not complete secondary education, completed secondary school/trade, bachelor degree or higher), maternal age (<25 years, >25 years), when first decided how to feed baby (during/after pregnancy, before pregnancy), timing of pregnancy (actively trying, mistimed, unplanned), attend antenatal classes (no, never, yes, this and/or previous pregnancy), intended duration of breastfeeding (<4 months, <4 months).

21.5%-46%.[16–21] In 1998, an Australian study reported a pre-pregnancy smoking level of 45.9%.[19]

The variability in reported smoking prevalence may be a consequence of self-reported smoking. A limitation of the current study may be that our measure of self-reported smoking in pre-pregnancy was recalled up to one week after delivery and social desirability may lead to a biased recall of smoking in new mothers. Like other studies of self-reported smoking levels in pre-pregnancy, our reports of smoking were not biochemically confirmed.[16,17,20] Some studies have claimed reasonably accurate self-reports of smoking, even long after pregnancy,[22] however others have found that smoking during pregnancy is under-reported or undisclosed.[23]

Smoking prevalence decreased during pregnancy (26%); despite this our level was higher than the most recent national Australian figures reported (18%),[24] and lower than the 31% recorded for the period 1996–1998 in a previous Australian study.[25]

Postpartum smoking prevalence further decreased to 23%. Previous research has reported 26–28% of women smoking postnatally.[17]

Maternal age has been shown to be a strong independent indicator of smoking before,[16–20] and during pregnancy.[21] We failed to find a lack of association between young age and maternal smoking, which may simply be a reflection of current national Australian smoking trends. Nationally female smoking rates peak in the 20–29 and 30–39 years age groups at 22.9% and 21.8%, respectively.[26]

Unlike previous studies we were unable to find a significant relationship between smoking before, during and after pregnancy and education level after adjusting for covariates.[16–18,20,21] This may be due to other factors exerting a stronger influence over maternal smoking throughout this emotionally and physically demanding time, particularly after the birth.

Our finding that pre-pregnant smokers were almost three times as likely to drink alcohol as non-smokers is supported by the literature.[17,18] Alcohol has also been shown to be a factor strongly associated with relapse in women who quit smoking prior to pregnancy.[18]

The lack of association between alcohol and smoking during pregnancy is most likely attributable to the public health awareness of reducing alcohol intake during pregnancy that exists today. Postnatally women may find they no longer desire the taste of alcohol due to their abstinence during pregnancy or they may find a lack of social occasions to drink alcohol in their new mothering role.

A strong relationship was confirmed between smoking pre-pregnancy, during pregnancy and postnatally, and the father's smoking status. This effect has been documented prior to pregnancy,[17,18] during pregnancy,[18,21] and postnatally,[17–19] in previous research.

In our study, we assumed the father of the child to be the mother's partner as approximately 90% of smoking mother's responded that the only (other) smoker in the household was the father. Given this information we found that if the father smoked the mother was between five and seven times more likely to smoke herself, prior to falling pregnant, during pregnancy and after the birth. Research has shown this relationship extends beyond the partner, in that women who cohabit with a smoker are less likely to quit smoking during pregnancy and more likely to relapse if they have quit.[17,18]

Infants exposed to environmental tobacco smoke (ETS) are at increased risk of respiratory illness, and a continuation of both parents smoking poses a health risk for the newborn infant.[1] Having a father who smokes makes it difficult for the mother not to smoke as the presence of another smoker within the household automatically provides for the availability of cigarettes and therefore the opportunity to smoke, as well as the temptation to smoke.

Women who decided how they were going to feed their baby before becoming pregnant were less likely to be smokers prior to pregnancy. When adjusted for, this association only existed with smoking prior to pregnancy and to date no other study has investigated this variable as a factor in maternal smoking.

Intending to breastfeed for less than four months was significantly associated with smoking prior to pregnancy and during pregnancy. This is akin to O'Campo and Faden[16] who found that women intending to breastfeed were less likely to smoke prior to pregnancy and more likely to quit during pregnancy than women intending to formula feed.

Antenatal classes aim to prepare expectant parents for childbirth and their new family life. Our finding that mothers not attending antenatal classes was significantly associated with smoking before and during pregnancy agrees with the literature.[27] Women who are smoking and not attending antenatal classes may not be receiving information related to exposure of their infant to nicotine and ETS further amplifying the hazards of smoking, and may not be provided with opportunities for education on smoking cessation.

It is possible that together the attendance at antenatal classes, intended duration of breastfeeding, timing of both the pregnancy and the decision of how to feed the baby may signify the preparedness of the mother for the oncoming pregnancy. A lack of readiness for this major life event may be enacted through a continuation of smoking whereas those women enthusiastically anticipating this event have had time to contemplate and quit smoking before conception.

Unlike previous studies[17,19,24,25] we failed to find a significant relationship between smoking and income level or social group. This discrepancy between our study and those before us may be due to power differences between their investigations and the current one. In addition, education and age are considered to be highly correlated with income. Women who are older are often more educated and more aware of the dangers of smoking before, during and after pregnancy and therefore less likely to smoke.

Kahn, Certain and Whittaker[17] found that Caucasian race was a significant predictor of smoking in the 12 months before pregnancy. Likewise in our study Caucasian women were four times more likely to smoke before pregnancy than 'other' women. The most recent national Australian data,[24] and Australian study,[25] also found that women from English speaking countries or predominantly Caucasian women had a higher smoking level during pregnancy than 'other' women.

A low IIFAS is indicative of negative maternal breastfeeding attitudes and previous studies have indicated that positive maternal breastfeeding attitudes are strongly correlated with maternal age, level of education, income, and marital status.[14] In our study a low IIFAS score was significantly associated with smoking postnatally. As a high score indicates willingness to breastfeed, a low IIFAS score may also be a proxy for the lack of anticipation of the approaching birth.

This study is the first Australian study to assess the relationship between smoking before, during and after pregnancy with sociodemographic factors predictive of smoking, but it needs to be replicated to verify our results and to investigate further other factors that may play a role in predicting maternal smoking habits. In addition, several limitations of this study exist.

All smoking behaviours were self-reported and cigarette smoking may have been under-reported particularly during the antenatal period when there is increased stigma associated with smoking, as opposed to smoking before and after pregnancy. However self-reported smoking status is considered to be reasonably accurate.[22] Future studies should consider the inclusion of alternative measures of cigarette smoking.

The relatively small sample size, and the fact that all women came from government hospitals is a limitation of this study. Thus, the results may not be generalizable to the rest of Australia or to other cultures. Future studies in other countries that use larger, more representative samples and that investigate sociodemographic factors indicative of maternal smoking should be conducted to confirm our findings.

In summary this study further substantiates a number of factors independently associated with smoking prior to pregnancy, during pregnancy and postnatally. Foremost is the impact the partner's (father's) smoking status has on all stages of pregnancy. This potentially modifiable risk factor[28] is paramount in promoting positive breastfeeding outcomes and optimum health of the baby.

Alcohol intake is a health risk behaviour known to cluster with cigarette smoking, and in this study maternal alcohol intake was associated with smoking prior to pregnancy.[29] Being emotionally prepared for the pregnancy and making important choices for the care of the baby (e.g., feeding method) is possibly another factor in the conundrum of maternal smoking and an important area for education.

Smoking cessation interventions targeted at women of childbearing age need to consider the likelihood of women conceiving a baby and the harmful effect of smoking on the unborn foetus and newborn baby. Factors predictive of pre-pregnancy, antenatal and postnatal smoking highlighted in this and previous research are essential in tailoring client interventions. Most importantly since a smoker's partner often smokes as well, the anti-smoking efforts in antenatal care must be complementary to the general preventive work in the community and inclusive of the partner.

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References

1. US Department of Health and Human Services. Women and smoking: a report of the Surgeon General-2001. Washington, DC: Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention; 2001.
2. Hill PD, Hanson KS, Mefford AL. Mothers of low birthweight infants: breastfeeding patterns and problems. *Journal of Human Lactation* 1994;10:169–76.
3. Sallout B, Walker M. The fetal origin of adult diseases. *J Obstet Gynaecol* 2003;23:555–60.
4. Binns CW, Davidson GP. Infant feeding guidelines for health workers. In Food for Health: Dietary Guidelines for Children and Adolescents in Australia. Canberra: Commonwealth of Australia; 2003. p. 287–450.
5. Labbok MH, Clark D, Goldman AS. Breastfeeding: maintaining an irreplaceable immunological resource. *Nat Rev. Immunol.* 2004;4:565–72.
6. Horta BL, Kramer MS, Platt RW. Maternal smoking and the risk of early weaning: a meta-analysis. *Am J Public Health* 2001;91(2):304–7.
7. Amir LH, Donath SM. Does maternal smoking have a negative physiological effect on breastfeeding? The epidemiological evidence. *Birth* 2002;29(2):112–23.
8. World Health Organization. The optimal duration of exclusive breastfeeding. Report of an expert consultation. Geneva: WHO; 2001.
9. National Health and Medical Research Council. *Dietary guidelines for children and adolescents in Australia*. Canberra: National Health and Medical Research Council; 2003.
10. Australian Bureau of Statistics. Breastfeeding in Australia, 2001. Canberra: Australian Bureau of Statistics; 2003. Cat. no. 4810.0.55.001.
11. Graham KI, Scott JA, Binns CW, Oddy WH. National targets for breastfeeding at hospital discharge have been achieved in Perth. *Acta Paediatrica* 2005;94:352–6.
12. Australian Bureau of Statistics. National Health Survey, Australia (2001). Basic Confidentialised Unit Record File. Canberra: Australian Bureau of Statistics; 2003. Cat. no. 4324.0.30.001.
13. Scott JA, Aitkin I, Binns CW, Aroni RA. Factors associated with the duration of breastfeeding amongst women in Perth, Australia. *Acta Paediatr* 1999;88:416–21.
14. De la Mora A, Russell D, Dungy C, Losch M, Dusdieker L. The Iowa Infant Feeding Attitude Scale: analysis of reliability and validity. *Journal of Applied Social Psychology* 1999;29:2362–80.
15. Scott JA, Shaker I, Reid M. Parental attitudes toward breastfeeding: Their association with feeding outcome at hospital discharge. *Birth* 2004;31:125–31.
16. O'Campo P, Faden RR. The impact of pregnancy on women's prenatal and postpartum smoking behaviour. *Am J Prev Med* 1992;8:8–13.
17. Kahn RS, Certain L, Whitaker RC. A reexamination of smoking before, during, and after pregnancy. *Am J Public Health* 2002;92:1801–8.
18. Severson HH, Andrews JA, Lichtenstein E, Wall M, Zoref L. Predictors of smoking during and after pregnancy: a survey of mothers of newborns. *Prev Med* 1995;24:23–8.
19. Najman JM, Lanyon A, Andersen M, Williams G. Socioeconomic status and maternal cigarette smoking before, during and after pregnancy. *Aust N Z J Public Health* 1998;22:60–6.
20. Fingerhut LA, Kleinman JC, Kendrick JS. Smoking before, during and after pregnancy. *Am J Public Health* 1990;80:541–4.
21. Dejin-Karlsson E, Hanson BS, Ostergren P, Ranstam J, Isacsson S, Sjoberg N. Psychosocial resources and persistent smoking in early pregnancy—a population study of women in their first pregnancy in Sweden. *J Epidemiol Community Health* 1996;50:33–9.
22. Heath AC, Knopik VS, Madden PA, Neuman RJ, Lynskey MJ, Slutske WS, et al. Accuracy of mother's retrospective reports of smoking during pregnancy: comparison with twin sister informant ratings. *Twin Res* 2003;6(4):297–301.
23. Russell TV, Crawford MA, Woodby LL. Measurements for active cigarette smoke exposure in prevalence and cessation studies: why simply asking pregnant women isn't enough. *Nicotine and Tobacco Research* 2004;6:S141–51.
24. McDermott L, Russell A, Dobson A. Cigarette smoking among women in Australia. Canberra: National Tobacco Strategy. Commonwealth Department of Health and Ageing; 2002.
25. Phung HN, Bauman AE, Young L, Tran MH, Hillman KM. Ecological and individual predictors of maternal smoking behaviour. *Looking beyond individual socioeconomic*

predictors at the community setting. Addictive Behaviours 2003;28:1333–42.
26. Australian Institute of Health and Welfare. 2004. National Drug Strategy Household Survey: First Results. AIHW Cat. no. PHE 57. Canberra: AIHW (Drug Statistics Series No. 13); 2005.
27. Fabian HM, Ra'destad IJ, Waldenstrom U. Characteristics of Swedish women who do not attend childbirth and parenthood education classes during pregnancy. *Midwifery* 2004;20:226–35.
28. Blackburn C, Bonas S, Spencer N, Dolan A, Coe C, Moy R. Smoking behaviour change among fathers of new infants. *Soc Sci Med* 2005;61:517–26.
29. English RM, Najman JM, Bennett SA. Dietary intake of Australian smokers and nonsmokers. *Aust N Z J Public Health* 1997;21:141–6.

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Erratum

Erratum to: Which mothers smoke before, during and after pregnancy? [Public Health 121 (12) 942–949]

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The author wishes to apologise for any confusion caused by a misprint in the fourth author's name. It should be as it appears above, Y. Zhao, and not as printed in the issue.

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Maternal cigarette smoking and breastfeeding duration

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Maternal cigarette smoking and breastfeeding duration

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Abstract

Aim: To examine the relationship between cigarette smoking and breastfeeding duration at 2 wk, 6 mo, and longer. *Methods: Design.* A 12-mo longitudinal study. *Setting.* Two public maternity hospitals in the Perth metropolitan area (Western Australia). *Subjects.* Eligible mothers of healthy newborn infants. *Interventions.* Participants completed a self-administered baseline questionnaire while in hospital or shortly after discharge. All women regardless of their chosen infant feeding method were followed up by telephone interview at 4, 10, 16, 22, 32, 40 and 52 wk postpartum. *Main outcome measures.* Prevalence of breastfeeding at 2 wk, 2 wk to 6 mo and >6 mo in women who smoked during pregnancy, and breastfeeding duration. *Results:* Women who smoked during pregnancy had a lower prevalence and shorter duration of breastfeeding than non-smoking mothers (28 vs 11 wk, 95% CI 8.3–13.7). This effect remained even after adjustment for age, education, income, father's smoking status, mother's country of birth, intended duration of breastfeeding >6 mo and birthweight (risk ratio 1.59, 95% CI 1.22–2.08).

Conclusion: Women who smoke during pregnancy are at greater risk of not achieving national and international targets for breastfeeding. Encouraging smoking cessation in the antenatal setting is an area for considerable public health gain.

Key Words: *Breastfeeding, duration, smoking*

Introduction

Based on the evidence supporting the long-term health benefits of breastfeeding to both the mother and infant, current Australian and World Health Organization (WHO) guidelines recommend exclusive breastfeeding for the first 6 mo of life, with continued breastfeeding until 2 y of age together with complementary foods [1,2].

It is well documented that cigarette smoking during pregnancy compromises these benefits by negatively impacting on the initiation and duration of lactation [3–10]. Despite this conclusive evidence base, there are at present no clear national or international guidelines that pregnant or lactating women cease smoking. Health professionals working closely with pregnant and lactating women are encouraged to promote smoking cessation; however, these interventions are often haphazard and unstructured [11], and to date only the American Academy of Pediatrics (AAP) has moved to address smoking at this critical time by removing nicotine from its list of contra-indicated drugs of abuse during breastfeeding in an effort to increase breastfeeding rates in the United States and to promote opportunities for physician-based smoking cessation advice during pregnancy and lactation [12].

The fact that smoking mothers cease breastfeeding earlier remains an area of topical debate. Do mothers cease breastfeeding earlier because of the stigma associated with smoking at this time, or are there other contributing socio-demographic factors affecting duration? This study aims to examine the relationship between cigarette smoking and breastfeeding duration at 2 wk, 6 mo, and longer, and to contribute to the body of evidence supporting maternal cigarette smoking as a risk factor for the early cessation of breastfeeding.

Methods

Sample

The second Perth Infant Feeding Study (PIFSII) was conducted between mid-September 2002 and mid-July 2003 to monitor breastfeeding rates and identify changes in breastfeeding practices and the determinants of breastfeeding. The study was conducted in the same hospitals using the same methodology as the first PIF Study (PIFSI). PIFSI was conducted

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10 years previous, and results have been reported elsewhere [13].

Mothers were contacted within the first 3 d following the birth of their infant. Women were considered eligible for the study if they had delivered a live infant free of any serious health conditions requiring transfer to the neonatal intensive care unit at Perth's major maternity hospital.

Those women agreeing to participate in the study completed the self-administered baseline questionnaire while in hospital or shortly after discharge. Women declining to participate were asked to provide some basic socio-demographic data in order to determine the representativeness of the sample. All women regardless of their chosen infant feeding method were followed up by telephone interview at 4, 10, 16, 22, 32, 40 and 52 wk postpartum. The study instruments used were essentially the same as those used in PIFSI, with only minor improvements and additions being made to the instruments used in the PIFSII. Questions relating to smoking were based on the 1989–1990 National Health Survey [14].

Mothers were asked if they had smoked before pregnancy and if they had smoked during pregnancy as part of the baseline questionnaire. Women were classified as smokers or non-smokers during pregnancy according to their self-reported smoking status.

Statistical analysis

Data were entered and analysed using the Statistical Package for Social Sciences, version 11.0 (SPSS for Windows, SPSS Inc., Chicago, IL, USA). Crude and adjusted analyses were conducted at specific time points (<2 wk, 2 wk–6 mo and >6 mo), in which the outcome variable was categorical (i.e. method of infant feeding: yes, breastfeeding full or partial; no, receiving full formula). These time periods were chosen for the following reasons. Less than 2 wk was considered to be an adequate amount of time for mothers to have been at home with their new baby and to make their decision on whether they would continue breastfeeding without the influence of the hospital environment. From 2 wk to 6 mo, and greater than 6 mo, are time periods based on the WHO recommendations for exclusive breastfeeding and were considered to be significant reference points for infant feeding duration. Findings from the literature and univariate analyses were used (criterion for inclusion: $p \leq 0.15$) to decide which variables should be entered into the final multivariate logistic model. In the final model, variables were entered stepwise and all variables were kept in the final model. Potential interaction effects were also assessed. The relationship between smoking status and breastfeeding duration was determined using Kaplan-Meier survival analysis. This was adjusted by using a Cox regression model with smoking status as the time-dependent covariate. This extension of the standard Cox model allows changes over time to be taken into account, and it does not assume proportionality of risks [15].

Presented p values are two-sided, and a 5% significance level was used.

Ethical considerations

The PIFSII was approved by the Human Ethics Committee of Curtin University and the research ethics committees of the two participating hospitals. Signed informed consent was obtained from participants.

Results

Twenty-six per cent of women smoked during pregnancy. Some of the characteristics of the smokers and non-smokers at the time of pregnancy are summarized in Table I.

Women who smoked were significantly less likely to be breastfeeding between 2 wk and 6 mo, and longer than 6 mo postpartum, even after adjustment for confounding covariates (Table II).

Using Kaplan-Meier survival analysis (Figure 1), the median duration of breastfeeding for non-smoking mothers was 28 wk (95% CI 25.2–30.8) and for smoking mothers 11 wk (95% CI 8.3–13.7) (log rank 18.9, $p < 0.001$).

Table III indicates that smoking was significantly related to a shorter duration of breastfeeding. Women who smoked were 60% more likely to cease breastfeeding than non-smoking mothers, even after adjustment for potential confounders.

Results conclusively indicate that cigarette smoking during pregnancy was significantly associated with a shorter duration of breastfeeding, even after adjustment for confounding covariates.

Discussion

A strong negative association was observed between maternal smoking during pregnancy and breastfeeding duration. At least four possible explanations may apply.

The association between a decrease in the duration of breastfeeding among smoking mothers was first described in 1950 [16]. It is thought that nicotine inhibits breast-milk supply by suppressing prolactin levels [17]. Despite a suggested physiological mechanism ascribed to nicotine-dependent alterations in prolactin and oxytocin production resulting in a subsequent diminished let-down reflex and decreased breast-milk volume [17,18], continued research fails to support this theory [19,20].

Table I. Characteristics of smoking and non-smoking women during pregnancy.

	n	Percentage smoking	No smoking during pregnancy [a] (%) (*n* =427)	Smoking during pregnancy [a] (%) (*n* = 153)	*p* [a]
Maternal age (y)					
<20	32	50	3.8	10.5	0.014
20–24	120	26	20.9	20.3	
25–29	168	27	28.9	29.4	
30–35	175	26	30.3	30.1	
35+	85	18	16.2	9.8	
Maternal education level					
did not complete high school	209	40	29.5	54.2	<0.001
completed high school or trade	302	23	54.8	44.4	
bachelor degree or higher	69	3	15.7	1.3	
Marital status					
Single	46	37	6.8	11.1	0.090
married/de facto	534	25	93.2	88.9	
Country of birth					
Caucasian	496	29	83.1	95.4	<0.001
Other	78	9	16.9	4.6	
Intended duration of breastfeeding					
<4 mo	114	34	18.5	27.5	0.024
>4 mo	433	24	81.5	72.5	
Feeding method at discharge					
full formula	36	42	4.9	9.8	0.057
partial breastfeeding	98	30	16.2	19.0	
fully breastfeeding	446	24	78.9	71.2	
Breastfeeding at 4 mo	286	17	65.6	40.7	<0.001
Breastfeeding at 6 mo	250	15	58.8	31.6	<0.001

[a] χ^2 test.

In their review of the epidemiological evidence, Donath and Amir [21] state that "if smoking had a negative physiological effect on breastfeeding, we would expect the effects of smoking to be seen universally" (p. 1517) in reference to studies from Jordan, Hong Kong and New Zealand, in which maternal smoking was not associated with a decreased duration of breastfeeding. Similarly, our research group has found that high rates of smoking in Aboriginal women did not adversely affect breastfeeding initiation or duration [22].

Second, excessive crying has been observed in infants of smoking mothers [23]. This irritability may be interpreted as hunger, and a mother may cease breastfeeding prematurely and commence formula feeding in response.

Third, our findings that mothers who smoke are significantly more likely to have a shorter duration of any breastfeeding, even after adjustment for potential confounders, conforms with the literature [3,5,8,24]. Age, income, education, parity, mother's country of birth, partner's smoking status and birthweight have all been shown to play a role in maternal smoking status and breastfeeding duration; however, when controlled for, maternal smoking was still significantly associated with a shorter duration of breastfeeding [3,8,9,24]. Breastfeeding intention has previously been shown to have a greater effect on breastfeeding duration than

Table II. Smoking during pregnancy and breastfeeding duration at less than 2 wk, 2 wk to 6 mo, and longer than 6 mo (*n* =587).

Variable	OR breastfeeding at 2 wk (95% CI)	OR breastfeeding 2 wk–6 mo (95% CI)	OR breastfeeding >6 mo (95% CI)
Smoking in pregnancy	0.6 (0.4–0.9) [c]	0.3 (0.2–0.4) [d]	0.3 (0.2–0.4) [d]
Smoking in pregnancy [a,b]	0.8 (0.4–1.6)	0.2 (0.1–0.4) [d]	0.3 (0.2–0.5) [d]

[a] Reference group is "non-smokers".
[b] Adjusted for age, education, income, father smoking during pregnancy, mother's country of birth, intended duration of breastfeeding > 6 mo and birthweight.
[c] Significant at $p \leq 0.05$, [d] significant at $p \leq 0.001$.

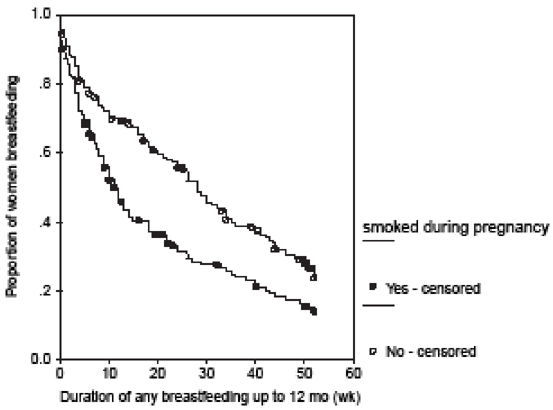

Figure 1. Duration of breastfeeding by smoking status at pregnancy.

maternal smoking [21]; however, in our study, maternal smoking remained a significant predictor of breastfeeding duration even after controlling for an intended breastfeeding duration of greater than 6 mo.

Finally, smoking mothers who stop breastfeeding earlier than non-smokers might do so because they consider breastfeeding combined with smoking to be harmful to the baby [8]. Although continued breastfeeding is recommended for mothers who smoke [12], lower rates of breastfeeding amongst this group may stem from an unwillingness of these women to seek advice from health professionals for breastfeeding problems for fear of being stigmatized as smoking mothers [24,25].

Haug et al. suggests that those women who continue to smoke during pregnancy (and postnatally) belong to a group of "hardcore" smokers, and it may be that these mothers will continue to smoke regardless of socio-demographic characteristics or health beliefs [8].

As in most studies of smoking during pregnancy, all smoking behaviours were self-reported in this study.

Table III. Smoking during pregnancy and breastfeeding duration ($n = 587$).

	Stopping breastfeeding, HR (95% CI)	p value
Smoking	1.6 (1.3–2.0)	<0.001
Smoking [a,b]	1.6 (1.2–2.1)	0.001

HR: hazard ratios were calculated using Cox's regression model with time-dependent covariates.
[a] Reference group is "non-smokers".
[b] Adjusted for age, education, income, father's smoking status, mother's country of birth, intended duration of breastfeeding >6 mo and birthweight.

Cigarette smoking tends to be underreported, particularly during the antenatal period when there is increased stigma associated with smoking [26], and therefore the effect of smoking on breastfeeding duration may be even more pronounced than the results presented here. Although this study used a standardized questionnaire to elicit smoking information, future studies should consider the inclusion of alternative measures of cigarette smoking.

Notwithstanding the relatively small sample size, and the fact that all women came from government-based hospitals, results from this study do reflect the current evidence. In addition, these mothers are representative of the "hard to reach" groups in Australian health promotion. Therefore, the lessons learned from this study could be usefully used in health education programmes.

Smoking mothers in our study were at greater risk of not achieving national and international breastfeeding targets. These results validate the importance of smoking as a health promotion challenge for health professionals working with pregnant and breastfeeding women. Mothers are a highly motivated group and will go to great lengths to provide the best care for their unborn fetus and infant children. Given this high level of motivation and the central role of smoking in breastfeeding duration, there is a need for the development of specific programmes for smoking cessation before, during and after pregnancy. However, until these programmes are developed, it should be stressed that smoking cessation is paramount for optimum antenatal and lactation outcomes. Mothers who continue to smoke should be encouraged to breastfeed in accordance with evidence-based recommendations.

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References

[1] National Health and Medical Research Council. Dietary guidelines for children and adolescents in Australia. Canberra: Commonwealth of Australia; 2003.
[2] World Health Organization. The optimal duration of exclusive breastfeeding. Report of an expert consultation. Report no. WHO/NHD/01.09, WHO/FCH/CAH/01.24. Geneva: WHO; 2001.
[3] Clements M, Mitchell E, Wright S, Esmail A, Jones D, Ford R. Influences on breastfeeding in southeast England. Acta Paediatr 1997;86:51–6.
[4] Dennis CL. Breastfeeding initiation and duration: a 1990–2000 literature review. J Obstet Gynecol Neonatal Nurs 2002; 31:12–32.
[5] Horta BL, Kramer MS, Platt RW. Maternal smoking and the risk of early weaning: a meta-analysis. Am J Public Health 2001;91:304–7.
[6] Scott J, Binns C. Factors associated with the initiation and duration of breastfeeding: a review of the literature. Australian Journal of Nutrition and Dietetics 1998;55:51–61.
[7] Lande B, Andersen L, Baeug A, Trygg K, Lund-Larsen K, Veierød M, et al. Infant feeding practices and associated factors in the first six months of life: the Norwegian Infant Nutrition Survey. Acta Paediatr 2003;92:152–61.
[8] Haug K, Irgens L, Baste V, Markestad T, Skjaerven R, Schreuder P. Secular trends in breastfeeding and parental smoking. Acta Paediatr 1998;87:1023–7.
[9] Yang Q, Wen S, Dubois L, Chen Y, Walker M, Krewski D. Determinants of breast-feeding and weaning in Alberta, Canada. J Obstet Gyanecol Can 2004;26:975–81.
[10] Antoniou E, Daglas M, Iatrakis G, Kourounis G, Greatsas G. Factors associated with initiation and duration of breastfeeding in Greece. Clin Exp Obstet Gynecol 2005;32:37–40.
[11] Hunt JM, Lumley J. Are recommendations about routine antenatal care in Australia consistent and evidence-based? Med J Aust 2002;176:255–9.
[12] American Academy of Pediatrics. The transfer of drugs and other chemicals into human milk. Pediatrics 2001;108:776–89.
[13] Scott JA, Aitkin I, Binns CW, Aroni RA. Factors associated with the duration of breastfeeding amongst women in Perth, Australia. Acta Paediatr 1999;88:416–21.
[14] Australian Bureau of Statistics. National health survey questionnaire 1989–1990. Canberra: Australian Bureau of Statistics; 1991.
[15] Therneau TM, Grambsch PM. Modelling survival data. Extending the Cox model. New York: Springer; 2000.
[16] Mills CA. Tobacco smoking: some hints of its biologic hazards. Ohio State Med J 1950;46:1165–70.
[17] Howard C, Lawrence R. Breast-feeding and drug exposure. Obstet Gynecol Clin North Am 1998;25:195–217.
[18] Vio F, Salazar G, Infante C. Smoking during pregnancy and lactation and its effects on breast-milk volume. Am J Clin Nutr 1991;54:1011–6.
[19] Amir LH. Maternal smoking and reduced duration of breastfeeding: a review of possible mechanisms. Early Hum Dev 2001;64:45–67.
[20] Amir LH, Donath SM. Does maternal smoking have a negative physiological effect on breastfeeding? The epidemiological evidence. Birth 2002;29:112–23.
[21] Donath S, Amir L. The relationship between maternal smoking and breastfeeding duration after adjustment for maternal infant feeding intention. Acta Paediatr 2004;93: 1514–8.
[22] Gilchrist D, Woods B, Binns C, Scott J, Gracey M, Smith H. Aboriginal mothers, breastfeeding and smoking. Aust N Z J Public Health 2004;28:225–8.
[23] Reijneveld SA, Lanting CI, Crone MR, Van Wouwe J. Exposure to tobacco smoke and infant crying. Acta Paediatr 2005;94:217–21.
[24] Bertini G, Perugi S, Dani C, Pezzati M, Tronchin M, Rubaltelli F. Maternal education and the incidence and duration of breast feeding: a prospective study. J Pediatr Gastroenterol Nutr 2003;37:447–52.
[25] Amir LH. Smoking status of breastfeeding women. Acta Paediatr 1999;88:1412–4.
[26] Klebanoff MA, Levine RJ, Morris CD, Hauth JC, Sibai BM, Curet LB, et al. Accuracy of self-reported cigarette smoking among pregnant women in the 1990s. Paediatr Perinat Epidemiol 2001;15:140–3.

Which women stop smoking during pregnancy and the effect on breastfeeding duration?

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Which women stop smoking during pregnancy and the effect on breastfeeding duration

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Abstract

Background: Cigarette smoking during pregnancy increases the risk of adverse pregnancy outcomes and women who quit smoking at this time are able to reduce the risk of low birth weight, preterm labour, spontaneous abortion and perinatal death. This study investigates the socio-demographic characteristics of pregnant women who stop smoking during pregnancy and the association between stopping smoking and breastfeeding duration.

Methods: A 12 month longitudinal study was conducted in two public maternity hospitals in Perth, Australia between mid-September 2002 and mid-July 2003. While in hospital, participating mothers completed a self-administered baseline questionnaire. Follow up telephone interviews were conducted at 4, 10, 16, 22, 32, 40 and 52 weeks.

Results: A total of 587 (55%) mothers participated in the study. Two hundred and twenty six (39%) mothers reported smoking prior to pregnancy and 77 (34%) of these stopped smoking during pregnancy. Women who were pregnant for the first time were twice as likely (OR = 2.05; 95% CI 1.047 – 4.03; $p < 0.05$) to quit smoking as multiparous women. Women who smoked more than 10 cigarettes per day were significantly less likely to quit smoking during pregnancy (OR = 0.36; 95% CI 0.18 – 0.69; $p < 0.05$). Women who consumed alcohol before pregnancy were three times more likely to quit smoking (OR = 2.58; 95% CI 1.00 – 6.66; $p < 0.05$). Quitting smoking during pregnancy was significantly associated with breastfeeding for longer than six months (OR = 3.70; 95% CI 1.55 – 8.83; $p < 0.05$).

Conclusion: Pregnancy is a time when many women are motivated to quit smoking and providing targeted smoking cessation interventions at this time, which take into account factors predictive of quitting smoking, are more likely to be successful.

Background

Despite considerable public understanding of the dangers of smoking during pregnancy, prevalence levels in Australia range between approximately 17%, reported in 2001, and 35%, reported in 1996 [1,2].

Substantial public health gains remain to be made in perinatal mortality and morbidity through the reduction of smoking during pregnancy [3] and pregnancy appears to be a time when women are highly motivated to quit smoking in the best interests of their unborn foetus. However, despite this not all women choose to quit smoking at this time and the differences between women who do stop smoking during pregnancy and those who don't may be caused by factors that can be influenced.

Lu et al reviewed nine cohort studies and found that the determinants of smoking cessation during pregnancy included maternal age, parity, number of cigarettes per day and duration of smoking, education level, partner's smoking status and socioeconomic status [4]. Furthermore, Ershoff, Solomon and Dolan-Mullen found additional sociodemographic and psychosocial differences between women with low intentions to stop smoking and those with high intentions [5]. In order to develop successful maternal smoking cessation public health programs the major determinants of quitting smoking during pregnancy need to be incorporated into intervention efforts.

The research team has already reported a significant increase over a 10 year period in the number of women breastfeeding upon discharge from hospital in Perth, Western Australia [6]. Likewise the major determinants of breastfeeding duration have been identified from the Perth Infant Feeding Study (PIFSII) cohort study [7]. The aims of this study were to document the number of women stopping smoking during pregnancy and to further examine the factors influencing the ability to stop smoking at this time. In addition, consideration was given to the exploration of variables (alcohol use before and during pregnancy; and attendance at antenatal classes) not previously reported in the Australian literature. The relationship between stopping smoking during pregnancy and breastfeeding duration was also examined.

Methods

The second Perth Infant Feeding Study (PIFSII) was conducted between mid-September 2002 and mid-July 2003 to monitor breastfeeding rates and identify changes in breastfeeding practices and the determinants of breastfeeding. The study was conducted in the same hospitals using the same methodology as the first Perth Infant Feeding Study (PIFSI). PIFSI was conducted 10 years previous and results have been reported elsewhere [8].

Mothers were contacted within the first three days following the birth of their infant. Women were considered eligible for the study if they had delivered a live infant free of any serious health conditions requiring transfer to the neonatal intensive care unit at Perth's major maternity hospital. Mothers whose infants were admitted to the Special Care Nurseries (SCN) of the participating hospitals were eligible for recruitment.

Those women agreeing to participate in the study completed the self-administered baseline questionnaire while in hospital or shortly after discharge. Women declining to participate were asked to provide some basic sociodemographic data in order to determine the representativeness of the sample. All women regardless of their chosen infant feeding method were followed up by telephone interview at 4, 10, 16, 22, 32, 40 and 52 weeks postpartum. The study instruments used were essentially the same as that used in PIFSI, with only minor improvements and additions being made to the instruments used in the PIFSII. Questions relating to smoking were based on the 1989–90 National Health Survey [9]. Mothers were asked if they had smoked before pregnancy and if they had smoked during pregnancy as part of the baseline questionnaire. Mothers who acknowledged that they had smoked before pregnancy but had not smoked during pregnancy were categorised as 'stopping smoking' during pregnancy.

Statistical analysis

Data were entered and analysed using the Statistical Package for Social Sciences, Version 11.0 (SPSS for Windows, SPSS Inc., Chicago, IL, USA). Risk factors associated with stopping smoking during pregnancy were analysed using the baseline questionnaire. Variables identified in the literature as being associated with breastfeeding initiation and duration were examined and included in the development of each statistical model.

Estimation of odds ratios was performed for univariate analysis testing statistical significance by χ^2 test. Adjusted odds ratios were calculated by logistic regression. All variables presented in Table 2 were entered into the model for the multivariate analysis of predicting stopping smoking during pregnancy. The model was reduced manually by excluding those variables with a less significant value.

Table 1: Smoking history of women (n = 226) and their partners (n = 270) (%)

Smoking History	Before Pregnancy		During Pregnancy		Week 4 postpartum	
	Women	Partners	Women	Partners	Women	Partners
Smoked	226 (100)	270 (100)	149 (66)	245 (91)	122 (54)	172 (64)
Stopped smoking	N/A	N/A	77 (34)	25 (4)	17 (8)	N/A

N/A – This data not available.

Table 2: Characteristics of women who did and did not stop smoking in pregnancy (n = 226). Figures are percentages if not otherwise stated

	Women who stopped smoking (n = 77)	Women who did not stop smoking (n = 149)	*p* value	Univariate OR (95% CI)
<25 years	46.8	35.6	0.103	1.6 (0.9–2.8)
>25 years	53.2	64.4		1
Income <$25 000	56	65.8	0.156	0.7 (0.4–1.2)
Income >$25 000	44	34.2		1
Primiparous	55.8	32.9	**0.001**	**2.6 (1.5–4.5)**†
Multiparous	44.2	67.1		1
Caucasian	90.9	96.6	0.068	0.3 (0.1–1.1)
Non-caucasian	9.1	3.4		1
Father smoked in pregnancy	61	75.5	**0.025**	**0.5 (0.3–0.9)**†
Father did not smoke in pregnancy	39	24.5		1
<12 years education	46.1	62.8	**0.016**	**0.5 (0.3–0.9)**†
>12 years education	53.9	37.2		1
Drank alcohol before pregnancy	87	72.3	**0.012**	**2.6 (1.2–5.5)**†
Non-drinker before pregnancy	13	27.7		1
Alcohol during preg	40.3	38.9	0.846	1.1 (0.6–1.9)
No alcohol in preg	59.7	61.1		1
Cigs before preg <10/day	63.6	36.4		1
Cigs before preg >10/day	36.4	63.6	**<0.001**	**0.3 (0.2–0.6)**†
Timing of pregnancy			**0.045**	
Planned	44	37.3		1
Mistimed	41.3	32.4		1.1 (0.6–2.0)
Unplanned	14.7	30.3		**0.4 (0.2–0.9)**†
Attend antenatal classes	33.8	52		1
Did not attend antenatal classes	66.2	48	**0.009**	**0.5 (0.3–0.8)**†

†Significant at $p = 0.05$. Significant figures in bold

The difference between duration of breastfeeding in those who stopped smoking during pregnancy and those who did not was initially explored using Kaplan Meier survival analysis. This relationship was further examined using logistic regression to examine breastfeeding duration less than and greater than six months using a variety of socio-demographic, biomedical and psychosocial factors reported to have an effect on breastfeeding duration in the literature. Variables were entered into the model to determine the effect on breastfeeding duration for more than or less than six months. Non-significant variables ($p > 0.10$) were manually excluded from the final model. Further analysis of this relationship using a Cox proportional hazard model was not attempted as the proportionality assumption had been violated and additional potential analytical techniques were considered beyond the scope of this paper. The six month time period was chosen based on the WHO recommendations for exclusive breastfeeding and was considered to be a significant reference point for infant feeding duration.

A mother's attitude towards infant feeding was measured by the Iowa Infant Feeding Attitude Scale (IIFAS) [10]. The IIFAS is a 17 item scale which measures attitudes towards both breast and formula feeding with regards to the health and nutritional benefits, and the cost and convenience of each method. It has been shown previously to be a valid and reliable measure of infant feeding attitudes amongst women in the USA [10] and Scotland [11]. Each item is measured on a 5-point scale and total scores could range from 17 (reflecting positive formula feeding attitudes) to a high of 85 (indicating attitudes that favour breastfeeding). For the purposes of the analysis mothers were split into two groups, those with an IIFAS score at or above the median (≥ 65) and those with a score less than the median (<65).

Presented *p* values are two-sided, and a 5% significance level was used.

Ethical considerations

The PIFSII was approved by the Human Ethics Committee of Curtin University and the Research Ethics Committees of the two participating hospitals. Signed informed consent was obtained from participants. Confidentiality was assured and mothers were advised that their participation was voluntary and that they could withdraw at any time without prejudice.

Results

In the PIFSII, 870 women of the 1068 women eligible to participate were contacted and 587 completed baseline

Table 3: Multivariate analysis of factors predicting likelihood of stopping smoking during pregnancy (n = 77)

	OR of stopping smoking during pregnancy (CI 95%)	*p*
Before pregnancy >10 cigarettes/day	0.4 (0.2–0.7)	0.002
Primiparous	2.1 (1.0–4.0)	0.036
Drank alcohol before pregnancy	2.6 (1.0–6.7)	0.049

Variables in the full model included age, income, mother's nationality, whether father smoked during the pregnancy, maternal years of education and whether the mother attended antenatal classes.

questionnaires (55%) and were maintained throughout the study period, representing 68% of women contacted. Those women discharged from hospital within the first 24 hours or not on the ward at the times that the researcher visited account for the eligible women not contacted. A similar proportion of eligible women participated in the PIFSI (58%) and the PIFSII (55%) studies. No significant differences were found in the age or level of education of participants compared with non-participants in either study [6,12].

A total of 226 women were smoking before pregnancy. This represents 39% of the total population of mothers. The proportion of mothers smoking decreased to 25% (n = 149) during pregnancy. Of the women who reported smoking before they became pregnant (n = 226), 34% of these (n = 77) stopped smoking during pregnancy, a reduction of 14%. Table 1 outlines the prevalence of smoking mothers and their partners.

Table 2 shows the results of the univariate analysis of smoking cessation during pregnancy using variables previously reported to be important and other relevant demographic variables. Stopping smoking during pregnancy was significantly associated with primiparous women (OR = 2.6; 95% CI 1.5–4.5; $p < 0.05$). A woman was less likely to stop smoking during pregnancy if she had a partner who smoked, had less than 12 years of education, smoked more than ten cigarettes per day, had an unplanned pregnancy and did not attend antenatal classes. Age, income level and mother's country of origin were not significantly associated with stopping smoking during pregnancy. Drinking alcohol before pregnancy was significantly associated with stopping smoking during pregnancy. However drinking alcohol during pregnancy was not associated with stopping smoking during pregnancy.

Table 4: Stopping smoking during pregnancy and breastfeeding for longer than 6 months (n = 77)

Variable	OR breastfeeding >6 months (95% CI)	*p*
Stopping smoking in pregnancy[a]	2.8 (1.6–5.1)	0.001
Stopping smoking in pregnancy[b, c]	3.7 (1.6–8.8)	0.003

[a]unadjusted
[b]reference group is women who did not stop smoking
[c]adjusted for income, age of infant when mother returned to work, breastfeeding problems at or before week four postpartum, age of infant when pacifier first used and mothers infant feeding attitude (IIFAS).

Table 3 shows the results of the multivariate analysis used to determine which variables were independent predictors of stopping smoking during pregnancy. It indicates that women who were primigravida and women who drank alcohol before pregnancy were more likely to stop smoking during pregnancy. Women who smoked more than ten cigarettes per day were less likely to stop smoking during pregnancy.

The association between stopping smoking and breastfeeding duration was explored using multivariate analysis. Table 4 indicates that stopping smoking during pregnancy was significantly related to breastfeeding duration. Of the 77 women who stopped smoking during pregnancy 35 (45%) of these continued to breastfeed for longer than six months. One hundred and forty nine women continued to smoke during pregnancy and of these, 34 (23%) breastfed for longer than six months. Women who stopped smoking were almost four times more likely to breastfeed for longer than six months, after adjustment for potential confounders (OR = 2.8; 95% CI 1.6 – 5.1; $p < 0.05$, adjusted OR = 3.7; 95% CI 1.6 – 8.8; $p < 0.05$).

Discussion

In this study approximately 34% of women who smoked before pregnancy reported stopping smoking during pregnancy. This is slightly higher than figures reported in the 1999 – 2002/3 National Tobacco Strategy of 20 to 30%, [13] however since this time smoking cessation rates in pregnancy may have increased in line with the general community [14]. In the analysis of the Australian Longitudinal Study on Women's Health year 2000 dataset a figure of 55% of women quitting was reported [15]. Most recently however a figure of 4% of women quitting smoking during pregnancy has been reported by Moshin and Bauman [16] in a large cross sectional study in New South Wales, Australia. Internationally figures range from 15.8% of women quitting smoking during pregnancy from a national survey in Canada [17] to 26.8% from New Zealand [18]. The disparity in these prevalence levels is most likely due to the timing of the data collection and whether the method of survey is cohort based or cross-sectional [19].

The relationship between smoking cessation during pregnancy and breastfeeding duration for longer than six months postpartum has not previously been reported in the research literature. More commonly continued maternal smoking in pregnancy has been reported in association with reduced breastfeeding initiation and duration [20-22], and only one previous study has explored smoking status and breastfeeding duration up to 26 weeks [23]. In this study women who stopped smoking during pregnancy were significantly more likely to breastfeed for longer than six months, which is in accordance with national and international recommendations [24,25]. Although stopping smoking is not exclusively responsible for prolonged breastfeeding duration, [26,27] promoting smoking cessation during pregnancy supports both positive perinatal outcomes and supports optimal breastfeeding duration, known to be associated with protection against infection, some chronic diseases and improved cognitive development in the infant [25,28].

The reported effects of alcohol consumption as a predictor of smoking cessation during pregnancy are varied and inconsistent, however in this study consuming alcohol prior to pregnancy was significantly associated with stopping smoking during pregnancy. In previous research Severson et al [19] looked at alcohol in the week prior to the study questionnaire being administered (administered two weeks postpartum) and found that mothers who stopped smoking during pregnancy were less likely to have consumed alcohol in this week. Using data from the US National Maternal and Infant Health Survey, consuming one or more drinks during pregnancy was independently associated with a lower likelihood of quitting smoking during pregnancy [29] and in a study of the relationship between quitting tobacco, alcohol and caffeine consumption during pregnancy, Pirie et al found that quitting either alcohol or cigarettes was not associated with an increased likelihood of quitting the other substance (e.g. quitting alcohol was not associated with quitting smoking or vice versa). Although this relationship was not significant in the multivariate model the clustering of multiple substance use in individuals was [30]. More recently a subset population of women in Spain who consumed alcohol (time of consumption not confined to either during pregnancy or three months after the birth) were also found to have a lower chance of quitting smoking [31].

In contrast, early research conducted in Sweden found continued alcohol consumption during pregnancy was not associated with a decrease in mothers stopping smoking [32]. Similarly, data from Canada demonstrated that drinking during pregnancy was positively related to a woman's likelihood of attempting to quit smoking during pregnancy [17]. However alcohol consumption was also significantly associated with cessation relapse before the child was born and the authors propose that although more women who drink make cessation attempts they are also more likely to relapse as it may be too difficult to give up smoking and drinking alcohol at the same time, or that continued alcohol use impairs the cessation maintenance. More recently, a New Zealand study found that women who quit smoking in the first trimester were more likely to report alcohol consumption at this time compared to women who reported not consuming alcohol [18].

In the current study alcohol intake before and during pregnancy was considered with regard to smoking cessation during pregnancy. The associations between alcohol before and during pregnancy with stopping smoking during pregnancy have previously not been studied concurrently. We found that women who consumed alcohol before pregnancy were more likely (OR = 2.6;95% CI 1.0–6.7; $p < 0.049$) to stop smoking during pregnancy. Alcohol intake is a health risk behaviour known to cluster with cigarette smoking [30,33] and therefore it is likely that those women who are consuming alcohol are also smoking hence the women most likely to stop smoking are those women drinking alcohol. Alcohol consumption during pregnancy was not significantly related to smoking cessation at this time.

In accordance with previous research, a woman was more likely to stop smoking during pregnancy if she was primigravida [16,18,29-31,34-38]. Women who have smoked during a previous pregnancy generally have an experience of giving birth to one or more healthy children and are therefore less motivated to quit smoking for subsequent pregnancies.

Pre-pregnancy smoking levels indicate that women who quit smoking during pregnancy are probably less addicted to smoking than women who continue to smoke. In the present study a woman was more likely to stop smoking if she reported smoking less than 10 cigarettes per day in the pre-pregnancy period. This result conforms with the current literature in that women who smoke at low levels are more likely to quit smoking [19,30,35-37,39,40].

Having a partner who smokes [19,31,35,36,38] and a low level of education [19] are factors previously found to be predictive of continued smoking during pregnancy. Although significant at the univariate level, education and father's smoking status were no longer significant when included in the multivariate analysis. Interestingly, a greater number of fathers stopped smoking after the baby was born. This may be due to the perception that the baby does not seem 'real' until after the birth when fathers are prompted by the baby's presence to quit smoking [41].

Antenatal classes aim to prepare expectant parents for childbirth and their new family life. Attendance at antenatal classes was a significant predictor of smoking cessation in the univariate analysis, although not significant in the multivariate model. Previous studies have found that early attendance at antenatal care was predictive of stopping smoking during pregnancy [16,35].

Timing of the pregnancy as a predictive factor for stopping smoking during pregnancy has not previously been reported using Australian data. Internationally previous research has shown that women having an unplanned pregnancy were more likely to continue smoking during pregnancy [32], whereas others have failed to find an effect of an unintended pregnancy [29]. In this study, women whose pregnancy was unplanned were less likely to stop smoking during pregnancy, however this was not significant in the multivariate analysis. A planned pregnancy enables a woman the opportunity to consider stopping smoking in preparation for the antenatal period, whereas women who become pregnant unexpectantly have less time to implement this change.

Neither age nor income was related to the likelihood of stopping smoking during pregnancy. The correlation with age has been found in some previous studies [19] but not in others [38-40]. A relationship between age and smoking cessation during pregnancy is still unclear and further research is required in this area.

Studies have reported 66% higher medical costs attributed to complicated births for smoking mothers compared with non-smoking mothers [42]. In Australia it has been estimated that smoking during pregnancy is responsible for 78 infant deaths, 6890 hospital separations and a cost of AUD23 million dollars to the health care system each year [43].

As smoking cessation programs have been shown to reduce the odds of continued smoking in pregnancy [44], it is imperative that the factors found in this study and previous research to predict smoking cessation during pregnancy be addressed in evidence based intervention programs. This concurs with recommendations from the 2001 National Tobacco Strategy [45]. However despite this recommendation there appears to be a lack in the provision of any routine antenatal smoking cessation advice in the Australian health care setting [46,47].

This study did not define those women who quit in the pre-pregnancy period from those who quit during pregnancy, often referred to as 'spontaneous quitters' [48]. In addition, there is considerable evidence outlining a high prevalence of relapse in the postpartum period in women who quit smoking during pregnancy, [39] however the design of this research study did not enable this issue to be addressed. Future cohort studies should take smoking abstinence into consideration in the design phase. Consideration of factors contributing to residual confounding, such as emotional antenatal attachment to the foetus in relation to smoking cessation, were not measured in this research. Future research should examine these additional potential factors that may help further explain the relationship between pregnancy and smoking cessation.

As in most studies of smoking during pregnancy, all smoking behaviours were self-reported in this study and cigarette smoking may have been underreported particularly during the antenatal period when there is an increased stigma associated with smoking. Nevertheless, self-reported smoking status is considered to be reasonably accurate [49,50] and results presented here give a good picture of smoking during pregnancy. Although this study used a standardised questionnaire, to elicit smoking information, future studies should consider the inclusion of alternative measures of cigarette smoking.

A further limitation of the study is having less than 60% of eligible women participate. Nevertheless, the sample size is still relatively large (>500), and there was no significant difference in maternal age and level of education between participant and non-participants, suggesting that the sample was representative of the population from which it was drawn.

Notwithstanding the relatively small sample size, and the fact that all women came from government-based hospitals, results from this study do reflect the current evidence. In addition these mothers are representative of the 'hard to reach' groups in Australian health promotion. Therefore the lessons learned from this study could be usefully applied in health education programs.

Conclusion

Quitting smoking during pregnancy is a potential area for huge public health gain in the short term through decreasing smoking related harm, and in the long term by promoting the positive health benefits of prolonged breastfeeding. Pregnancy is a time when women are more receptive to quitting smoking and many opportunities exist for implementing cessation efforts that are succinct and simple. A large proportion of women stop smoking voluntarily at this time, however many continue putting their health and that of their unborn foetus at risk. The current study highlights women who are primiparous, smoke less than 10 cigarettes per day before pregnancy, and consume alcohol before pregnancy, as significant predictors of quitting smoking at this time. Quitting smoking during pregnancy is supportive of breastfeeding for longer than six months.

In an effort to decrease the risk of adverse pregnancy outcomes and promote the best possible health outcomes for the infant and the mother, smoking cessation intervention programs in pregnancy should be designed with the predictive factors identified in this study in mind. It is also important that tobacco control strategies targeting the mainstream population run concurrently with smoking cessation programs for pregnant women. Antenatal care services at all levels and in both the public and private domain are paramount in supporting these cessation efforts.

Authors' contributions

RCG had primary responsibility for the data analysis and writing the manuscript.

CWB supervised the design and execution of the study, and contributed to writing the manuscript.

HA participated in the final data analyses and contributed to writing the manuscript.

Competing interests

The author(s) declare that they have no competing interests.

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References

1. Centre for Epidemiology and Research New South Wales Department of Health: **Mothers and babies, 2001.** *NSW Public Health Bulletin* 2002, 13(13):S-4.
2. **Australian Longitudinal Study on Women's Health** [http://www.newcastle.edu.au/centre/wha/]
3. US Department of Health and Human Services: **Women and smoking: a report of the Surgeon General – 2001.** *Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Washington, DC; Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention* 2001.
4. Lu Y, Tong S, Oldenburg B: **Determinants of smoking cessation during and after pregnancy.** *Health Promot Int* 2001, 16:355-365.
5. Ershoff DH, Solomon LJ, Dolan-Mullen P: **Predictors of intentions to stop smoking early in prenatal care.** *Tob Control* 2000, 9(suppl 3):iii41-iii45.
6. Graham KI, Scott JA, Binns CW, Oddy WH: **National targets for breastfeeding at hospital discharge have been achieved in Perth.** *Acta Paediatr* 2005, 94:352-356.
7. Scott JA, Binns CW, Oddy WH, Graham KI: **Predictors of breastfeeding duration: evidence from a cohort study.** *Pediatrics* 2006, 117(4):e646-e655.
8. Scott JA, Aitkin I, Binns CW, Aroni RA: **Factors associated with the duration of breastfeeding amongst women in Perth, Australia.** *Acta Paediatr* 1999, 88(4):416-421.
9. Australian Bureau of Statistics: **National Health Survey questionnaire 1989–1990.** *Canberra*; 1991.
10. De la Mora A, Russell D, Dungy C, Losch M, Dusdieker L: **The Iowa Infant Feeding Attitude Scale: analysis of reliability and validity.** *Journal of Applied Social Psychology* 1999, 29(11):2362-2380.
11. Scott JA, Shaker I, Reid M: **Parental attidtudes toward breastfeeding: Their association with feeding outcome at hospital discharge.** *Birth* 2004, 31(2):125-131.
12. Scott JA, Binns CW, Aroni RA: **The influence of reported paternal attitudes on the decision to breast-feed.** *J Paediatr Child Health* 1997, 33(4):305-307.
13. McDermott L, Russell A, Dobson A: **Cigarette smoking among women in Australia.** In *National Tobacco Strategy 1999–2002/03 occasional paper* National Tobacco Strategy. Canberra: National Tobacco Strategy. Commonwealth Department of Health and Ageing;; 2002.
14. Australian Institute of Health and Welfare: **2004 National Drug Strategy Household Survey: first results. AIHW cat. no. PHE 57.** *Canberra: AIHW* 2005.
15. McDermott L, Dobson A, Russell A: **Changes in smoking behaviour among young women over life stage transitions.** *Aust N Z J Public Health* 2004, 28(4):330-335.
16. Moshin M, Bauman AE: **Socio-demographic factors associated with smoking and smoking cessation among 426,344 pregnant women in New South Wales, Australia.** *BMC Public Health* 2005, 5:138.
17. Connor SK, McIntyre L: **The sociodemographic predictors of smoking cessation among pregnant women in Canada.** *Can J Public Health* 1999, 90(5):352-355.
18. McLeod D, Pullon S, Cookson T: **Factors that influence changes in smoking behaviour during pregnancy.** *N Z Med J* 2003, 116(1173):U418.
19. Severson HH, Andrews JA, Lichtenstein E, Wall M, Zoref L: **Predictors of smoking during and after pregnancy: a survey of mothers of newborns.** *Prev Med* 1995, 24:23-28.
20. Horta BL, Kramer MS, Platt RW: **Maternal smoking and the risk of early weaning: a meta-analysis.** *Am J Public Health* 2001, 91(2):304-307.
21. Ludvigsson JF, Ludvigsson J: **Socio-economic determinants, maternal smoking and coffee consumption, and exclusive breastfeeding in 10205 children.** *Acta Paediatr* 2005, 94:1310-1319.
22. Amir LH, Donath SM: **Does maternal smoking have a negative physiological effect on breastfeeding? The epidemiological evidence.** *Birth* 2002, 29(2):112-123.
23. Liu J, Rosenberg KD, Sandoval AP: **Breastfeeding duration and perinatal cigarette smoking in a population-based cohort.** *Am J Public Health* 2006, 96(2):309-314.
24. World Health Organization: **The optimal duration of exclusive breastfeeding. Report of an expert consultation.** *Geneva; WHO* 2001.
25. Binns CW, Davidson GP: **Infant feeding guidelines for health workers.** In *Food for Health: Dietary Guidelines for Children and Adolescents in Australia* Edited by: NHMRC. Canberra: NHMRC; 2003:452.
26. Gilchrist D, Woods B, Binns CW, Scott JA, Gracey M, Smith H: **Aboriginal mothers, breastfeeding and smoking.** *Aust N Z J Public Health* 2004, 28(3):225-228.
27. Leung GM, Lam T, Ho L: **Breast-feeding and its relation to smoking and mode of delivery.** *Obstet Gynecol* 2002, 99:785-794.
28. Labbok MH, Clark D, Goldman AS: **Breastfeeding: maintaining an irreplaceable immunological resource.** *Nat Rev Immunol* 2004, 4:565-572.
29. Kahn RS, Certain L, Whitaker RC: **A reexamination of smoking before, during, and after pregnancy.** *Am J Public Health* 2002, 92:1801-1808.
30. Pirie PL, Lando H, Curry SJ, McBride CM, Grothaus LC: **Tobacco, alcohol, and caffeine use and cessation in early pregnancy.** *Am J Prev Med* 2000, 18:54-61.
31. Torrent M, Sunyer J, Cullinan P, Basagana X, Harris J, Garcia O, Anto JM: **Smoking cessation and associated factors during pregnancy.** *Gac Sanit* 2004, 18(3):184-189.
32. Dejin-Karlsson E, Hanson BS, Ostergren P, Ranstam J, Isacsson S, Sjoberg N: **Psychosocial resources and persistent smoking in early pregnancy – a population study of women in their first pregnancy in Sweden.** *J Epidemiol Community Health* 1996, 50:33-39.
33. English RM, Najman JM, Bennett SA: **Dietary intake of Australian smokers and nonsmokers.** *Aust N Z J Public Health* 1997, 21:141-146.
34. Cnattingius S, Lindmark G, Meirik O: **Who continues to smoke while pregnant?** *J Epidemiol Community Health* 1992, 46:218-221.

35. Panjari M, Bell RJ, Astbury J, Bishop SM, Dalais F, Rice GE: **Women who spontaneously quit smoking in early pregnancy.** *Australian and New Zealand Journal of Obstetrics and Gynaecology* 1997, 37:271-278.
36. Hakansson A, Lendahls L, Petersson C: **Which women stop smoking?** *Acta Obstetricia et Gynaecologica Scandinavica* 1999, 78:217-224.
37. Lindqvist R, Aberg H: **Who stops smoking during pregnancy?** *Acta Obstetricia et Gynaecologica Scandinavica* 2001, 80:137-141.
38. Suzuki J, Kikuma H, Kawaminami K, Shima M: **Predictors of smoking cessation during pregnancy among the women of Yamato and Ayase municipalities in Japan.** *Public Health* 2005, 119:679-685.
39. Wakefield MA, Jones WR: **Cognitive and social influences on smoking behaviour during pregnancy.** *Australian and New Zealand Journal of Obstetrics and Gynaecology* 1991, 31(3):235-239.
40. Fingerhut LA, Kleinman JC, Kendrick JS: **Smoking before, during and after pregnancy.** *Am J Public Health* 1990, 80(5):541-544.
41. Wakefield M, Reid Y, Roberts L, Mullins R, Gillies P: **Smoking and smoking cessation among men whose partners are pregnant: a qualitative study.** *Soc Sci Med* 1998, 47:657-664.
42. Orleans CT, Barker DC, Kaufman NJ, Marx JF: **Helping pregnancy smokers quit: meeting the challenge in the next decade.** *Tob Control* 2000, 9:iii6-iii11.
43. Ford JH, Dobson AJ: **Smoking and pregnancy.** *Med J Aust* 2004, 181(5):285-286.
44. Lumley J, Oliver SS, Chamberlain C, Oakley L: **Interventions for promoting smoking cessation during pregnancy (review).** *Cochrane Database of Systematic reviews, Published in the Cochrane Library* 2005, 4:.
45. Miller M, Wood L: **Smoking cessation interventions. Review of evidence and implications for best practice in health care settings.** In *National Tobacco Strategy 1999–2002/03 occasional paper* National Tobacco Strategy. Canberra: National Tobacco Strategy. Commonwealth Department of Health and Ageing; 2001.
46. Mabbutt J, Bauman A, Moshin M: **Tobacco use of pregnant women and their male partners who attend antenatal classes: what happened to routine quit smoking advice in pregnancy?** *Aust N Z J Public Health* 2002, 26:571-572.
47. Hunt JM, Lumley J: **Are recommendations about routine antenatal care in Australia consistent and evidence-based?** *Med J Aust* 2002, 176:255-259.
48. DiClemente CC, Dolan-Mullen P, Windsor RA: **The process ofpregnancy cessation: implications for interventions.** *Tob Control* 2000, 9:iii16-iii21.
49. Klebanoff MA, Levine RJ, Morris CD, Hauth JC, Sibai BM, Curet LB, Catalano P, Wilkins DG: **Accuracy of self-reported cigarette smoking among pregnant women in the 1990s.** *Paediatric and Perinatal Epidemiology* 2001, 15:140-143.
50. Heath AC, Knopik VS, Madden PA, Neuman RJ, Lynskey MJ, Slutske WS, Jacob T, Martin NG: **Accuracy of mother's retrospective reports of smoking during pregnancy: comparison with twin sister informant ratings.** *Twin Research* 2003, 6(4):297-301.

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Appendix 2 Consent forms

IMPORTANT – PLEASE COMPLETE AND RETURN THIS FORM IF YOU CAN HELP US WITH THE STUDY

CURTIN UNIVERSITY OF TECHNOLOGY

PERTH INFANT FEEDING STUDY 2002-2004

STUDY OF PERTH INFANT FEEDING PRACTICES

The School of Public Health at Curtin University is studying how Perth babies are fed. As part of this project mothers and fathers of newborn babies in two hospitals in Perth are being asked about their experiences and opinions. Initially as a mother you will be asked to complete a 'Mothers' Questionnaire' while in hospital. Over the following year a Research Officer will contact you periodically by telephone to ask you some further questions as your baby gets older. Fathers may be contacted once more during this time. If you are able to help us with our research, please sign the consent form below and provide us with your name and telephone number.

Thank you in anticipation of your assistance.

Yours sincerely

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September 2002

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September 2002

Perth Infant Feeding Study - Consent Form

I agree to participate in the study of Perth infant feeding practices. I understand that my participation is completely voluntary and I may withdraw from the study at any time. I understand that my participation will be limited to completing a questionnaire and answering some follow-up phone calls during my baby's first year of life. I understand that all interviewers working on the study are qualified health professionals and that all individual data will be kept strictly confidential.

____________________ _______________
Signature Date

____________________ _______________
Name (please print) Telephone number

____

____
Address

IMPORTANT - PLEASE COMPLETE AND RETURN THIS FORM IF YOU CAN HELP US WITH THE STUDY

CURTIN UNIVERSITY OF TECHNOLOGY

PERTH INFANT FEEDING STUDY 2002-2004

STUDY OF PERTH INFANT FEEDING PRACTICES

The School of Public Health at Curtin University is studying how Perth babies are fed. As part of this project mothers and fathers of newborn babies in two hospitals in Perth are being asked about their experiences and opinions. As a father you will be asked to complete a 'Fathers Questionnaire'. Over the following year a Research Officer will contact the baby's mother periodically by telephone to ask some further questions as the baby gets older. You may be contacted as the baby's father perhaps once during this time. If you are able to assist us with our research, please sign the consent form below and provide us with your name and telephone number.

Thank you in anticipation of your assistance.

Yours sincerely

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____
Signature

____
Date

____
Name (please print)

____
Telephone number

____

____
Address

Appendix 3 Mother's In-Hospital baseline questionnaire

Curtin University of Technology

Perth Infant Feeding Study
2002 – 2004

Mothers' 'In-Hospital' Questionnaire

This project is funded by

The Commonwealth Department of Health and Ageing

Dear Mother

We really appreciate your assistance with our study of infant feeding. We know it takes some of your valuable time. We would like to offer you the chance to win a small prize. With the completion of this questionnaire we will put your name into a draw for one of six packages of photographs of your baby and/or your family from PixieFotos. To be included in the draw, just tick the 'Enter Draw 1' box below once you have completed your questionnaire and ensure that we have your correct contact details on the adjacent page. We will draw the prizes for the first draw when we have completed recruiting for the study, which will be in about March 2003.

As you know we would like to ring you regularly to update our information on how your infant is going. At six months of age we will again offer six photo packages. We will ask when we ring you at 6 months if you would like to be included in the second draw.

At the end of the study, everyone who has continued in the study will be asked if they would like to enter our final draw. The final draw will be for a dinner for two at one of Perth's top restaurants with an additional allowance of $100 for taxis and a babysitter.

We really appreciate your help and hope you will enter our draws.

Kathleen and Colin
September 2002

- - -✂- - - - - - - - -✂- - - - - - - - - - - - ✂- - - - - - - - - - - -✂- - - - - - - - - -✂- - - - - - - - - -✂- - -

ENTER DRAW 1 – PIXIEFOTOS	YES	☐	NO	☐
ENTER DRAW 2 – PIXIEFOTOS	YES	☐	NO	☐
ENTER FINAL DRAW – DINNER	YES	☐	NO	☐

CURTIN UNIVERSITY OF TECHNOLOGY

PERTH INFANT FEEDING STUDY 2002-2004

Please circle numbers corresponding to your responses or complete the spaces as indicated below.

Date your baby was born (DD/MM/YY)	___ ___/___ ___/___ ___	
Sex of baby	Male	1
	Female	2
Birth weight (gm)	___ ___ ___ ___	
Birth length (cm)	___ ___.___	
Gestational age of baby at birth (weeks)	___ ___.___	
Total number of children	___	
Hospital	Bentley	1
	Swan District	2
Early discharge program	Yes	1
	No	2

Your name ____________________

Address ____________________

____

Telephone number ____________________

Baby's name ____________________

Father's name ____________________

Address (if different) ____________________

____

Telephone number (if different) ____________________

Office use only

ID _ _ _ _

Recruitment date _ _/_ _/_ _

SECTION 1

office use only

In this section we are interested in finding out about how you are feeding your new baby.

1a How are you feeding your baby?

bottle-feeding infant formula 1
breast-feeding only GO TO Q3..2
mainly bottle-feeding (formula) but also breast-feeding.......................3 (q1a)
mainly breast-feeding but 'topping up' with bottle-feeding (formula)...4
other (please specify)________________________________ (q1a.1)
____

1b If you are giving your baby any bottle-feeds, how many bottles did your baby have yesterday (24 hours)?

infant formula...________ bottles (q1b.1)
water ....________ bottles (q1b.2)
other (please specify)..________ bottles (q1b.3)

2a If you are only bottle-feeding, did you try to breast-feed your baby?

yes 1 (q2a)
no GO TO Q3 2

2b Why did you change to bottle-feeding?

____
________________________________ (q2b.1)
____
________________________________ (q2b.2)

3 When did you **first** decide how you were going to feed your new baby?

before I became pregnant...1
early in my pregnancy 2
late in my pregnancy 3 (q3)
during labour...4
after my baby was born 5

4 Who helped you decide whether you would bottle-feed or breast-feed?

(Please circle **any answers** that apply. You can have more than one answer.)

no one 1 (q4.1)
the baby's father 2 (q4.2)
my mother 3 (q4.3)
other relatives 4 (q4.4)
friends 5 (q4.5)
my doctor 6 (q4.6)
other health professionals e.g., nurse, dietitian 7 (q4.7)
midwife 8 (q4.8)
lactation consultant 9 (q4.9)
alternative practitioner (please specify) 10 (q4.10)
______________________ (q4.11)
other (please specify) ______________________
______________________ (q4.12)
(q4.13)

GO TO Q6a IF YOU ARE BREAST-FEEDING

5 If you decided to bottle-feed your baby from the start, what were the reasons for this choice? (Please circle **any answers** that apply. You can have more than one answer.)

formula is better for the baby 1 (q5.1)
bottle-feeding is easier 2 (q5.2)
I don't like breast-feeding 3 (q5.3)
I will go back to work soon after the birth 4 (q5.4)
breast-feeding will make my breasts sag 5 (q5.5)
the baby's father prefers bottle-feeding 6 (q5.6)
formula is just as good as breast milk 7 (q5.7)
the baby's father can help with bottle-feeding 8 (q5.8)
I want to know how much milk my baby has at each feed 9 (q5.9)
I want to continue smoking 10 (q5.10)
I play a lot of sport 11 (q5.11)
breast-feeding is too embarrassing 12 (q5.12)
my mother suggested bottle-feeding 13 (q5.13)
friend or relative suggested bottle-feeding 14 (q5.14)
health worker (e.g. doctor, nurse) suggested bottle-feeding 15 (q5.15)
other (please specify) ______________________
______________________ (q5.16)
______________________ (q5.17)

6a How much of the time have you kept your baby with you in your room?

all during the day and all of the night 1
all during the day and part of the night 2 (q6a)
all during the day but not overnight 3
part of the day but not all of the day 4
baby has been in the Special Care Nursery all of the time.....................5

6b Where do you think your baby should sleep?

in the same bed with me..1
in the same room but not in the same bed with me.......................2 (q6b)
in another room...3

7 Have you shared your hospital room with other mothers?

yes, one other mother.....................1
no..2 (q7)
yes, two or more other mothers......3

8a If your baby is in the nursery at night, what do the nursery staff **mainly** do when the baby gets hungry?

they bring the baby to me to feed...1
the nurse lets me know and I go to the nursery to feed baby 2
they give baby a bottle of formula 3
they give baby a bottle of my expressed breast milk 4 (q8a)
they give baby a bottle of glucose water 5
they give baby a bottle of plain water 6
I don't know...7

8b Did the hospital staff ask you for your permission before they fed your baby?

yes 1 (q8b)
no..2
they aren't feeding my baby...........3

9 How often are you feeding your baby?

on demand i.e. feeding whenever baby wants to be fed
(e.g., cries out in hunger)..1
by the clock – about every 2 hours...2
by the clock – about every 3 hours...3 (q9)
by the clock – about every 4 hours...4
other (please explain) ________________________________
____ (q9.1)

10 About how long does your baby spend at the breast for a feed?

baby is bottle-feeding 1
less than 15 minutes...2
15 minutes to half an hour 3 (q10)
half an hour to an hour..4
over an hour 5
other (please specify)________________________________ (q10.1)

11a About how many times per day do you feed your baby? (in a 24 hour period)?..__________ times (q11a)

11b About how many of these feeds are breast milk feeds?
....__________ feeds (q11b)

11c About how many of these feeds are formula-feeds?
....__________ feeds (q11c)

12a Have you been encouraged by hospital staff to 'demand feed'? ('demand feeding' is feeding whenever the baby wants to feed)?

yes 1
no..2 (q12a)

12b Have you been satisfied with the hospital's policy about how often you should feed your baby?

yes GO TO Q13a 1
no..2 (q12b)

12c Please explain what you don't like about the hospital's policy.

____ (q12c.1)
____ (q12c.2)
____

13a In general, do you think you have had enough help and information about feeding your baby from hospital staff?

yes GO TO Q14a..1
no 2 (q13a)

13b What kind of help or information would you have liked?

____ (q13b.1)
____
____ (q13b.2)

14a Hospital staff members sometimes have conflicting ideas and opinions about infant feeding. Do you feel you have been given conflicting advice by different members of this hospital staff about feeding your baby?

yes 1
no GO TO Q14c............................2 (q14a)

14b If yes, please explain.

______________________________ (q14b.1)
______________________________ (q14b.2)
____
____

14c How satisfied are you overall with the hospital's advice on feeding your baby?

very satisfied.................................1
satisfied..2 (q14c)
slightly dissatisfied........................3
very dissatisfied 4

15a **Since** you have been **in hospital** have you received any of the following from hospital staff? (Please circle **all** that you have received. You can have more than one answer.)

pamphlets or booklets on **breast-feeding** your baby 1 (q15a.1)
lectures or classes on **breast-feeding** your baby 2 (q15a.2)
demonstrations on how to **breast-feed** your baby 3 (q15a.3)
video (TV) or slide show on how to **breast-feed** your baby.................4 (q15a.4)
individual consultation or discussion with any of the staff about **breast -feeding** your baby 5 (q15a.5)
pamphlets or booklets on **bottle-feeding** your baby.............................6 (q15a.6)
lectures or classes on **bottle-feeding** your baby 7 (q15a.7)
demonstrations on how to **bottle-feed** your baby.................................8 (q15a.8)
video (TV) or slide show on how to **bottle-feed** your baby 9 (q15a.9)
individual consultation or discussion with any of the staff about **bottle -feeding** your baby 10 (q15a.10)
pamphlets or booklets on **introducing solids** to your baby 11 (q15a.11)
lectures or classes on **introducing solids** to your baby 12 (q15a.12)
demonstrations on **introducing solids** to your baby.............................13 (q15a.13)
video (TV) or slide show on **introducing solids** to your baby 14 (q15a.14)
none of the above 15 (q15a.15)
other (please specify) ______________________________
______________________________ (q15a.16)
______________________________ (q15a.17)

15b **Before coming to hospital** to have your baby did you receive any of the following materials or participate in any of the following activities? (Please circle **all** that apply. You can have more than one answer.)

pamphlets or booklets on **breast-feeding** your baby	1	(q15b.1)
lectures or classes on **breast-feeding** your baby	2	(q15b.2)
demonstrations on how to **breast-feed** your baby	3	(q15b.3)
video (TV) or slide show on how to **breast-feed** your baby	4	(q15b.4)
individual consultation or discussion with any of the staff about **breast -feeding** your baby	5	(q15b.5)
pamphlets or booklets on **bottle-feeding** your baby	6	(q15b.6)
lectures or classes on **bottle-feeding** your baby	7	(q15b.7)
demonstrations on how to **bottle-feed** your baby	8	(q15b.8)
video (TV) or slide show on how to **bottle-feed** your baby	9	(q15b.9)
individual consultation or discussion with any of the staff about **bottle -feeding** your baby	10	(q15b.10)
pamphlets or booklets on **introducing solids** to your baby	11	(q15b.11)
lectures or classes on **introducing solids** to your baby	12	(q15b.12)
demonstrations on **introducing solids** to your baby	13	(q15b.13)
video (TV) or slide show on **introducing solids** to your baby	14	(q15b.14)
none of the above	15	(q15b.15)
other (please specify) ______		
______		(q15b.16)
______		(q15b.17)

16 Did your mother breast-feed any of her children?

yes	1	
no	2	(q16)
don't know	3	

17 Does the baby's father have any preference for how you feed your baby?

yes, he prefers bottle-feeding	1	
yes, he prefers breast-feeding	2	
he doesn't mind how I feed my baby	3	(q17)
never really discussed the matter with him	4	

18 Does your mother have any preference for how you feed your baby?

yes, she prefers bottle-feeding	1	
yes, she prefers breast-feeding	2	
she doesn't mind how I feed my baby	3	(q18)
never really discussed the matter with her	4	

19 How have your friends fed their babies?

- most chose to bottle-feed 1
- most chose to breast-feed 2
- some chose to breast-feed and some to bottle-feed 3 (q19)
- friends don't have babies 4
- don't know how they fed their babies 5

20 For the next few weeks, how do you think you will feed your baby?

- continue bottle-feeding 1
- continue breast-feeding 2
- continue to combine breast- and bottle-feeding 3 (q20)
- stop breast-feeding and start bottle-feeding 4
- stop bottle-feeding and start breast-feeding 5
- other (please specify)________________________ (q20.1)

21a When do you plan to first give your baby solids?

- before 2 months 1
- between 2 and 3 months 2
- between 4 and 6 months 3
- between 7 and 9 months 4 (q21a)
- between 10 and 12 months 5
- over 12 months 6
- when baby is ready 7
- I don't know 8
- other (please specify)________________________ (q21a.1)

21b When you are introducing your baby to new foods and fluids over the next 12 months, the likely order that you will give these in is....

- before a breast- or bottle-feed 1
- after a breast- or bottle-feed 2 (q21b)
- not sure 3

21c When did your mother start you on solids?

before 2 months....................1
between 2 and 3 months....................2
between 4 and 6 months....................3
between 7 and 9 months....................4 (q21c)
between 10 and 12 months....................5
over 12 months....................6
when I was ready....................7
I don't know....................8
other (please specify) ______________ (q21c.1)

22 How was your baby delivered?

vaginal without forceps or suction....................1
vaginal with forceps or suction....................2 (q22)
caesarean....................3

23a What was your baby's first feed?

formula....................1
breast milk (or colostrum)....................2
cow's milk....................3 (q23a)
glucose water....................4
plain water....................5
other (please specify)______________ (q23a.1)

23b Did any member of the hospital staff encourage you to put your baby to the breast right after the birth?

yes....................1 (q23b)
no GO TO Q24a....................2

23c Who encouraged you to put your baby to the breast right after the birth? (Please circle **any answers** that apply. You can have more than one answer.)

doctor....................1 (q23c.1)
midwife....................2 (q23c.2)
nurse....................3 (q23c.3)
other....................4 (q23c.4)

24a Has your baby had any health problems, either since the birth or as a result of the birth?

yes....................1 (q24a)
no GO TO Q26....................2

24b What health problems has your baby had?

____ (q24b.1)

____ (q24b.2)

25a Has your baby spent any time in a Special Care Nursery?

yes 1

no GO TO Q26 ....2 (q25a)

25b How long was your baby in the Special Care Nursery?

baby is still in the nursery.......................1

less than one day....................................2

between 1 and 2 days..............................3

between 3 and 4 days..............................4 (q25b)

between 5 and 7 days..............................5

more than 7 days....................................6

26 Is this the first child you have given birth to?

yes GO TO Q28a 1

no..2 (q26)

27 If you have other children, please write how many weeks or months each child was breast-fed and formula-fed and when you introduced new foods and fluids <u>in their first year of life</u>. Include when you introduced cow's milk as a drink to each child.

Child 1			
Total months of breast-feeding	**Total months of formula-feeding**	**Name of new food or fluid introduced to your 1st baby**	**Age of baby when you introduced the new food/fluid**

Child 2			
Total months of breast-feeding	**Total months of formula-feeding**	**Name of new food or fluid introduced to your 2nd baby**	**Age of baby when you introduced the new food/fluid**

Child 3			
Total months of breast-feeding	**Total months of formula-feeding**	**Name of new food or fluid introduced to your 3rd baby**	**Age of baby when you introduced the new food/fluid**

Child 4			
Total months of breast-feeding	**Total months of formula-feeding**	**Name of new food or fluid introduced to your 4th baby**	**Age of baby when you introduced the new food/fluid**

SECTION 2

Now we would like to ask you some questions about your pregnancy.

28a How would you describe the timing of this pregnancy?
- I was actively trying to become pregnant 1
- I was planning to become pregnant at a later time 2 (q28a)
- I was not planning to have this child or any further children 3

28b Were you using any form of contraception at the time you got pregnant?
- yes.. 1 (q28b)
- no.. 2

28c If YES, what method were you using?
- 'rhythm' or 'billings' method 1
- oral contraceptive pill.................................. 2
- IUD.. 3 (q28c)
- condoms or a diaphragm 4
- anti-spermicidal 5
- other (please specify) ____________ (q28c.1)

29 Have you ever attended any antenatal classes or lectures on how to feed your baby?
- yes, for this pregnancy... 1
- no 2 (q29)
- yes, for a previous pregnancy 3
- yes, for this pregnancy and a previous pregnancy 4

30a **Before** you became pregnant, did you smoke cigarettes?
- yes 1 (q30a)
- no GO TO Q30c 2

30b How many cigarettes did you smoke a day before you became pregnant?
....______ (q30b)

30c **While** you were pregnant, did you smoke cigarettes?
- yes 1 (q30c)
- no GO TO Q30e 2

30d How many cigarettes did you smoke a day when you were pregnant?
.... _______ (q30d)

30e Did the baby's father smoke **before** you were pregnant? (q30e)
- yes 1
- no 2

30f Did the baby's father smoke **while** you were pregnant? (q30f)
- yes 1
- no 2

31a **Before** you became pregnant, did you drink alcoholic drinks at all? (q31a)
- yes 1
- no GO TO Q31e 2

31b How many days of the week did you have a drink before you were pregnant?.. _______ (q31b)

31c How many standard drinks did you have each time before you were pregnant?.. _______ (q31c)

note: 1 can of full strength beer (4-6% alcohol) is 1 ½ standard drinks
1 can of mid-strength beer (3-4% alcohol) is 1 standard drink
1 schooner of full-strength beer is 1 standard drink
1 schooner of mid-strength beer is 0.8 standard drinks
½ a glass of wine (100ml of 10-14% alcohol) is 1 standard drink
1 nip of spirits (30 ml of 37-43% alcohol) is 1 standard drink

31d What type of alcoholic drink did you mostly drink before you were pregnant?.. _______ (q31d)

31e **While** you were pregnant, did you drink alcoholic drinks at all? (q31e)
- yes 1
- no GO TO Q31i 2

31f How many days of the week did you have a drink while you were pregnant?.. _______ (q31f)

31g How many standard drinks did you have each time while you were pregnant?.._______ (q31g)

note: 1 can of full strength beer (4-6% alcohol) is 1 ½ standard drinks
1 can of mid-strength beer (3-4% alcohol) is 1 standard drink
1 schooner of full-strength beer is 1 standard drink
1 schooner of mid-strength beer is 0.8 standard drinks
½ a glass of wine (100ml of 10-14% alcohol) is 1 standard drink
1 nip of spirits (30 ml of 37-43% alcohol) is 1 standard drink

31h What type of alcoholic drink did you mostly drink while you were pregnant?.._______ (q31h)

31i Does the baby's father drink alcoholic drinks at all?
yes 1 (q31i)
no GO TO Q32 2

31j Did the baby's father drink **before** you were pregnant?
yes 1 (q31j)
no 2

31k Did the baby's father drink **while** you were pregnant?
yes 1 (q31k)
no 2

32 How much did you weigh before you became pregnant?
_______________ kilograms OR _______________ stones & pounds
[ ][ ][ ].[ ] (q32)

33 How much weight did you gain during your pregnancy?
_______________ kilograms OR _______________ stones & pounds
[ ][ ].[ ] (q33)

34 How tall are you?
_______________ centimetres OR _______________ feet & inches
[ ][ ][ ] (q34)

35a On average, **before** you became pregnant, how many **hours in a day** did you spend in the following sitting activities? Circle a number from 1-7 for each of the following activities below where: **1** = never; **2** = <1 hr; **3** = 1-2 hrs; **4** = 3-4 hrs; **5** = 5-6 hrs; **6** = 7-10 hrs; **7** = ≥11 hrs.

sitting in a car or bus	1 2 3 4 5 6 7	(q35a.1)
sitting at work..	1 2 3 4 5 6 7	(q35a.2)
watching TV...	1 2 3 4 5 6 7	(q35a.3)
sitting at meals...	1 2 3 4 5 6 7	(q35a.4)
other sitting activities (e.g. reading)...............	1 2 3 4 5 6 7	(q35a.5)

35b On average, **before** you became pregnant, how many **hours in a week** did you spend in the following activities? <u>Circle</u> a number from 1-8 for each of the following activities below where: **1** = never; **2** = ½-1hr; **3** = 2-3hrs; **4** = 4-6hrs; **5** = 7-10hrs; **6** = 11-20hrs; **7** = 21-30hrs; **8** = ≥31hrs.

strenuous sports (e.g. jogging, cycling on hills, tennis, swimming laps, aerobics) 1 2 3 4 5 6 7 8 (q35b.1)

vigourous work (e.g. moving heavy furniture, weight lifting or equivalent manual labour) 1 2 3 4 5 6 7 8 (q35b.2)

moderate activity (e.g. housework, brisk walking, golfing, cycling on level ground, gardening, Tai Chi*)* 1 2 3 4 5 6 7 8 (q35b.3)

35c On average, **before** you became pregnant, how many **times in a week** did you take part in vigourous physical activity (strenuous sports or work) long enough to work up a sweat? <u>Circle</u> a number below between 1-8 where: **1** = never; **2** = 1 time; **3** = 2 times; **4** = 3 times; **5** = 4 times; **6** = 5 times; **7** = 6 times; **8** = 7 times or more.

....1 2 3 4 5 6 7 8 (q35c)

36a Just before you became pregnant or during the first three months of your pregnancy, did you eat any food products because they had folate added to them?

yes..1
no 2 (q36a)
don't know 3

36b Just before you became pregnant or during the first three months of your pregnancy, did you drink any beverages because they had folate added to them?

yes..1
no 2 (q36b)
don't know 3

36c Just before you became pregnant or during the first three months of your pregnancy, did you take any vitamin or mineral supplements because they had folate added to them?

yes.. 1
no 2
don't know 3 (q36c)

36d Did you take iron supplements during this pregnancy?

yes, during and before my pregnancy 1
no 2 (q36d)
yes, during my pregnancy only 3

37a Before being admitted to hospital to give birth, were you diagnosed by a medical doctor as having any illnesses or medical conditions?

yes 1 (q37a)
please specify...... ________________ (q37a.1)
no 2

37b Were you taking any prescription medications before coming to hospital to give birth?

yes 1 (q37b)
please specify...... ________________ (q37b.1)
no 2

37c.Are you following a vegetarian diet (i.e. no red meats, chicken or fish)?

yes, vegan (excludes eggs & all dairy foods) 1
no 2
yes, lacto-vegetarian (includes dairy foods but excludes eggs) 3 (q37c)
yes, ovo-vegetarian (includes eggs but excludes dairy foods) 4
yes, lacto-ovo-vegetarian (includes both eggs and diary foods) ... 5

38. For each of the following statements, please indicate how much you agree or disagree by circling the number that most closely corresponds to your opinion. The number '1' indicates strong disagreement, whereas '5' indicates strong agreement.

	Strongly disagree				Strongly agree	
a) The nutritional benefits of breast milk last only until the baby is weaned from breast milk	1	2	3	4	5	(q38a)
b) Formula-feeding is more convenient than breast-feeding	1	2	3	4	5	(q38b)
c) Breast-feeding increases mother-infant bonding	1	2	3	4	5	(q38c)
d) Breast milk is lacking in iron	1	2	3	4	5	(q38d)
e) Formula-fed babies are more likely to be overfed than breast-fed babies	1	2	3	4	5	(q38e)
f) Formula-feeding is the better choice if the mother works outside the home	1	2	3	4	5	(q38f)

	Strongly disagree				Strongly agree	
g) Mothers who formula-feed miss one of the great joys of motherhood	1	2	3	4	5	(q38g)
h) Women should not breast-feed in public places such as restaurants	1	2	3	4	5	(q38h)
i) Babies who are fed breast milk are healthier than babies who are fed formula	1	2	3	4	5	(q38i)
j) Breast-fed babies are more likely to be overfed than formula-fed babies	1	2	3	4	5	(q38j)
k) Fathers feel left out if a mother breast-feeds	1	2	3	4	5	(q38k)
l) Breast milk is the ideal food for babies	1	2	3	4	5	(q38l)
m) Breast milk is more easily digested than formula	1	2	3	4	5	(q38m)
n) Formula is as healthy for an infant as breast milk	1	2	3	4	5	(q38n)
o) Breast-feeding is more convenient than formula-feeding	1	2	3	4	5	(q38o)
p) Breast milk is less expensive than formula	1	2	3	4	5	(q38p)
q) A mother who occasionally drinks alcohol should not breast-feed her baby	1	2	3	4	5	(q38q)

SECTION 3

The following questions are for mothers who are breast-feeding. If you are not breast-feeding at all, please go to Section 4 which starts with question 53 on page 24.

39 How long after the birth was it before you put your new baby to the breast?

- immediately after birth, cord still attached 1
- within 15 minutes 2
- between 15 and 30 minutes 3
- between 30 minutes and 1 hour 4 (q39)
- within a few hours 5
- the next day 6
- baby was given a bottle instead 7
- other (please specify) ______________________________ (q39.1)

____

40 How long was it before your milk came in?

- within one day of the birth 1
- the second day after the birth 2
- the third day after the birth 3 (q40)
- still waiting for milk to come in 4
- other (please specify) ______________________________ (q40.1)

____

41 How much information about breast-feeding were you given by the hospital staff?

- none or very little 1
- some, but I would have liked more 2
- enough 3 (q41)
- more than I wanted 4
- didn't need any information 5

42 Did any staff member check how your baby's mouth was attached to your breast when you first started feeding?

- yes 1
- no 2 (q42)
- didn't need to be checked 3

43 Did any staff member teach you how to position and attach your baby to the breast?

yes 1
no..2 (q43)
I didn't need to be taught..................3

44 Why did you decide to breast-feed? (Please circle **any answers** that apply. You can have more than one answer.)

the baby's father wanted me to breast-feed....................................1 (q44.1)
breast milk is better for the baby..2 (q44.2)
breast-feeding is the right thing to do..3 (q44.3)
breast-feeding is cheaper 4 (q44.4)
breast-fed babies are more intelligent...5 (q44.5)
breast-feeding helps you lose weight 6 (q44.6)
breast-feeding is fashionable..7 (q44.7)
my mother advised me to breast-feed..8 (q44.8)
breast-feeding helps prevent allergies 9 (q44.9)
other people advised me to breast-feed 10 (q44.10)
breast-feeding is more convenient..11 (q44.11)
breast-fed infants have fewer infections.......................................12 (q44.12)
breast-feeding is natural...13 (q44.13)
breast-feeding promotes mother-infant bonding............................14 (q44.14)
other (please specify)________________________________
____ (q44.15)

45a At what age do you plan to stop breast-feeding your baby?

before baby is 6 weeks old..1
between 6 weeks and 2 months 2
between 2 and 3 months...3
between 4 and 6 months...4
between 7 and 9 months...5 (q45a)
between 10 and 12 months..6
over 12 months 7
other (please specify)____________________________ 8 (q45a.1)

45b Are you planning to start giving your baby formula-feeds?

yes 1
no GO TO Q46 ....2 (q45b)
I have already started my baby on formula GO TO Q46.....3

45c At what age do you plan to start giving your baby formula-feeds?

before baby is 6 weeks old 1
between 6 weeks and 2 months 2
between 2 and 3 months 3
between 4 and 6 months 4
between 7 and 9 months 5 (q45c)
between 10 and 12 months 6
over 12 months 7
other (please specify)________ (q45c.1)

46 Have you experienced any of the following since you started breast-feeding? (Please circle **any answers** that apply. You can have more than one answer.)

inverted nipples 1 (q46.1)
cracked or sore nipples 2 (q46.2)
baby gets too much milk 3 (q46.3)
baby gets milk too fast 4 (q46.4)
takes a long time before milk starts flowing at start of feed 5 (q46.5)
baby too tired to feed 6 (q46.6)
difficulty expressing milk 7 (q46.7)
baby not gaining enough weight 8 (q46.8)
baby has problems sucking 9 (q46.9)
breasts engorged (too full) 10 (q46.10)
baby doesn't wake up for feeds 11 (q46.11)
not enough milk or colostrum for baby 12 (q46.12)
feeling that I'm not doing very well at breast-feeding 13 (q46.13)
trouble positioning and/or attaching the baby to the breast 14 (q46.14)
other (please specify) ________ (q46.15)
________ (q46.16)
____

47a Has any member of the hospital staff given you the name of anyone to contact if you have problems with breast-feeding after you leave hospital?

yes 1
no GO TO Q48 .... 2 (q47a)

47b Who were you told to contact?

(Please circle **any answers** that apply. You can have more than one answer.)

doctor	1	(q47b.1)
clinic nurse/community health nurse	2	(q47b.2)
lactation consultant	3	(q47b.3)
Australian Breastfeeding Assoc. (Nursing Mothers Assoc.)	4	(q47b.4)
dietitian	5	(q47b.5)
hospital midwife	6	(q47b.6)
other (please specify)________________		
______________________________		(q47b.7)
______________________________		(q47b.8)

For the following questions, there are no right or wrong answers. Please circle the response that you first think of. For example, in question 48, if you feel very confident in breast-feeding, circle 5. If you don't feel confident, circle 1. If you fall somewhere in-between please circle the appropriate number between 1 and 5. If it is too early to tell, please circle 9.

48 How would you rate your confidence in breast-feeding?

not confident				*very confident*	*too early to tell*	
1	2	3	4	5	9	(q48)

49 How enjoyable do you find breast-feeding?

not enjoyable				*very enjoyable*	*too early to tell*	
1	2	3	4	5	9	(q49)

50 How satisfied are you with your breast-feeding experience?

not satisfied				*very satisfied*	*too early to tell*	
1	2	3	4	5	9	(q50)

51 In general, how comfortable do you feel while breast-feeding in front of other people?

not comfortable				*very comfortable*	*too early to tell*	
1	2	3	4	5	9	(q51)

52 Have any of the following people supported or encouraged you with breast-feeding? (Please circle **any answers** that apply. You can have more than one answer.)

your friends	1	(q52.1)
the baby's father	2	(q52.2)
other members of your family	3	(q52.3)
please specify__________		(q52.4)
your clinic sister	4	(q52.5)
your doctor	5	(q52.6)
Australian Breastfeeding Assoc. (Nursing Mothers Assoc.)	6	(q52.7)
your mother	7	(q52.8)
your mother-in-law	8	(q52.9)
'in-home' help	9	(q52.10)
other (please specify)__________		
__________		(q52.11)
__________		(q52.12)

SECTION 4

The following information about you will help us to analyse our data. We recognise that some of the questions are very personal. Please remember that your responses will remain strictly confidential.

53 What is your postcode? (q53)

If you don't know the postcode, what suburb do you live in?

.. ..______________________________

54 What is your age (years)?

.. ..______________________________ (q54)

55 What is the highest level of education you have completed?

left school before year 10 1

junior/achievement certificate/year 10 or equivalent 2

TEE/TAE/leaving (year 12 or equivalent) 3

trade, diploma or TAFE course e.g., hairdressing, secretarial.......4 (q55)

bachelor degree or higher 5

other (please specify)________________________________

____ (q55.1)

56 How many years of schooling have you completed?

.. ..______________________________ (q56)

57 Were you employed outside the home or studying in the past 6 months?

no 2

yes, full-time employed..1

yes, part-time employed...3

yes, full-time student..4 (q57)

yes, part-time student...5

58 What is your occupation? (If currently unemployed, please give your occupation or job title prior to leaving the workforce. If you were self-employed, please give your occupation or job title e.g. hairdresser.)

.. ..______________________________ (q58)

59 What do you plan to do in the next 6 months?

will still be at home with the baby 1
work full-time 2
work part-time 3
study full-time...4 (q59)
study part-time 5
undecided...6

60 What is your marital status?

never married 1
married...2
defacto 3 (q60)
divorced or separated 4
widowed...5

61 What is your partner's occupation? (If your partner is self-employed, please give his occupation or job title e.g. plumber, electrician. If your partner is currently unemployed, please give your partner's occupation when he is working.)

.. ..______________________________ (q61)

62a In what country were you born?

.. ..______________________________ (q62a)

62b If not born in Australia, how many years have you lived in Australia?

.. ..______________________________ (q62b)

63 In what country was your mother born?

.. ..______________________________ (q63)

64 Are you of Aboriginal or Torres Strait Islander descent?

yes, Aboriginal descent 1
no..2
yes, Torres Strait Islander descent 3 (q64)

65 What type of health insurance do you have?

public (Medicare)...........................1
private...2 (q65)

66a Approximately, what was your total family income for the past 12 months?

less than $10,000............................1
$10,001 to 15,000..........................2
$15,001 to 25,000..........................3
$25,001 to 40,000..........................4 (q66a)
$40,001 to 50,000..........................5
$50,001 to 60,000..........................6
more than $60,000.........................7

66b Are you on paid maternity leave from paid employment?

yes..1 (q66b)
please specify the number of weeks of paid leave_____ (q66b.1)
no..2

67 Finally, how many days old was your baby when you completed this questionnaire? days (q67)

68 Today's date (DD/MM/YY) when you completed this questionnaire:

__ __/__ __/__ __

THANK YOU VERY MUCH FOR YOUR PARTICIPATION

Now that your questionnaire is complete please place it in the box in the Ward office or you can mail it directly in the envelope that was provided.

Appendix 4 Father's baseline questionnaire

Curtin University of Technology

Perth Infant Feeding Study
2002 – 2004

Fathers' Questionnaire

This project is funded by
The Commonwealth Department of Health and Ageing

CURTIN UNIVERSITY OF TECHNOLOGY

PERTH INFANT FEEDING STUDY 2002-2004

Please circle numbers corresponding to your responses or complete the spaces as indicated below.

Date your baby was born (DD/MM/YY)	___ ___/___ ___/___ ___	
Sex of baby	Male	1
	Female	2
Birth weight (gm)	___ ___ ___ ___	
Birth length (cm)	___ ___.___	
Gestational age of baby at birth (weeks)	___ ___.___	
Total number of children	___	
Hospital	Bentley	1
	Swan District	2
Early discharge program	Yes	1
	No	2

Your name ______________________________

Address ______________________________

____

Telephone number ______________________________

Baby's name ______________________________

Mother's name ______________________________

Address (if different) ______________________________

____

Telephone number (if different) ______________________________

Office use only

ID ___ ___ ___ ___

Recruitment date ___ ___/___ ___/___ ___

SECTION 1

office use only

In this section we are interested in your thoughts about infant feeding. First of all we will ask you about your experiences and thoughts leading up to the birth of your new baby.

1 Before the birth, did you and your partner discuss how the baby would be fed?

yes	1	
no	2	(q1)
don't remember	3	

2 Before the birth, did you participate in any of the following activities? (Please circle any answers that apply. You can have more than one answer.)

Read pamphlets on how to feed a baby

yes – on breast-feeding	1	(q2.1)
no	2	(q2.2)
yes – on correct preparation and use of formula	3	(q2.3)
yes – on feeding baby solids	4	(q2.4)

Attend lectures or classes on feeding a baby

yes – on breast-feeding	1	(q2.5)
no	2	(q2.6)
yes – on correct preparation and use of formula	3	(q2.7)
yes – on feeding baby solids	4	(q2.8)

Attend demonstrations on how to feed a baby

yes – on breast-feeding	1	(q2.9)
no	2	(q2.10)
yes – on correct preparation and use of formula	3	(q2.11)
yes – on feeding baby solids	4	(q2.12)

Watch a video (TV) or slideshow on feeding a baby

yes – on breast-feeding	1	(q2.13)
no	2	(q2.14)
yes – on correct preparation and use of formula	3	(q2.15)
yes – on feeding baby solids	4	(q2.16)

Personally discuss the feeding of a baby with a health professional

yes – on breast-feeding 1 (q2.17)

please specify whom ____________________________ (q2.18)

no 2 (q2.19)

yes – on correct preparation and use of formula 3 (q2.20)

please specify whom ____________________________ (q2.21)

yes – on feeding baby solids 4 (q2.22)

please specify whom ____________________________ (q2.23)

3 Do you think that the opinion of a baby's father about how a baby should be fed has any influence on how the baby is fed?

yes 1 (q3)

no 2

other comments____ (q3.1)

____ (q3.2)

4 Were you breast-fed?

yes 1

no 2 (q4)

I don't know 3

5 Did your mother breast-feed any of her children?

yes 1

no 2 (q5)

I don't know 3

6 When did your mother start you on solids?

before 2 months 1

between 2 and 3 months...2

between 4 and 6 months...3 (q6)

between 7 and 9 months...4

between 10 and 12 months...5

over 12 months 6

I don't know 7

7 Does your mother have any preference for how your baby is fed?

yes, she prefers bottle-feeding....... 1

yes, she prefers breast-feeding 2 (q7)

she dosen't mind how I feed my baby 3

never really discussed the matter with her 4

8 Have you talked about feeding babies with your friends/work collegues/mates? (Please circle any answers that apply. You can have more than one answer.)

yes, talked about breast-feeding	1	(q8.1)
no	2	(q8.2)
yes, talked about bottle-feeding	3	(q8.3)
yes, talked about feeding solids	4	(q8.4)

9 What feeding method have your friends and work mates chosen for their babies?

most chose to bottle-feed	1	
most chose to breast-feed	2	(q9)
some chose to breast-feed and some to bottle-feed	3	
friends don't have babies	4	
I don't know	5	

10 How do you think a baby should be fed?

I prefer a baby to be breast-fed	1	
I prefer a baby to be bottle-fed	2	(q10)
I don't mind how the baby is fed	3	
I've never really thought about it	4	

11 Where do you think a baby should be fed?

with other members of the household	1	
separate from other members of the household	2	(q11)
I don't think it matters	3	

12 Where do you think a baby should sleep?

in the same bed with the mother	1	
in the same room but not in the same bed as the mother	2	(q12)
in another room	3	

13 When your baby is having other foods and fluids introduced over the next 12 months, in what order do you think the baby should have these?

before a breast-feed or bottle-feed	1	
after a breast-feed or bottle-feed	2	(q13)
I don't know	3	

14 What role did you play in the decision on how your baby would be fed?

both the baby's mother and I discussed it freely and decided together.. ....1 (q14)

my preference was the major influence on how the baby would be fed 2

I didn't play a role in the decision 3

other comments____ (q14.1)

____ (q14.2)

15 To encourage mothers to **start** breast-feeding their babies, it would be helpful to have (Please circle any answers that apply. You can have more than one answer.):

support from health professionals... ....1 (q15.1)

specify what____ (q15.2)

support from relatives 2 (q15.3)

specify what____ (q15.4)

support from friends 3 (q15.5)

specify what____ (q15.6)

support from the general community..4 (q15.7)

specify what____ (q15.8)

support from employers 5 (q15.9)

specify what____ (q15.10)

support from me as a father........... ....6 (q15.11)

specify what____ (q15.12)

I don't think mothers need to breast-feed their babies 7 (q15.13)

16 To encourage mothers to **breast-feed** their babies **for longer**, it would be helpful to have (Please circle any answers that apply. You can have more than one answer.):

extra support from health professionals..1 (q16.1)

specify what____ (q16.2)

extra support from relatives 2 (q16.3)

specify what____ (q16.4)

extra support from friends............. ....3 (q16.5)

specify what____ (q16.6)

extra support from the general community...4 (q16.7)

specify what____ (q16.8)

extra support from employers 5 (q16.9)

specify what____ (q16.10) extra support from me as a father 6 (q16.11)

specify what_______________________________________ (q16.12)

I don't think mothers need to breast-feed their babies for longer 7 (q16.13)

SECTION 2

Now we would like to ask you some questions about the opinions of men in general. Please think about how your mates would answer the following questions.

17 What do you think men generally think about breast-feeding? Please circle **1** for 'yes', **2** for 'no' and **3** for 'don't know' after each of the following statements.

	yes	*no*	*don't know*	
breast-feeding is best for babies	1	2	3	(q17.1)
breast-feeding helps women to lose weight ..... after pregnancy	1	2	3	(q17.2)
breast-feeding makes women's breasts .... saggy	1	2	3	(q17.3)
breast-feeding makes women's breasts .... smaller	1	2	3	(q17.4)
breasts should not be seen in public .... when breast-feeding	1	2	3	(q17.5)
breasts are made for breast-feeding	1	2	3	(q17.6)
women should breast-feed for as long .... as their children need	1	2	3	(q17.7)
women don't need to breast-feed any more ..... now that there's infant formula	1	2	3	(q17.8)
breast-feeding takes too much time – more ..... time than bottle-feeding	1	2	3	(q17.9)
breast-feeding means less time for men...........	1	2	3	(q17.10)
breast-feeding in public is baring too much.....	1	2	3	(q17.11)
breast-feeding gives too much attention to ...... the baby and can spoil the baby	1	2	3	(q17.12)
breast-feeding doesn't allow fathers to feed .... their babies	1	2	3	(q17.13)
women have less energy and time for the........ the baby's father if they breast-feed	1	2	3	(q17.14)

18 How would your mates feel if a woman in a restaurant began to breast-feed at a nearby table? (Please circle **any** answers that apply. You can have more than one answer.)

wouldn't notice.............................. ....1 (q18.1)

would approve.............................. ....2 (q18.2)

would try and look the other way... ....3 (q18.3)

would be embarrassed and not approve...4 (q18.4)

other____ (q18.5)

____ (q18.6)

19 How would your mates feel if their mate's wife began to breast- feed at a nearby table in a restaurant? (Please circle **any** answers that apply. You can have more than one answer.)

wouldn't notice.............................. ....1 (q19.1)

would approve.............................. ....2 (q19.2)

would try and look the other way... ....3 (q19.3)

would be embarrassed and not approve...4 (q19.4)

other____ (q19.5)

____ (q19.6)

20 How do men feel when their mate's friend removes her top while sun-baking at the beach? (Please circle **any** answers that apply. You can have more than one answer.)

wouldn't notice.............................. ....1 (q20.1)

would approve.............................. ....2 (q20.2)

would try and look the other way... ....3 (q20.3)

would be embarrassed and not approve...4 (q20.4)

other____ (q20.5)

____ (q20.6)

21 How do you think men would react if a mate took paternity leave? (Please circle **any** answers that apply. You can have more than one answer.)

wouldn't mind.............................. ....1 (q21.1)

would approve.............................. ....2 (q21.2)

wouldn't approve.......................... ....3 (q21.3)

other____ (q21.5)

____ (q21.6)

SECTION 3

We would now like to ask you about your general opinions and feelings about infant feeding.

22 For each of the following statements, please indicate how much you agree or disagree by circling the number that most closely corresponds to your opinion. The number '1' indicates strong disagreement, whereas '5' indicates strong agreement.

	Strongly disagree				Strongly agree	
a) The nutritional benefits of breast milk last only until the baby is weaned from breast milk	1	2	3	4	5	(q22a)
b) Formula feeding is more convenient than breast-feeding	1	2	3	4	5	(q22b)
c) Breast-feeding increases mother-infant bonding	1	2	3	4	5	(q22c)
d) Breast milk is lacking in iron	1	2	3	4	5	(q22d)
e) Formula-fed babies are more likely to be overfed than breast-fed babies	1	2	3	4	5	(q22e)
f) Formula feeding is the better choice if the mother works outside the home	1	2	3	4	5	(q22f)
g) Mothers who formula-feed miss one of the great joys of motherhood	1	2	3	4	5	(q22g)
h) Women should not breast-feed in public places such as restaurants	1	2	3	4	5	(q22h)
i) Babies who are fed breast milk are healthier than babies who are fed formula	1	2	3	4	5	(q22i)
j) Breast-fed babies are more likely to be overfed than formula-fed babies	1	2	3	4	5	(q22j)
k) Fathers feel left out if a mother breast-feeds	1	2	3	4	5	(q22k)

	Strongly disagree				Strongly agree	
l) Breast milk is the ideal food for babies	1	2	3	4	5	(q22l)
m) Breast milk is more easily digested than formula	1	2	3	4	5	(q22m)
n) Formula is as healthy for an infant as breast milk	1	2	3	4	5	(q22n)
o) Breast-feeding is more convenient than formula-feeding	1	2	3	4	5	(q22o)
p) Breast milk is less expensive than formula	1	2	3	4	5	(q22p)
q) A mother who occasionally drinks alcohol should not breast-feed her baby	1	2	3	4	5	(q22q)

The next few statements are related to breast-feeding. Please answer 'true', 'false' or 'don't know'. It really doesn't matter if you don't know. Please answer the questions to the best of your ability.

23 Feeding more often increases milk supply

true 1
false 2 (q23)
don't know 3

24 Babies need to feed more when they are having a growth spurt

true 1
false 2 (q24)
don't know 3

25 There are lots of women who need to give their babies formula because they can't make enough milk

true 1
false 2 (q25)
don't know 3

26 Birth control pills can reduce milk supply

true 1
false 2 (q26)
mini-pill won't but normal pill will 3
don't know 4

27 Getting extra rest and relaxation is necessary to ensure a good milk supply

true 1
false 2 (q27)
don't know 3

28 Feeding formula to a one month old baby will not reduce the amount of milk produced by the mother

true 1
false 2 (q28)
don't know 3

29 Babies naturally know how to breast-feed correctly

true 1
false 2 (q29)
don't know 3

30 Formula-fed babies sleep longer at night

true 1
false 2 (q30)
don't know 3

SECTION 4

The following information about you will help us to analyse our data. We recognise that some of the questions are very personal. Please remember that your responses will remain strictly confidential.

---

31 What is your postcode?... .... _ _ _ _ (q31)

32 If you don't know your postcode, what suburb do you live in?

____________________________ (q32)

33 What is your age (years)?... ....______ (q33)

34 What is the highest level of education you have completed?
left school before year 10.............. 1
junior/achievement certificate/year 10 or equivalent 2 (q34)
TEE/TAE/leaving (year 12 equivalent)..3
trade, diploma or TAFE course e.g. business studies............................4
bachelor degree or higher............. 5
other (please specify) ____ (q34.1)

35 How many years of schooling have you completed?................... _____ (q35)

36 Are you employed outside the home or studying at the moment?
yes, full-time employed 1
no (go to question 38).................. ....2 (q36)
yes, part-time employed................ 3
yes, full-time student 4
yes, part-time student.................... 5

37 Do you work shift work?
yes 1 (q37)
no 2

38 Are you away from home for long periods of time?
yes... .... 1 (q38)
no 2

39 What is your occupation?......... .....____________________________ (q39)
(If you are self-employed, please give your occupation or job title e.g. plumber, office manager, hairdresser. If you are currently unemployed, please give your occupation when you were working.)

40 What do you plan to do in the next 6 months?
be at home with the baby 1
work full-time.............................. ....2 (q40)
work part-time 3
study full-time 4
study part-time.............................. 5
undecided 6

41 What is your marital status?

never married..1
married..2 (q41)
defacto..3
divorced or separated...4
widowed...5

42 Is this your first child?

yes 1 (q42)
no 2
number of children .... ______________ (q42.1)

43 What is your partner's occupation? ....________________ (q43)
(If your partner is a homemaker but was previously employed outside the home, please give their occupation when employed outside the home.)

44 In what country were you born? ....________________ (q44)

45 In what country was your mother born? ....________________ (q45)

46 Are you of Aboriginal or Torres Strait Islander descent?

yes, Aboriginal descent... 1
no 2 (q46)
yes, Torres Strait Islander descent... 3

47 What type of health insurance do you have?

public (Medicare) 1 (q47)
private 2

48 Approximately, what was your total family income for the past 12 months?

less than $10,000 1
$10,001 to $15,000 .... 2 (q48)
$15,001 to $25,000 3
$25,001 to $40,000 4
$40,001 to $50,000 5
$50,001 to $60,000 6
more than $60,000 7

49 If you were working in paid employment recently, or you are currently in paid employment, do you know if your employer supports parental leave for the birth of a child? (q49)

yes, he supports parental leave 1

specify support offered ______________________________ (q49.1)

______________________________ (q49.2)

no, he doesn't support parental leave 2

I don't know 3

I haven't been in paid employment recently.. 4

50 Are you on paid paternity leave from paid employment?

yes 1 (q50)

number of weeks of paid paternity leave ...... _____________ (q50.1)

no 2

SECTION 5

This last section asks about your general health and lifestyle.

---

51 Did you smoke cigarettes **before** the pregnancy (of the baby's mother)?

yes 1 (q51)

no (go to question 53).. 2

52 How many cigarettes did you smoke everyday before the pregnancy?

...._______ (q52)

53 **During** the pregnancy of the baby's mother, did you smoke cigarettes?

yes 1 (q53)

no (go to question 55).. 2

54 How many cigarettes did you smoke everyday during the pregnancy?

...._______ (q54)

55 Did you drink alcoholic drinks at all **before** the pregnancy of the baby's mother?

yes 1 (q55)

no (go to question 59).. 2

56 How many days of the week did you have a drink before the pregnancy?
....________ (q56)

57 How many standard drinks did you have each time before the pregnancy?
....________ (q57)

note: 1 can of full strength beer (4-6% alcohol) is 1 ½ standard drinks
1 can of mid-strength beer (3-4% alcohol) is 1 standard drink
1 schooner of full-strength beer is 1 standard drink
1 schooner of mid-strength beer is 0.8 standard drinks
½ a glass of wine (100ml of 10-14% alcohol) is 1 standard drink
1 nip of spirits (30 ml of 37-43% alcohol) is 1 standard drink

58 What type of alcoholic drink did you mostly drink before the pregnancy?
....________ (q58)

59 **During** the pregnancy of the baby's mother, did you drink alcoholic drinks at all?
yes 1 (q59)
no (go to question 63).. 2

60 How many days of the week did you have a drink during the pregnancy?
....________ (q60)

61 How many standard drinks did you have each time during the pregnancy?
....________ (q61)

note: 1 can of full strength beer (4-6% alcohol) is 1 ½ standard drinks
1 can of mid-strength beer (3-4% alcohol) is 1 standard drink
1 schooner of full-strength beer is 1 standard drink
1 schooner of mid-strength beer is 0.8 standard drinks
½ a glass of wine (100ml of 10-14% alcohol) is 1 standard drink
1 nip of spirits (30 ml of 37-43% alcohol) is 1 standard drink

62 What type of alcoholic drink did you mostly drink during the pregnancy?
....________ (q62)

63 On average, how many **hours in a day** do you spend in the following sitting activities? <u>Circle</u> a number from 1-7 for each of the following activities below where: **1** = never; **2** = <1hr; **3** = 1-2 hrs; **4** = 3-4 hrs; **5** = 5-6 hrs; **6** = 7-10 hrs; **7** = ≥ 11 hrs

sitting in a car or bus..1 2 3 4 5 6 7 (q63.1)
sitting at work..1 2 3 4 5 6 7 (q63.2)
watching TV 1 2 3 4 5 6 7 (q63.3)
sitting at meals 1 2 3 4 5 6 7 (q63.4)
other sitting activities (e.g. reading, computing) 1 2 3 4 5 6 7 (q63.5)

64 On average, how many **hours in a week** do you spend in the following activities? <u>Circle</u> a number from 1-8 for each of the following activities below where: **1** = never; **2** = ½-1hr; **3** = 2-3hrs; **4** = 4-6hrs; **5** = 7-10hrs; **6** = 11-20hrs; **7** = 21-30hrs; **8** = ≥31hrs.

strenuous sports (e.g. jogging, cycling on hills, tennis, swimming laps, aerobics)...1 2 3 4 5 6 7 8 (q64.1)
vigourous work (e.g. moving heavy furniture, weight lifting or equivalent manual labour) 1 2 3 4 5 6 7 8 (q64.2)
moderate activity (e.g. housework, brisk walking, golfing, cycling on level ground, gardening, Tai Chi).........1 2 3 4 5 6 7 8 (q64.3)

65 On average, how many **times in a week** do you take part in vigourous physical activity (strenuous sports or work) long enough to work up a sweat? <u>Circle</u> a number below between 1-8 where: **1** = never; **2** = 1 time; **3** = 2 times; **4** = 3 times; **5** = 4 times; **6** = 5 times; **7** = 6 times; **8** = 7 times or more.

....1 2 3 4 5 6 7 8 (q65)

66 What is your weight?

_________________ kilograms OR ________________ stones & pounds (q66)

67 What is your height?

_________________ centimetres OR ________________ feet & inches (q67)

68 Are you following a vegetarian diet (i.e. no red meats, chicken or fish)?

yes, vegan (excludes eggs & all dairy foods) 1
no 2
yes, lacto-vegetarian (includes dairy foods but excludes eggs) 3 (q68)
yes, ovo-vegetarian (includes eggs but excludes dairy foods) 4
yes, lacto-ovo-vegetarian (includes both eggs and diary foods) 5

69 Today's date (DD/MM/YY) when you completed this questionnaire

__ __/__ __/__ __ (q69)

THANK YOU VERY MUCH FOR YOUR PARTICIPATION

Now that your questionnaire is complete please place it in the box in the Ward office or you can mail it directly in the envelope that was provided.

Appendix 5 Mother's follow-up questionnaire

Curtin University: Perth Infant Feeding Study 2002 - 2004

MOTHER'S NAME:

BABY'S NAME:

PHONE NUMBER:

Married / Defacto / Single (circle)

Other children:

Address:

Preferred time/s to call:

Dates away:

IDENTIFICATION CODE

Baby's father's ID Code ___ ___ ___

DURATION (WEEKS) (dur)

COMPLETED STUDY

OR

LOST TO FOLLOW-UP AFTER _______ WK INTERVIEW

(cf)

	A 4 weeks	B 10 weeks	C 16 weeks	D 22 weeks	E 32 weeks	F 40 weeks	G 52 weeks
Date interview due							
Date interview completed							
Dates/times tried							
Notes							
Age of baby							

1

1a. **How are you feeding your baby?**.................. **1** = breast-feeding exclusively; **2** = breast-feeding fully (with occasional water and juice); **3** = formula-feeding only GO TO Q2; **4** = combination of breast-feeding and formula-feeding GO TO Q2; **5** = other GO TO Q2 other responses:...	A	B	C	D	E	F	G

A ____

B ____

C ____

D ____

E ____

F ____

G ____

Other possibilities may include:

- cow's milk only/infant formula & cow's milk/breast-feeding & cow's milk
- solids & breast-feeding with or without cow's milk
- infant formula with or without cow's milk

Check the use of other 'milks' such as soy, rice etc. Note the brand of formula/'milk'

IF MOTHER HAS STOPPED BREAST-FEEDING SINCE LAST INTERVIEW ENSURE BREAST-FEEDING TERMINATION QUESTIONS ARE COMPLETED AT THE END OF THE QUESTIONNAIRE

1b. **Has your baby received any formula or other drinks or foods since his/her birth** (or **when we last spoke**)? ....

1 = yes; occasional bottle of formula; **2** = no;
3 = yes, other

A	B	C	D	E	F	G

other responses:..

A ____________________
B ____________________
C ____________________
D ____________________
E ____________________
F ____________________
G ____________________

GO TO Q5a IF FEEDING METHOD HAS NOT CHANGED SINCE LAST INTERVIEW

2. **Why did you change feeding methods?**..............

A ____________________
B ____________________
C ____________________
D ____________________
E ____________________
F ____________________
G ____________________

GO TO Q16 IF NOT BREAST-/BOTTLE-FEEDING	A	B	C	D	E	F	G
5a. **How many times per day on average do you feed your baby (24 hours)?**......................................							
5b. **How many of these feeds would be breast-feeds (in 24 hours)?** (use 00 if none).............................							
5c. **How many of these feeds would be formula-feeds (in 24 hours)?** (use 00 if none) GO TO Q6a IF 00.....							
5d. **What size bottle are you using (ml)?**...............							
6a. **How many times, on average, would your baby feed between the hours of 10.00 pm and 6.00 am?**.....							
6b. **How many of these feeds would be breast-feeds?**							
6c. **How many of these feeds would be bottle-feeds (formula)?**...							
7a. **What is the average length of each feeding episode?**... **1** = < 15 minutes; **2** = ≥ 15 minutes but < 30 minutes; **3** = ≥ 30 minutes but < 1 hour; **4** = ≥ 1 hour							

GO TO Q10 IF NOT BREAST-FEEDING AT ALL							
7b. **If your baby is still hungry after a breast-feed, do you give him/her a top-up formula-feed?** **1** = yes; **2** = no GO TO Q11 IF NOT USING ANY BOTTLE-FEEDS..							

	A	B	C	D	E	F	G
10. **At what times do you usually give your baby bottle-feeds**……………………………………………… **1** = no particular time; **2** = mainly during the day; **3** = mainly during the night; **4** = late afternoon (around dinner time); **5** = when I need to go out							
GO TO Q16 IF 'YES' AT ANY PAST I/V 11. **Have you expressed your milk since we last spoke** (or **since you left hospital**)? **1** = yes; **2** = no GO TO Q16……………………………………							
13. **What method did you use to express your milk**? **1** = hand express; **2** = manual pump; **3** = electric pump – single; **4** = electric pump – double……………………							
12. **Why did you express your milk**?………………… **1** = wanted extra breast-milk just in case; **2** = feed to be given by someone else (going to work); **3** = feed to be given by someone else (baby-sitting); **4** = had too much milk/uncomfortable; **5** = sore nipples/engorgement; **6** = baby given tube feeds; **7** = baby ill; **8** = self ill; **9** = other							
other responses:…………………………………………							

A ______________________ E ______________________

B ______________________ F ______________________

C ______________________ G ______________________

D ______________________

	A	B	C	D	E	F	G
14. **Did you have any difficulties expressing your milk?** **1** = yes; **2** = no GO TO Q16........................							
15. **What difficulties - expressing milk?**..................... 1 = took too long; **2** = was painful; **3** = couldn't get very much/enough milk; **4** = other difficulties experienced (expressing milk)							
other difficulties (experienced expressing):..............							

A

B

C

D

E

F

G

GO TO Q24b IF NOT BR/FEEDG AT LAST I/V

16. **Have you had any difficulties with breast-feeding since I spoke to you last** (or **you left hospital), so things like; - problems with your breasts or problems with the baby feeding?** 1 = yes; **2** = no GO TO Q24b..........................							

17. **What difficulties experienced**? (unprompted, but probe for more than one answer)	A	B	C	D	E	F	G
Problems with breasts……………………………… **1** = cracked or sore nipples; **2** = breasts engorged (too full); **3** = mastitis or breast infection; **4** = inverted nipples; **5** = breast-feeding is painful							
Problems with baby feeding……………………… **6** = baby not gaining enough weight; **7** = baby has difficulties sucking; **8** = baby gets too much milk or too fast; **9** = poor 'let-down'; **10** = baby refuses to breast-feed; **11** = baby too tired to feed i.e. falls asleep at breast; **12** = feeling that I'm not doing very well at breast-feeding; **13** = not enough milk for baby; **14** = others							
Any others? other responses:……………………………………							

A ______________________ E ______________________

B ______________________ F ______________________

C ______________________ G ______________________

D ______________________

Q18 – ASK AT THE 4 WEEK I/V ONLY.

	A
18a. **Did you expect to have difficulties establishing breast-feeding?** 1 = yes; 2 = no……………………….	☐

18b. **How easy did you think it would be to establish breast-feeding on a scale of 1 to 5 where 1 equals very easy and 5 equals very hard?**……………………	very easy 1	2	3	4	very hard 5
18c. **In reality how easy has it been for you to establish breast-feeding on a scale of 1 to 5 where 1 equals very easy and 5 equals very hard?**…………….	very easy 1	2	3	4	very hard 5

		B	C	D	E	F	G
19. **Have you asked for advice or help from anyone about your breast-feeding problem(s)?**…………………	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐
2 = no – GO TO Q24b; **1** = yes, doctor; **3** = yes, child health nurse; **4** = yes, hospital midwife;	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐
5 = yes, friend/s; **6** = yes, mother; **7** = yes, other family member; **8** = yes, Aust. B'feeding Assoc (NMA)	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐
9 = yes, pharmacist/chemist; **10** = yes, pharmacy nurse;	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐
11 = yes, pharmacy assistant; **12** = yes, lactation consultant; **13** = yes, alternative practitioner; **14** = yes, breast-feeding helpline/hotline;	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐
15 = yes, other responses other responses:…………………………………………	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐

A ______________________ E ______________________

B ______________________ F ______________________

C ______________________ G ______________________

D ______________________

	A	B
GO TO Q24b IF PAST THE 10 WEEK I/V 20. **Did anyone check to see how your baby's mouth was attached to your breast?** **1** = yes; **2** = no…………	☐	☐
21. **Has the clinic nurse** (or **anyone else**) **taught you how to position and attach your baby to the breast?** **1** = yes; **2** = no; **3** = I didn't need to be taught………….	☐	☐
22. **In general, do you feel you have had enough help and advice about feeding since you left hospital** (or **since we last spoke**)?…………………………… **1** = yes - needed help and got it GO TO Q24b; **2** = no - needed help but not available/or insufficient help; **3** = haven't needed any help GO TO Q24b	☐	☐
23. **What kind of help would you have liked?**	☐☐	☐☐
other types of help:………………………………………	☐☐	☐☐

A ______________________________

B ______________________________

			C	D	E	F	G
24b. **Have you had any follow-up to see how you're going with feeding _______ since leaving hospital**/or **since last time we spoke?**…………………………… **1** = yes; **2** = no GO TO Q24a	☐	☐	☐	☐	☐	☐	☐

	A	B	C	D	E	F	G
24c. **Please specify the follow-up** type of follow-up:..							

A ______
B ______
C ______
D ______
E ______
F ______
G ______

24a. **Have different people given you conflicting advice about feeding since we last spoke** (or **since you left hospital**)? **1** = yes; **2** = no GO TO Q26.............							
25. **Please explain - what type of conflicting advice have you been given?**...................................... types of conflicting advice:							

A ______
B ______
C ______
D ______
E ______
F ______
G ______

	A	B	C	D	E	F	G
26. **Have you seen any advertisements for infant formula since we last spoke** (or **since you left hospital**)? **1** = yes; **2** = no - GO TO Q28a if using formula or GO TO Q34a if not using formula………	☐	☐	☐	☐	☐	☐	☐
27. **Where did you see the ad?**………………………… responses:	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐

A ______________________________

B ______________________________

C ______________________________

D ______________________________

E ______________________________

F ______________________________

G ______________________________

GO TO Q34a IF FORMULA NOT INTRODUCED 28a. **What type of formula are you using?** (SEE LIST Don't prompt unless 'I don't know'). …………………	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐

A ______________________________

B ______________________________

C ______________________________

D ______________________________

E ______________________________

F ______________________________

G ______________________________

INFANT FORMULA LIST	A	B	C	D	E	F	G
1 = SMA infant formula (Wyeth)							
2 = S26 from birth infant formula (Wyeth)							
3 = S26 infant formula 0-6 months (Wyeth)							
4 = S26 Gold infant formula 0-3 months (Wyeth)							
5 = Infasoy infant formula (Wyeth)							
6 = S26 LF (lactose free) infant formula (Wyeth)							
7 = S26 AR (anti reflux) infant formula (Wyeth)							
8 = S26 Progress 2 (6 months +) (Wyeth)							
9 = S26 Progress Gold (6 months +) (Wyeth)							
10 = Infasoy Progress infant formula (Wyeth)							
11 = S6 Toddler (Wyeth)							
12 = Lactogen starter infant formula (with iron) (Nestle)							
13 = Nan 1 starter infant formula with iron (Nestle)							
14 = Nan HA1 easy to digest starter infant formula (Nestle)							
15 = Nan 2 follow-up formula with iron (Nestle)							
16 = Neslac Formula Bifidus Toddler (Nestle)							
17 = Heinz Nuture Starter infant formula (Heinz)							
18 = Heinz Nuture Gold Starter infant formula (Heinz)							
19 = Heinz Nuture Follow-on infant formula (Heinz)							
20 = Heinz Nuture Gold Follow-on infant formula (Heinz							
21 = Heinz Nuture Toddler (Heinz)							

INFANT FORMULA LIST	A	B	C	D	E	F	G
22 = Karicare infant starter **formula** 1 **(Nutricia)**							
23 = Karicare Gold starter **infant formula** 1 **(Nutricia)** ...							
24 = Karicare Goat **infant starter formula** 1 **(Nutricia)** ..							
25 = Karicare Soya **infant formula (Nutricia)**							
26 = Karicare AR thickened **infant formula (Nutricia)** ...							
27 = Karicare infant follow-on **formula** 2 **(Nutricia)**							
28 = Karicare Gold follow-on **formula** 2 **(Nutricia)**							
29 = Karicare Goat follow-on **formula** 2 **(Nutricia)**							
30 = Karicare Soya follow-on **(Nutricia)**							
31 = Toddler growing up **formula** 3 **(Nutricia)**							
32 = Enfalac Starter **infant formula (Mead Johnson)**							
33 = Enfapro **infant formula (Mead Johnson)**							
34 = specialised infant formula/other							
specify type and brand:......................................							

A ______________________________

B ______________________________

C ______________________________

D ______________________________

E ______________________________

F ______________________________

G ______________________________

28b. **When did you begin ______ (baby) on this formula (weeks) ?**..	A	B	C	D	E	F	G

A ______________________________

B ______________________________

C ______________________________

D ______________________________

E ______________________________

F ______________________________

G ______________________________

28c. **Where do you buy this formula/milk from?**.......							
1 = pharmacy/chemist; **2** = supermarket; **3** = hospital; **4** = GP; **5** = community health service; **6** = other places							
other places:..							

A ________________ E ________________

B ________________ F ________________

C ________________ G ________________

D ________________

29a. **Why did you choose this particular formula?** (Do not prompt but probe for more than one answer)…..	A	B	C	D	E	F	G
1 = recommended by hospital staff; **2** = recommended by child health nurse; **3** = recommended by friend; **4** = recommended by mother; **5** = recommended by other family member; **6** = saw it advertised; **7** = it was the cheapest; **8** = recommended by chemist; **9** = recommended by doctor; **10** = available in trial size; **11** = saw it being used in the hospital; **12** = used it before; **13** = recommended by pharmacy nurse; **14** = recommended by pharmacy assistant; **15** = recommended by alternative health practitioner; **16** = other reasons							
other reasons:…………………………………………							

A ____________________

B ____________________

C ____________________

D ____________________

E ____________________

F ____________________

G ____________________

	A	B	C	D	E	F	G
29b. **When are you making up baby's infant formula**?...... **1** = just before feeding the baby; **2** = up to half an hour before; **3** = over ½ hour but less than an hour before; **4** = between 1 hour but less than 2 hours in advance; **5** = between 2 but less than 3 hours in advance; **6** = a day in advance; **7** = the night before; **8** = other lengths of time other lengths of time......							

A ______________________ E ______________________

B ______________________ F ______________________

C ______________________ G ______________________

D ______________________

	A	B	C	D	E	F	G
29c. **Once you do make up a bottle how long would you store the made-up formula before discarding it as unsafe to use**? **1** = less than one day; **2** = between 1 but less than 2 days; **3** = between 2 but less than 3 days; **4** = other lengths of time (hours) other lengths of time:......							

A ______________________ E ______________________

B ______________________ F ______________________

C ______________________ G ______________________

D ______________________

oher lengths of time:

A ____________________

B ____________________

C ____________________

D ____________________

E ____________________

F ____________________

G ____________________

29d. **How did you sterilise the bottles and teats yesterday?**............ **1** = used Milton; **2** = used boiling water; **3** = used the microwave; **4** = other methods other methods:............	**A**	**B**	**C**	**D**	**E**	**F**	**G**
	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐
	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐

A ____________________

B ____________________

C ____________________

D ____________________

E ____________________

F ____________________

G ____________________

	A	B	C	D	E	F	G
GO TO Q34a IF FORMULA NOT INTRODUCED FOR THE FIRST TIME 30. **Have you tried other formulas since last time we spoke?** **1** = yes; **2** = no GO TO Q34a......................							
31. **What other type of formula/s?** (SEE LIST. Do not prompt, unless 'I don't know')................................							
INFANT FORMULA LIST							
1 = SMA infant **formula (Wyeth)**							
2 = S26 from birth **infant formula (Wyeth)**							
3 = S26 infant **formula** 0-6 months **(Wyeth)**							
4 = S26 Gold **infant formula 0-3 months (Wyeth)**							
5 = Infasoy **infant formula (Wyeth)**							
6 = S26 LF **(lactose free) infant formula (Wyeth)**							
7 = S26 AR **(anti reflux) infant formula (Wyeth)**							
8 = S26 Progress 2 **(6 months +) (Wyeth)**							
9 = S26 Progress Gold **(6 months +) (Wyeth)**							
10 = Infasoy Progress **infant formula (Wyeth)**							
11 = S6 Toddler **(Wyeth)**							
12 = Lactogen starter **infant formula (with iron) (Nestle)**							
13 = Nan 1 starter **infant formula with iron (Nestle)**							
14 = Nan HA1 **easy to digest starter infant formula (Nestle)**							

INFANT FORMULA LIST	A	B	C	D	E	F	G
15 = Nan 2 follow-up formula **with iron (Nestle)**							
16 = Neslac Formula Bifidus Toddler **(Nestle)**							
17 = Heinz Nuture Starter **infant formula (Heinz)**							
18 = Heinz Nuture Gold **Starter infant formula (Heinz)** .							
19 = Heinz Nuture Follow-on **infant formula (Heinz)**							
20 = Heinz Nuture Gold Follow-on **infant formula (Heinz**							
21 = Heinz Nuture Toddler **(Heinz)**							
22 = Karicare infant starter **formula** 1 **(Nutricia)**							
23 = Karicare Gold starter **infant formula** 1 **(Nutricia)** ...							
24 = Karicare Goat **infant starter formula** 1 **(Nutricia)** ..							
25 = Karicare Soya **infant formula (Nutricia)**							
26 = Karicare AR thickened **infant formula (Nutricia)** ...							
27 = Karicare infant follow-on **formula** 2 **(Nutricia)**							
28 = Karicare Gold follow-on **formula** 2 **(Nutricia)**							
29 = Karicare Goat follow-on **formula** 2 **(Nutricia)**							
30 = Karicare Soya follow-on **(Nutricia)**							
31 = Toddler growing up **formula** 3 **(Nutricia)**							
32 = Enfalac Starter **infant formula (Mead Johnson)**							
33 = Enfapro **infant formula (Mead Johnson)**							

34. = specialised infant formula/other
specify type and brand:......................................

A	B	C	D	E	F	G

A ____________________

B ____________________

C ____________________

D ____________________

E ____________________

F ____________________

G ____________________

32. **Why did you try this particular formula/s?..........**

	A	B	C	D	E	F	G
1 = recommended by hospital staff GO TO Q34a; 2 = recommended by child nurse GO TO Q34a; 3 = recommended by friend GO TO Q34a; 4 = recommended by mother GO TO Q34a; 5 = recommended by other family member GO TO Q34a; 6 = saw it advertised; 7 = it was the cheapest GO TO Q34a; 8 = recommended by chemist GO TO Q34a; 9 = recommended by doctor GO TO Q34a; 10 = available in trial size GO TO Q34a; 11 = saw it being used in the hospital GO TO Q34a; 12 = recommended by pharmacy nurse GO TO Q34a; 13 = recommended by pharmacy assistant GO TO Q34a; 14 = recommended by alternative practitioner GO TO Q34a; 15 = other responses							
other responses - why formula was tried:....................							

A ______

B ______

C ______

D ______

E ______

F ______

G ______

33. **Where did you see it advertised?**......................	A	B	C	D	E	F	G

A ______

B ______

C ______

D ______

E ______

F ______

G ______

34a. **Since we last spoke** (or **you left hospital), has your baby had any drinks other than breast milk or formula?** **1** = yes; **2** = no, GO TO Q34e..............							
34b. **Has s/he had any of the following?**..............	**A**	**B**	**C**	**D**	**E**	**F**	**G**
1 = cow's milk; **2** = plain tap, filtered or mineral water;							
3 = fruit juice, fruit juice drink; **4** = ribena; **5** = cordial;							
6 = softdrinks; **7** = herbal tea; **8** = other responses							
other responses:...							

A ______

B ______

C ______

D ______

E ______

F ______

G ______

	A	B	C	D	E	F	G
GO TO Q34d IF NOT HAVING COW'S MILK 34c. **If baby is having cow's milk, is it**.................. **1** = whole milk/full cream; **2** = semi-skimmed/2% fat/hilo; **3** = skimmed; **4** = other responses other responses:..							

A ______

B ______

C ______

D ______

E ______

F ______

G ______

	A	B	C	D	E	F	G
34d. **Do you give your baby drinks mainly** (may have more than one reason)....................................... **1** = because s/he is thirsty; **2** = to help his/her colic/wind; **3** = to give him/her extra vitamins; **4** = to help his/her constipation; **5** = to settle him/her; **6** = other reasons other reasons:...							

A ______

B ______

C ______

D ______

E ______

F ______

G ______

NEXT FOUR QUESTIONS ARE NOT TO BE ASKED AGAIN ONCE THE BABY HAS STARTED ON SOLIDS

	A	B	C	D	E	F	G
34e. **Since we last spoke** (or **you left hospital) have you given your baby any solid foods**? **1** = yes; **2** = no GO TO Q36a.......	☐	☐	☐	☐	☐	☐	☐
34f. **How old was your baby when you first tried him/her on solids**? (weeks).......	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐
34g. **Why did you start your baby on solids at this time**? (Do not prompt but may have more than one response) **1** = baby was old enough to have solids; **2** = baby was hungry/wasn't satisfied with breast milk or formula; **3** = to settle the baby; **4** = to help baby sleep through the night; **5** = advised to start by child health nurse; **6** = advised to start solids by GP/specialist; **7** = advised to start by mother/mother in-law; **8** = advised to start by other person; **9** = other reason for starting solids	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐
other reasons:.......	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐

A ____________________

B ____________________

C ____________________

D ____________________

E ____________________

F ____________________

G ____________________

34h. **What was the first solid food that you gave your baby?**..	A	B	C	D	E	F	G

A ____________________ E ____________________

B ____________________ F ____________________

C ____________________ G ____________________

D ____________________

35. **Has your baby had any of the following foods?**							
1 = rusks							
2 = infant rice cereal							
3 = porridge							
4 = wheat based cereals (e.g. weeties, weetbix)							
5 = other cereals (e.g. rice bubbles, cornflakes)							
6 = sugar coated cereals (e.g. frosties, coco-pops)							
7 = bread/toast							
8 = biscuits/cakes							
9 = milk based desserts/puddings/custards							
10 = ice-cream							
11 = yoghurt/crème fraiche							
12 = cheese (e.g. cheese sticks, cheese slices)							
13 = fruit gels							

	A	B	C	D	E	F	G
14 = fresh fruit general (include mashed banana)							
15 = citrus fruits (e.g. orange, mandarin)							
16 = strawberries							
17 = foods containing nuts							
18 = cooked/pureed/mashed vegetables							
19 = chips/french fries							
20 = raw vegetables (e.g. carrot sticks)							
21 = meat (minced beef or lamb)							
22 = chicken							
23 = fish							
24 = shellfish (e.g. prawns, crab)							
25 = eggs in a cooked food (e.g. custard, dessert)							
26 = eggs boiled/poached/scrambled (clarify if yolk only or whole egg) yolk only/ whole egg (yolk and white)							
27 = other solid foods:......................................							

A ______________________________

B ______________________________

C ______________________________

D ______________________________

E ______________________________

F ______________________________

G ______________________________

	A	B	C	D	E	F	G
36a. **Is your baby using any of the following?** (prompt for each one) **1** = dummy; **2** = bottle; **3** = feeding spoon; **4** = feeding cup							
36b. **Is your baby…**…………………………………… **1** = holding his/her head fully unsupported; **2** = teething; **3** = crawling; **4** = standing by pulling up on a support; **5** = sitting unsupported for 10 minutes; **6** = walking more than 2 steps unsupported							
GO TO Q37 IF BABY HAS NO TEETH 36c **How many teeth has** _________ **got now?**……							
GO TO Q37 IF NOT BREAST-FEEDING 36d. **Is** __________ **biting while feeding?** **1** = yes; **2** = no GO TO Q37…………………………..							

36e. **Is the biting….** 1 = minor; 2 = really annoying…………………………		B ☐	C ☐	D ☐	E ☐	F ☐	G ☐

ASK Q37 ONLY ONCE

37. **How would you describe a healthy baby? (you can have more than one answer)** (unprompted)…….

1 = chubby; **2** = happy; **3** = sleeps well; **4** = feeds well; **5** = settles well after feeding; **6** = alert; **7** = energetic; **8** = other

other descriptions :……………………………………

A ______________________________

B ______________________________

C ______________________________

D ______________________________

E ______________________________

F ______________________________

G ______________________________

38. **Has your baby experienced any health problems since I spoke to you last** (or **since leaving hospital**)? **1** = yes; **2** = no GO TO Q40d…………………………	☐	☐	☐	☐	☐	☐	☐

39. **What type of problems?** .... **1** = vomiting; **2** = diarrhoea; **3** = respiratory (eg cough or cold); **4** = ear infection; **5** = skin – rash, dermatitis (that lasted more than a couple of days) etc; **6** = colic; **7** = other problem (baby) other problems:..	**A**	**B**	**C**	**D**	**E**	**F**	**G**

A ________________________________

B ________________________________

C ________________________________

D ________________________________

E ________________________________

F ________________________________

G ________________________________

40a. **Did you take your baby to see anyone about this problem?** 1 = yes; **2** = no GO TO Q40c...........							
40b. **Who did you take your baby to?**.................... **1** = local GP; **2** = paediatrician; **3** = child health nurse **4** = A & E; **5** = other responses other responses:...							

A ______________________________

B ______________________________

C ______________________________

D ______________________________

E ______________________________

F ______________________________

G ______________________________

	A	B	C	D	E	F	G
40c. **Was your child admitted for this problem?** 1 = yes; 2 = no…………	☐	☐	☐	☐	☐	☐	☐
40d. **How many colds has your child had in the past (month, year,** or **since we last spoke)**?…………	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐
40e. **Has anyone (ever) told you that your child has an allergy? 1** = yes; **2** = no…………	☐	☐	☐	☐	☐	☐	☐
40f. **Has anyone (ever) told you that your child has asthma? 1** = yes; **2** = no …………	☐	☐	☐	☐	☐	☐	☐
If yes, specify who…………	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐

A ______________________________

B ______________________________

C ______________________________

D ______________________________

E ______________________________

F ______________________________

G ______________________________

	A	B	C	D	E	F	G
40g. **How would you rate the overall health of your child**? **1** = excellent (nearly always well); **2** = OK, could be better (mostly well); **3**= so-so (he/she is ill as often as he/she is well); **4** = poor (seldom well)……………….							
40h. **Have you returned to work or study since we last spoke** (or **you left hospital**)? **2** = no GO TO Q40n; **1** = yes, full-time work or study; **3** = yes, part-time work or study………………………							
40i. **How many hours a week are you away from home working and/or studying?**………………………							
40j. **How many of these hours were in paid employment in the last week?**…………………………							
40k. **Does your work/study involve shift work** (i.e. **evening or weekend hours)? 1** = yes; **2** = no…………..							
40L. **What do you do about childcare for your baby while you're at work?** **1** = my relatives take care of the baby; **2** = my friends help to take care of the baby; **3** = the baby's father takes care of the baby; **4** = I use paid childcare; **5** = I'm at home working If relatives, specify who:………………………………							

40m. **What support does your employer provide to mothers to help them continue breast-feeding?......**	A	B	C	D	E	F	G
1 = fulltime parental leave							
a) no of weeks of paid leave..............................							
b) total weeks of paid leave..............................							
2 = periodic leave over the work day to breast-feed							
3 = there are facilities at work for feeding the baby							
a) specify facilities..							

A ____________ E ____________

B ____________ F ____________

C ____________ G ____________

D ____________

4 = promotes breast-feeding in the workplace specify how:...							

types of promotions in the workplace:

A ____________

B ____________

C ____________

D ____________

E ____________

G ____________

5 = don't know; **6** = other responses

other responses for employer support:.....................	A	B	C	D	E	F	G
	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐

A ______________________________

B ______________________________

C ______________________________

D ______________________________

E ______________________________

G ______________________________

	A	B	C	D	E	F	G
PROMPT FOR EACH OPTION IF THERE HASN'T BEEN A 'YES' PREVIOUSLY 40n. **Are you aware of any of the following facilities or activities in your community since last time we spoke** or **since leaving hospital**?							
a) feeding rooms for mothers............................. **1** = yes; **2** = no	☐	☐	☐	☐	☐	☐	☐
b) promotion of breast-feeding........................... **1** = yes; **2** = no	☐	☐	☐	☐	☐	☐	☐
c) promotion of formula feeding......................... **1** = yes; **2** = no	☐	☐	☐	☐	☐	☐	☐
d) other organised infant feeding support activities.. **1** = yes; **2** = no	☐	☐	☐	☐	☐	☐	☐
41. **Have YOU** (the mother) **experienced any health problems since I spoke to you last** (or **since leaving hospital**)? **1** = yes; **2** = no GO TO Q44a...............	☐	☐	☐	☐	☐	☐	☐

42. **What type of problems?**..............................	A	B	C	D	E	F	G

type of problems:

A ____________________

B ____________________

C ____________________

D ____________________

E ____________________

F ____________________

G ____________________

43. **Did you see anyone about this problem?**..........
1 = yes, local GP; **2** = no; **3** = yes, gynaecologist/ obstetrician; **4** = other responses
other responses:...

A ____________________ E ____________________

B ____________________ F ____________________

C ____________________ G ____________________

D ____________________

	A	B	C	D	E	F	G
44a. **Have you experienced any major changes in your life since I spoke to you last** (or **since leaving hospital**)? **2** = no; **1** = yes, moved house; **3** = yes, death in the family; **4** = yes, divorce, separation; **5** = yes, sickness in the family; **6** = other (major change) other major changes:……							

A ______________________________

B ______________________________

C ______________________________

D ______________________________

E ______________________________

F ______________________________

G ______________________________

	A	B	C	D	E	F	G
44b. **On average, how many hours of sleep in a day (24 hours) are you having (including naps)?**…………							
44c. **What is your current weight – i.e. within the last 2 weeks (in kg)**……							
45. **Are you currently taking a birth control pill?** 1 =yes; **2** = no GO TO Q47……							
46. Which pill are you on? **1** =regular pill; **2** = mini-pill……							
47. **Are you taking any other medications at the moment? (prescription or over the counter)?** **1** = yes; **2** = no GO TO Q48b……							

	A	B	C	D	E	F	G
48a. **What medications you are taking?**...............							

A ______

B ______

C ______

D ______

E ______

F ______

G ______

	A	B	C	D	E	F	G
48b. **Are you taking any vitamin and or mineral supplements at the moment? i.e. within the last 2 weeks. 1** = yes; **2** = no							
If yes, specify general type:...............................							

A ______

B ______

C ______

D ______

E ______

F ______

G ______

	A	B	C	D	E	F	G
71. **Are you smoking**? **1** = yes; **2** = no GO TO Q72b; **3** = usually, but not at the moment GO TO Q72b......	□	□				□	□
72a. **How many cigarettes do you smoke per day on average**? **1** = less than 5; **2** = 5 to 9; **3** = 10 to 19; **4** = 20 to 30; **5** = more than 30................................	□	□				□	□
72b. **Does anyone else who lives in your household smoke**? **1** = yes; **2** = no GO TO 72d......................	□	□				□	□
72c. **Who**? **1** = baby's father; **2** = other person..........	□	□				□	□
72d. **Do you drink alcoholic drinks at present**? .... **1** = yes; **2** = no GO TO Q104..............................	□	□	□	□	□	□	□
72e. **How many days in the last 2 weeks did you have a drink**?..	□□	□□	□□	□□	□□	□□	□□
72f. **When during the day do you have a drink**?...... **1** = just before feeding the baby; **2** = just after feeding the baby; **3** = in-between feeds; **4** = at no particular time; **5** = just before or with the evening meal	□	□	□	□	□	□	□
72g. **How many standard drinks do you have each time**? (read out standard drink equivalents)................	□□	□□	□□	□□	□□	□□	□□
72h. **What type of alcoholic drink do you drink mostly**?	□□	□□	□□	□□	□□	□□	□□

A ______________________________ E ______________________________

B ______________________________ F ______________________________

C ______________________________ G ______________________________

D ______________________________

72i. **On the days when you drink, do you find that** ____________ (baby) (choose all relevant answers)…. **1** = is easier than usual to put down; **2** = is more difficult than usual to put down; **3** = stayed awake all night; **4** = slept through the night; **5** = slept more than usual through the night; **6** = slept the same as he/she usually would; **7** = other responses other responses:……………………………………….	A	B	C	D	E	F	G

A ____

B ____

C ____

D ____

E ____

F ____

G ____

104. **On average, how many <u>hours in a day</u> do you spend in the following sitting activities?** **1** = never; **2** = <1 hr; **3** = 1-2 hrs; **4** = 3-4 hrs; **5** = 5-6 hrs; **6** = 7-10hrs; **7** = ≥ 11 hrs

a) sitting in a car or a bus……………………………….							
b) sitting at work…………………………………………							
c) watching TV…………………………………………							
d) sitting at meals………………………………………							
e) other sitting activities (such as reading, playing cards, sewing, being on the computer)……………………………………………							

	A	B	C	D	E	F	G
105. **On average, how many <u>hours in a week</u> do you spend in the following activities?** **1** = never; **2** = ½ to 1hr; **3** = 2-3hrs; **4** = 4-6 hrs; **5** = 7-10hrs; **6** = 11-20hrs; **7** = 21-30hrs; **8** = >or = 31hrs							
a) strenous sports (such as jogging, bicycling on hills, tennis, racquetball, swimming laps, aerobics).........	☐	☐	☐	☐	☐	☐	☐
b) vigorous work (such as moving heavy furniture, shoveling, weight lifting, loading/unloading trucks, or equivalent manual labour)............................	☐	☐	☐	☐	☐	☐	☐
c) moderate activity (such as housework, brisk walking, gardening, golfing, bowling, bicycling on level ground, Tai Chi)..	☐	☐	☐	☐	☐	☐	☐
106. **On average, how many <u>times a week</u> do you take part in vigorous physical activity** (strenuous sports or work) **long enough to work up a sweat?** **1** = never; **2** = 1 time; **3** = 2 times; **4** = 3 times; **5** = 4 times; **6** = 5 times; **7** = 6 times; **8** = 7 times or more	☐	☐	☐	☐	☐	☐	☐
49. **Have you had help from anyone, on a daily or almost daily basis, since we last spoke** (or **since you left hospital**)? **2** = no GO TO Q51; **1** = yes, husband/partner; **3** = yes, mother; **4** = yes, other family member or inlaw; **5** = yes, friend/s; **6** = paid help; **7** = nappy service; **8** = other other:..	☐☐ ☐☐ ☐☐ ☐☐ ☐☐	☐☐ ☐☐ ☐☐ ☐☐ ☐☐					

A ______________________________

B ______________________________

50. **What type of help did you receive?**
1 = house-work; **2** = caring for the other children; **3** = caring for baby to give me a break; **4** = shopping; **5** = cooking...

	A	B	C	D	E	F	G
50	☐☐ ☐☐ ☐	☐☐ ☐☐ ☐					
51	☐						
53a	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐
53b	☐	☐	☐	☐	☐	☐	☐
53c	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐
other responses	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐

51. **Since you have been home, how helpful has your husband/partner been in caring for the baby**? (Read out answers)..
1 = not very helpful; **2** = sometimes helpful or tries to help; **3** = very helpful; **4** = baby's father not around (DO NOT READ OUT THIS LAST OPTION)

53a. **Have you visited the child health nurse since we last spoke** (or **since you left hospital**)?
2 = no GO TO Q54a; **1** = yes; **3** = no, she visited me..

53b. **Did the child health nurse give you any advice or information on feeding your baby?**..................

2 = no GO TO Q54a **1** = yes

53c. **What was the advice about?** ....
1 = breast-feeding; **2** = bottle-feeding; **3** = feeding solids **4** = other responses
other responses..

A ______________________ E ______________________
B ______________________ F ______________________
C ______________________ G ______________________
D ______________________

	A	B	C	D	E	F	G
54a. **How much does your baby weigh? (grams)**							
54b. **When was that weight taken?** Date: (DD/MM)…………………							
55a. **How long is your baby**? **(cms)**………………							
55b. **When was that length taken**? Date: (DD/MM)…………………							

	A	B	C	D	E	F	G
56. **How do you feel about your baby's weight change since birth**/or **since we last interviewed you**? (Read out options)……………………………………… **1** = satisfied/pleased; **2** = a little concerned; **3** = very worried or concerned; **4** = don't know							
57. **How would you describe your baby's temperament**? (open ended)…………………………… **1** = placid/easy going; **2** = irritable/fussy; **3** = combination; **4** = don't know; **5** = other							
73. **How does the baby's father feel about breast-feeding and formula-feeding**?………………………… **1** = he prefers breast-feeding; **2** = he prefers formula-feeding; **3** = he doesn't mind how I feed my baby; **4** = never really discussed the matter with him							

74. **In general, what effect do you think breast-feeding has on a woman's weight?**........................ | A | G

1 = no effect; **2** = helps reduce weight; **3** = keeps the weight on; **4** = don't know/not sure

75. **In general, what effect do you think breast-feeding has on the shape or size of a woman's breasts after she has stopped feeding?**............................

1 = it causes breasts to sag; **2** = it doesn't make any difference; **3** = makes them smaller; **4** = makes them bigger; **5** = don't know/not sure

AT FOUR WEEKS ONLY **I'm going to read out a few statements which are related to breast-feeding. Please just answer true, false or don't know. It really doesn't matter if you don't know.**

83. **Babies naturally know how to breast-feed correctly** **1** = true; **2** = false; **3** = don't know..............

84. **Formula-fed babies sleep longer at night** **1** = true; **2** = false; **3** = don't know...................................

77. **Feeding more often increases breast-milk supply**

1 = true; **2** = false; **3** = don't know.........................

78. **Babies need to feed more when they are having a growth spurt** **1** = true; **2** = false; **3** = don't know........

79. **There are lots of women who need to give their babies formula because they can't make enough milk** **1** = true; **2** = false; **3** = don't know..........................

80. **Birth control pills can reduce milk supply** ....

1 = true; **2** = false; **3** = mini pill won't but normal pill will; **4** = don't know

	A
81. **Getting extra rest and relaxation is necessary to ensure a good milk supply** **1** = true; **2** = false; **3** = don't know..	☐
82a. **Feeding formula to a one month old baby will not reduce the amount of milk produced by the mother** **1** = true; **2** = false; **3** = don't know..............	☐
82b. **Are you a member of the baby club at your local chemist?** **1** = yes; **2** = no.............................	☐

EXCLUSIVELY FORMULA-FEEDING MOTHERS FINISH HERE – GO TO TERMINATION OF B'FEEDING QTNS (Q 86+) IF HAD STOPPED B'FEEDING SINCE LAST INTERVIEW OR LEAVING HOSPITAL

BREAST-FEEDING MOTHERS ONLY FROM THIS POINT ONWARDS

The following questions are on your feelings about breast-feeding, so there are no right or wrong answers. For example, the first question is 'How would you rate your confidence in breast-feeding?' If you can imagine a ruler with five points on it, at one end of the ruler is 'not confident' and at the other end of the ruler is five which is 'very confident'. Can you give me a number from one to five after I read out the following questions?

		B	C	D	E	F	G
58. **How would you rate your confidence in breast-feeding?** 1 = not very confident...**2**..**3**..**4**..**5** = very confident......	☐	☐	☐	☐	☐	☐	☐
59. **How enjoyable do you find breast-feeding?**........ 1 = not very enjoyable..**2**..**3**..**4**..**5** = very enjoyable	☐	☐	☐	☐	☐	☐	☐
60. **How satisfied are you with your breast-feeding experience?**.. 1 = not very satisfied..**2**..**3**..**4**..**5** = very satisfied	☐	☐	☐	☐	☐	☐	☐

	A	B
61. **In general, how comfortable would you or do you feel while breast-feeding in front of <u>other people</u>?**…………………………………. 1 = not very comfortable..**2**..**3**..**4**..**5** = very comfortable	☐	☐
62. **In general, how comfortable would you or do you feel while breast-feeding in front of <u>female friends</u>?**……………………………….. 1 = not very comfortable..**2**..**3**..**4**..**5** = very comfortable……………………………………	☐	☐
63. **In general, how comfortable would you or do you feel while breast-feeding in front of <u>female relatives</u> e.g., mother, sister?**………. 1 = not very comfortable..**2**..**3**..**4**..**5** = very comfortable	☐	☐
64. **In general, how comfortable would you or do you feel while breast-feeding in front of <u>male friends</u>?**…………………………………. 1 = not very comfortable..**2**..**3**..**4**..**5** = very comfortable	☐	☐
65. **In general, how comfortable would you or do you feel while breast-feeding in front of <u>male relatives</u> e.g., father, brother?**………. 1 = not very comfortable..**2**..**3**..**4**..**5** = very comfortable	☐	☐

	A	B
66. **In general, how comfortable would you or do you feel while breast-feeding in <u>someone else's house</u>?**…………………………………. 1 = not very comfortable..**2**..**3**..**4**..**5** = very comfortable	☐	☐
67. **In general, how comfortable would you or do you feel while breast-feeding on <u>public transport</u>?**…………………………………… 1 = not very comfortable..**2**..**3**..**4**..**5** = very comfortable	☐	☐
68. **In general, how comfortable would you or do you feel while breast-feeding in a <u>public eating place</u>?**…………………………………… 1 = not very comfortable..**2**..**3**..**4**..**5** = very comfortable	☐	☐
69. **In general, how comfortable would you or do you feel while breast-feeding in a public place such as a <u>park or the beach</u>?**…………. 1 = not very comfortable..**2**..**3**..**4**..**5** = very comfortable	☐	☐
70a. **In general, how comfortable would you or do you feel while breast-feeding in a public place such as <u>Hay Street Mall</u>?**……………… 1 = not very comfortable..**2**..**3**..**4**..**5** = very comfortable	☐	☐

70b. **Apart from when you were in hospital, have you ever tried to breast-feed your baby in a public place?**
1 = yes; **2** = no GO TO QUESTION 70d................ A

70c. **When you have breast-fed in public do you** (choose one only) ...**1** = prefer a mother and baby room; **2** = prefer to breast-feed without going to a special place; **3** = no preference...

70d. **Have you ever had problems finding somewhere to feed your baby when you were out in public places?** **1** =yes; **2** = no.......................................

B	C	D	E	F	G

TERMINATION OF BREAST-FEEDING ONLY

86. **How old was _____ when you stopped breast-feeding?**
Convert to weeks ________ .... T

87. **Why did you decide to stop breast- feeding?**

prolonged breast-feeding reasons..

1 = baby old enough to not be breast-fed; **2** = baby weaned itself; **3** = I've done my bit, given a good start

problems/pain..

1 = breast-feeding too painful; **2** =cracked or bleeding nipples; **3** = breast engorgement; **4** = breast infection/mastitis; **5** = inverted nipples; **6** = problem with nursing technique

maternal psychological..

1 = mother anxious or unsure about breast-feeding; **2** = breast-feeding requires too much motivation; **3** = breast-feeding too difficult; **4** = breast-feeding too inconvenient; **5** = mother has been under stress; **6** = mother too tired; **7** = dislike breast-feeding; **8** = concern about how breast-feeding will affect your figure

T

insufficient milk/ other baby factors......

1 = can't tell how much baby is drinking; **2** = my milk isn't good enough; **3** = not enough milk; **4** = baby not gaining enough weight; **5** = baby no longer interested in the breast; **6** = baby biting nipples; **7** =baby prefers a bottle; **8** = baby ready for solids; **9** =baby ill

other maternal factors......

1 = mother ill; **2** = use of prescription medication; **3** = wanted to go onto oral contraceptive; **4** = return to work or study

paternal factors......

1 = baby's father preferred formula-feeding; **2** = baby's father can help with formula-feeding; **3** = other responses

other reasons for deciding to stop breast-feeding:......

A__________ E__________

B__________ F__________

C__________ G__________

D__________

92. **Did anyone advise you to stop breast-feeding?**......

2 = no; **1** = yes, child health nurse; **3** = yes, local doctor; **5** = specialist; **6** = lactation consultant; **7** = ABA (Nursing Mothers Assoc); **8** = friend; **9** =mother; **10** = midwife specify (hospital/community); **11** = pharmacist/chemist; **12** = alternative health practitioner

specify specialist:......

specify alternative practitioner:......

specify midwife (hospital/community)......

other responses:......

A__________ E__________

B__________ F__________

C__________ G__________

D__________

T

90a. **Did you plan to stop breast-feeding now (that is when you did)?** **1** = yes; **2** = no..........

90b. **Were you disappointed at not breast-feeding for longer?** **1** = yes; **2** = no

....

90c. **Do you feel guilty for not breast-feeding for longer?** **1** = yes; **2** = no..........

90d. **Have other people made you feel guilty for not breast-feeding for longer?** **1** = yes; **2** = no..........

93. **Would you breast-feed another child if you had another baby?** **1** = yes; **2** = no GO TO Q95; **3** = yes, if I could..........

94. **Why?** (unprompted, but probe for more than one answer)..........

1 = better for baby; **2** = better for mother; **3** = more contented baby; **4** = natural; **5** = closer relationship with baby; **6** = convenience; **7** = enjoyment/satisfaction of mother; **8** = no particular reason; **9** = other responses (why would breast-feed another child) GO TO Q96

other responses:..........

A__________ E__________

B__________ F__________

C__________ G__________

D__________

95. **Why wouldn't you breast-feed another child?** (unprompted but probe for more than one)..........

1 = inconvenient; **2** = lack of enjoyment/satisfaction of mother; **3** = tied to the house; **4** = embarrassment; **5** = too emotionally taxing for mother; **6** = formula is just as good; **7** = baby's father feels left out; **8** = other responses - why wouldn't breast-feed another child

other responses:..........

A__________ E__________

B__________ F__________

C__________ G__________

D__________

96. **Would you encourage a friend to breast-feed**?... T

1 = yes, definitely; **2** = yes, probably; **3** = perhaps GO TO QUESTION 98; **4** =if she wants to GO TO QUESTION 98; **5** = no GO TO QUESTION 98; **6** = other responses

other responses:..

A____________________ E____________________

B____________________ F____________________

C____________________ G____________________

D____________________

97. **Why would you encourage a friend to breast-feed**? (Unprompted, but probe for more than one)...

1 = better for baby; **2** = better for mother; **3** = natural**; 4** = closer relationship with baby**; 5** = convenience; **6** = enjoyment/satisfaction of mother; **7** = no particular reason**; 8** = baby's father feels left out; **9** = other responses

other reasons

A____________________ E____________________

B____________________ F____________________

C____________________ G____________________

D____________________

GO TO Q99

98. **Why wouldn't you encourage a friend**? (unprompted, but probe for more than one reason).. T

1 = inconvenient; **2** = lack of enjoyment/satisfaction of mother; **3** = tied to the house; **4** = embarrassment; **5** = too emotionally taxing for mother; **6** = formula is just as good; **7** = other responses

other responses:..

A____________________ E____________________

B____________________ F____________________

C____________________ G____________________

D____________________

The following questions are on your feelings about breast-feeding. So there are no right or wrong answers.

On a scale of 1 to 5 where 1 equals "not very successful" and 5 equals "very successful", how successful would you say your breast-feeding experience has been?

99. **How would you describe your breast-feeding experience?** **1** = not very successful **2..3..4..5** = very successful......................................

100. **How enjoyable did you find breast-feeding? 1** = not very enjoyable **2..3..4..5** = very enjoyable...

On a scale of 1 to 6 where 1 equals "not satisfied" and 6 equals "uncertain", how satisfied would you say your breast-feeding experience has been?

101. **How satisfied are you with you breast-feeding experience? 1** = not very satisfied **2..3..4..5** = very satisfied..**6** = uncertain........................

On a scale of 1 to 5 where 1 equals 'strongly disagree' and 5 equals 'strongly agree', how much do you agree with each of the following statements?

102. **Community attitudes in Australia encourage breast-feeding 1** = strongly disagree **2..3..4..5** = strongly agree..................................

103. **Australians in general approve of mothers breast-feeding in public 1** = strongly disagree **2..3..4..5** = strongly agree...........................

THANK YOU VERY MUCH FOR YOUR PARTICIPATION

Appendix 6 Smoking and alcohol questions from the 1989/90 National Health Survey

TOBACCO 29

401. I WOULD NOW LIKE TO ASK YOU SOME QUESTIONS ABOUT SMOKING.

DO YOU CURRENTLY SMOKE?

Yes.. .... ☐ 1
No.. .... → Q413 ☐ 2

402. DO YOU SMOKE -

CIGARETTES?.. .... a ☐ 1
CIGARS?.. .... b ☐ 2
A PIPE? .... c ☐ 3

403. HOW OLD WERE YOU WHEN YOU STARTED SMOKING REGULARLY?

Age ☐☐

404. Sequence Guide

. *If cigarette smoker (code 1 in Q402)* .... → Q405 ☐ 1
. *Otherwise*.. .... → Q417 ☐ 2

405. DO YOU USUALLY SMOKE PACKET CIGARETTES OR ROLL-YOUR-OWN CIGARETTES?

Packet cigarettes.. .... ☐ 1
Roll-your-own cigarettes.. .... → Q428 ☐ 2

406. HOW MANY CIGARETTES DO YOU USUALLY SMOKE A DAY?

Number .... ☐☐

407. HAVE YOU EVER TRIED TO GIVE UP SMOKING CIGARETTES?

Yes .... ☐ 1
No .... ☐ 2

408. WHAT IS THE TAR CONTENT OF YOUR CIGARETTES?

Interviewer: Tell the respondent the tar content can usually be found on the cigarette packet.

Milligrams ____

Don't know .. .. → Q428 ☐ 99

409. WHAT IS THE NICOTINE CONTENT OF YOUR CIGARETTES?

Interviewer: Tell the respondent the nicotine content can usually be found on the cigarette packet.

Milligrams ☐.☐

Don't know .... ☐ 99

410. → Q428

413. HAVE YOU EVER SMOKED REGULARLY?

Yes.. .... ☐ 1
No.. .... → Q428 ☐ 2

414. DID YOU SMOKE -

CIGARETTES?.. .... a ☐ 1
CIGARS?.. .... b ☐ 2
A PIPE?.. .... c ☐ 3

415. HOW OLD WERE YOU WHEN YOU STARTED SMOKING REGULARLY?

Age ☐☐

416. Sequence Guide

. *If cigarette smoker (code 1 in Q414)* ...... → Q418 ☐ 1
. *Otherwise*.. .... → Q428 ☐ 2

417. HAVE YOU EVER SMOKED CIGARETTES REGULARLY?

Yes .... ☐ 1
No .... → Q428 ☐ 2

418. DID YOU USUALLY SMOKE PACKET CIGARETTES OR ROLL-YOUR-OWN CIGARETTES?

Packet cigarettes.. .... ☐ 1
Roll-your-own cigarettes.. ...... → Q428 ☐ 2

419. HOW MANY CIGARETTES DID YOU USUALLY SMOKE A DAY?

Number .... ____

420. HOW OLD WERE YOU WHEN YOU LAST GAVE UP SMOKING CIGARETTES ?

Age

421. WHY DID YOU GIVE UP SMOKING CIGARETTES?

- Advice of family/friends/doctor

Interviewer: Ask - WHY DID .... ADVISE YOU TO GIVE UP?

- Health

Interviewer: Ask - WHAT PARTICULAR ASPECT OF HEALTH DO YOU MEAN?

- Smoking harmful to health/cancer/lung disease/ heart disease .. .. *a* 1
- Cough/sore throat.. .. .. *b* 2
- Reduces fitness/restricts activity.. .. .. *c* 3
- Other health reasons eg. operations,pregnancy .. .. *d* 4
- Offensive to others .. .. *e* 5
- Expense.. .. .. *f* 6
- Lost interest/didn't feel like it anymore.. .. .. *g* 7
- Other reasons .. .. *h* 8

422. *Sequence Guide*

. *If 2 or more boxes ticked in Q421..* .. .. → *Q423* 1

. *Otherwise..* .. .. → *Q428* 2

423. WHICH WAS THE MAIN REASON FOR GIVING UP SMOKING CIGARETTES?

Enter code from Q421

428. THE NEXT FEW QUESTIONS ARE ABOUT ALCOHOLIC DRINKS.

IN THE LAST SEVEN DAYS HAVE YOU HAD ANY DRINKS AT ALL THAT CONTAIN ALCOHOL, INCLUDING HOME MADE WINE AND BEER?

Yes .. .. → *Q431* 1

No.. 2

429. HOW LONG AGO DID YOU LAST HAVE AN ALCOHOLIC DRINK ?

More than one week to less than 1 month ago 1

1 month to less than 3 months ago.. 2

3 months to less than 12 months ago 3

12 months or more ago 4

Never.. 5

430. → *Q460*

431. *Interviewer: Tick day on which interview conducted*

Monday .. ..

Tuesday .. ..

Wednesday .. ..

Thursday .. ..

Friday .. ..

Saturday .. ..

Sunday .. ..

432. DID YOU HAVE ANY DRINKS THAT CONTAINED ALCOHOL ON *(specify each day of the week, starting from yesterday)* ? *Interviewer: Complete A-G then go to Q433*		433. *Interviewer:* *For each day on which respondent drank, ask both questions below* WHAT KIND OF DRINKS DID YOU HAVE ON *(specify day)*? HOW MUCH *(specify drink)* DID YOU HAVE ON *(specify day)*? BEER		
		EXTRA/SPECIAL LIGHT	LOW ALCOHOL	FULL STRENGTH
A. SUNDAY a Yes........ No	1 2			
B. SATURDAY b Yes........ No	1 2			
C. FRIDAY c Yes........ No	1 2			
D. THURSDAY d Yes........ No	1 2			
E. WEDNESDAY e Yes........ No	1 2			
F. TUESDAY f Yes........ No	1 2			
G. MONDAY g Yes........ No	1 2			
OFFICE USE ONLY		434.	435.	436.

ABBREVIATIONS

Beer glasses
Best: 10 oz, 285 ml etc
Second best: pony, middy, schooner etc
Last resort: small (7 oz / 200 ml or less) : sg
medium (8-11 oz / 230-315 ml) : mg
large (12 oz 345 ml or more) : ℓg

Wine glasses /Fortified wine glasses:
small (3 oz / 85 ml or less) : sg
medium (4 oz / 115 ml) : mg
large (5 oz / 145 ml or more) : ℓg

All bottles and cans : b/c
Small (10 oz / 285 ml) - twist tops: sb/sc
Medium (13 oz / 375 ml) - stubbie normal can : mb/mc
Large (26 oz / 750 ml) - bottle of wine or spirits: ℓb/ℓc
Flagon : f
Other : specify size

Spirits: (1 nip = 1 oz)
half nip : hn
nip : n
double nip : dn or 2n

Other:
Specify type of drink and quanti[ty] as accurately as possible.

WINE	SPIRITS	FORTIFIED WINE	OTHER (Specify)		TOTA[L] OFFI[CE] USE ONL[Y]
				441.	
				442.	
				443.	
				444.	
				445.	
				446.	
				447.	
437.	438.	439.	440.		

459. IS THE AMOUNT YOU DRANK LAST WEEK MORE, LESS OR ABOUT THE SAME AS YOU WOULD DRINK MOST WEEKS?		
More than usual	☐ 1	
Less than usual..	☐ 2	
About the same..	☐ 3	
460. *Personal interview obtained* *Interview conducted:-*		
Fully in English..	☐ 1	
Partly in English..	☐ 2	
Fully in a language other than English..	☐ 3	
Interview obtained by PROXY:-		
English language difficulties.. .	☐ 4	
Other reasons..	☐ 5	
461. *Interviewer:*		
. *If female aged 18-64, no more questions and give Women's Health Form*...	☐ 1	
. *Otherwise, no more questions*..	☐ 2	

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Appendix 7 Statements from co-authors, copyright and related publication material

Information related to the following published paper.

Giglia R, Binns CW. 2006, Alcohol and lactation: a systematic review. *Nutrition & Dietetics, vol.* 63, no. 2, pp. 103-116 (Impact Factor: *NA*)[12]

[12] Evidence of refereed status is provided where a 2007 journal Impact Factor is not available.

Written statement of co-author

To Whom It May Concern,

I, Professor Colin W Binns, contributed to the development of the paper entitled **Giglia R**, Binns CW. 2006, Alcohol and lactation: a systematic review. *Nutrition & Dietetics, vol.* 63, no. 2, pp. 103-116,

undertaken with Roslyn Giglia.

Signed

Professor Colin W Binns

Signed

Roslyn Giglia

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Manuscript no. (if known): 10 ND-06-03-0018

Names of all authors in the order in which they appear in the Article: ROSLYN C GIGLIA COLIN W BINNS

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Re: Manuscript 06/147 Patterns of alcohol intake of pregnant and lactating women in Perth, Australia

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1. Overall there is quite some confusion in the manuscript between the various data reported – careful conceptual clarity about each research question and the associated findings (data) would be of assistance in elucidating the key findings of the research
2. The data in the abstract appear to be different from the data in the results section – for example, the percentages reported in the last sentence of the abstract (cf page 9). I suggest very careful finalisation of the data in the body of the report following the reviewers and my comments, and then writing the abstract to ensure accuracy of the figures.
3. Results, page 7 – the opening sentence of the results section could be reworked, and the details regarding sample size placed after the description of the PIFSII eligibility (this is a muddled paragraph altogether).
4. The second para of the results indicates that 31.9% of women discontinued drinking, but on the next page (paragraph 4) the 31.9% does not accord with the 81.7% of women who apparently drank during pregnancy… This is mentioned by way of example of the difficulties (from the readers point of view) in understanding the findings.
5. The Discussion contains new data that should appear in the results section.
6. Paragraph 2, page 10 NDSHS – you need to suggest explanations for why the findings differ.
7. The percentage calculations (eg page 11, paragraph 4, but also throughout) must be re-calculated to exclude non-breastfeeding women at each timepoint. Otherwise these data are nonsensical.

If you do resubmit, please include a cover letter outlining the changes made by page and paragraph number. If you disagree with any of the reviewers' comments, please include your reasons in the cover letter also. As a guide we would expect to receive your revised manuscript before 15 January 2007.

Kind regards,

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Giglia R, Binns CW. 2008, Alcohol, pregnancy and breastfeeding; a comparison of the 1995 and 2001 National Health Survey data. *Breastfeeding Review*, 16:17-24.

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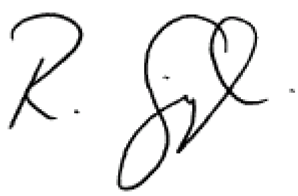

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