The public health, safety and economic benefits of the Northern Territory's Living With Alcohol program 1992/3 to 1995/6

Errata

pp24: Then F = ((pccref - pccX)/pccref*-1)
pp88, line 8 : These analyses revealed large, consistent and significant reductions in alcohol related harm from the introduction of the Living With Alcohol program.

The public health, safety and economic benefits of the Northern Territory's Living With Alcohol program 1992/3 to 1995/6

National Drug Research Institute*
Preventing harmful drug use in Australia

Curtin University of Technology
*(Formerly the National Centre for Research into the Prevention of Drug Abuse)

&
The Lewin-Fordham Group

A report commissioned by the NT Government's
Living With Alcohol program.

The public health, safety and economic benefits of the Northern Territory's
Living With Alcohol program 1992/3 to 1995/6

September 1999

National Drug Research Institute, Curtin University of Technology.

Level 2, 10 Selby Street Shenton Park, Western Australia, 6845
GPO Box U1987, Perth, 6845

Printed in Australia

ISBN 1 86342 8127

Contents

Tables and Figures

Tables

Figures

Acknowledgments

Many people have assisted with our work and we apologise if not all are mentioned by name. In particular we would like to thank Don Sheen of Vehicle and Accident Management Services at the Northern Territory Department of Transport and Works; Karen Dempsey, Michael Pearse and all staff, at the Epidemiology branch of Territory Health Services; Chris Hoffman and Chris Shaw of the Northern Territory Liquor Licensing Commission; Ian Hambour of the Motor Vehicle Registry Department of Transport and Works; Dr Peter d'Abbs of Menzies School of Health Research as well as Ian Crundall and the Research and Evaluation section of the Northern Territory Living With Alcohol program . We also gratefully acknowledge the assistance of Susan Wilson for formatting the final version of this report.

Membership of the Project Team

National Drug Research Institute:

Ms Tanya Chikritzhs, Research Fellow
Professor Tim Stockwell, Director
Mr Mike Phillips, Honorary Senior Research Fellow
Ms Joanne Cronin, Research Associate

The Lewin-Fordham Group:

Dr Richard Fordham, Director
Ms Delia Hendrie, Senior Lecturer, Department of Public Health, University of Western Australia
Ms Faith Ying, Research Assistant
Ms Karin Orlemann, Research Officer

NT Government Living With Alcohol program

Dr Bridie O'Reilly, Research and Evaluation Coordinator, Living With Alcohol program

Contributions from members of the Project Team

The work reported here was a collaboration between the National Drug Research Institute, Curtin University and the health economics consulting firm The Lewin-Fordham Group. While assisted by personnel employed by the Living With Alcohol program of the NT Health Department to gain access to data sets, the study was essentially carried out independently. The contributions of individuals to the project from both organisations are summarised below:

National Drug Research Institute

Ms Tanya Chikritzhs, Research Fellow, was responsible for collating and analysing the harm indicator data sets and summarising the results of analyses. She also undertook a considerable amount of project coordination, contributed to devising the overall analytic approach and wrote much of the successful tender for the project.

Professor Tim Stockwell, Director, oversaw the choice of harm indicators, devised the analytic approach adopted for the project and wrote much of the introduction and summaries of the results. Professor Stockwell and Ms Chikritzhs were largely responsible for the writing of the report.

Ms Joanne Cronin, Research Associate, was responsible for coordinating access to data sets and obtaining descriptions of the activities undertaken by the Living With Alcohol program during the initial weeks of the study.

Mr Mike Phillips, Honorary Senior Research Fellow, gave invaluable advice on statistical methods throughout.

The Lewin-Fordham Group

Ms Delia Hendrie, Senior Lecturer, Department of Public Health, University of Western Australia was sub-contracted to oversee the cost-estimation component of the study and to summarise the methods employed.

Ms Faith Ying, research assistant was responsible for the collection of economic costing information and creating the spreadsheets which were used to estimate costs of high risk alcohol use in the NT.

Dr Richard Fordham, Director, was responsible for project management of the costing study and for its quality control.

Ms Karin Orlemann, contributed to project coordination.

Executive summary

- A methodology was developed to estimate the impact of the Living With Alcohol (LWA) program on significant indicators of alcohol related harm in the Northern Territory. The LWA program was established to reduce the significant levels of alcohol related harm experienced in the NT and was funded by a new levy on alcoholic drinks introduced in April 1992.

- The focus of the study was on the costs associated with hazardous or harmful alcohol use. Methods for estimating levels of alcohol related harm and the economic costs of these were developed principally from the epidemiological work of English *et al* (1995) and international guidelines for estimating the economic costs of drug misuse (Single *et al*, 1998). These methods were applied with some innovations and adaptations for the Northern Territory.

- Economic costs were estimated for total alcohol caused mortality and morbidity taking special account of the costs of alcohol related road injuries for the four full financial years after the introduction of the program that the necessary data were available.

- Data on hospital admissions were considered incomplete by NT Health Services for the four years preceding the introduction of LWA and were excluded. As a consequence analyses focused on comparisons of hospital admission data prior to 1989 and post introduction of LWA. Fortunately, there were complete series of data for road crashes and alcohol related deaths. In each case controlled comparisons were made with trends in non-alcohol related harms.

- Significant reductions in alcohol related harm were apparent over the four year period studied with an estimated 129 fewer alcohol related deaths, 1394 road crash injuries

requiring medical attention and 1277 fewer alcohol related hospital admissions for other conditions.

- Reductions in road crash injuries were most pronounced for those with serious or fatal consequences. Reductions in hospital admissions were largest for those conditions caused by alcohol in 80% or more of cases.

- The total cost of all alcohol related morbidity and mortality in constant dollars (1995/96 reference year) was estimated to be $459.1 million during that period while the cost of the LWA program was estimated to have been $18.4 million. This was a conservative estimate as it was not possible with available data, to quantify the police and legal costs associated with alcohol related violence and other crime. This figure includes the value of lost productivity to the economy of the NT through illness, injury and premature death which accounts for 83% of the estimated savings.

- As a consequence of the demonstrated public health and safety benefits observed during the operation of the program, it was estimated that the net saving to the people of the Northern Territory as a consequence of LWA was $124.3 million. These figures assume that all the observed reductions in alcohol related harm in the study period are attributable to the LWA program. Towards the end of the study period a reduced legal blood alcohol limit and an additional levy on cask wine was introduced both of which may have contributed to some of the observed benefits.

- It is possible that alcohol related morbidity was reducing in the few years prior to the introduction of LWA and hence there was some over-estimation in this study. The design employed a controlled comparison with rates of non-alcohol related morbidity which should have minimised any such confounding effects. Estimated reductions in harm and consumption were consistently large across the several different indicators.

- For most indicators of alcohol related harm, it was apparent that the benefits of the program were evident most clearly for the years 1992/3 and 1993/4. However, in nearly all instances substantial benefits were maintained throughout the study period.

- The timing of the observed reductions in alcohol related harm was consistent with there having been a positive benefit from the introduction of the levy on all drinks with a strength greater than 3.0% in April 1992. The impact of the levy on alcohol consumption is likely to have been gradually eroded as a function of rising incomes and the establishment of cross-border purchasing patterns. As a consequence, the finding of sustained benefits in some areas is at least consistent with there having being benefits from the increased treatment and prevention activity funded by the LWA program.

Introduction

The Living With Alcohol program (LWA) was established in 1991 with the aim of being a comprehensive public health strategy to address alcohol related harm in the Northern Territory. It was originally funded by an additional levy on alcohol products containing more than 3% alcohol by volume. Other funding mechanisms were developed following a High Court ruling in 1997 which disallowed States and Territories using licensing fees to raise revenue.

The LWA program followed a general increase in community concern about alcohol in the late 1980s which led to an influential report of a Select Committee presented in 1991 to the Legislative Assembly. In this report it was estimated that the financial cost to the Northern Territory Government and the community from problems associated with the use of alcohol in 1988 was A$150 million, or approximately $1000 per resident (Report by Legislative Assembly of the NT 1991). Some key events and statistics from this report which influenced the instigation of LWA are summarised below:

- May 1990, 300 traditional Aboriginal women marched through Alice Springs in a "March against Grog".
- Harmful consumption was twice as prevalent in the Northern Territory as in Australia as a whole.
- Apparent per capita consumption of absolute alcohol in the Territory was 70% higher than the consumption rate for Australia as a whole.
- In 1989/1990 household expenditure on beer in the Territory was twice the National average and overall expenditure on alcohol in the Territory was 80% higher than the National average.
- Alcohol was involved in one out of every two road deaths.
- In 1989 the percentage of driver and motorcycle deaths attributed to alcohol was 50% higher than the National average.

- In 1989/1990 there were over 30,000 incidents of people being taken into protective custody by police for public drunkenness.
- In 1992 more than half of all adult Community Service orders were for alcohol related offences
- In 1991/1992 three-quarters of sentenced prisoners reported that alcohol was a factor in their offending.
- In 1984 hospital separations for selected alcohol illnesses were 2-5 times higher in NT than in other States.
- In 1986 the proportion of all deaths which were alcohol related in the Territory was three times higher than for the nation as a whole.

Source*: Crundall, Ian (1994), The Northern Territory Living With Alcohol program: Progress to July 1993.Darwin, NT Department of Health and Community Services.*

The 'Living With Alcohol program' (LWA) was instigated in November 1991 to address these unacceptably high levels of alcohol related harm throughout the Territory. The initial goal of the program was to progressively reduce the levels of measurable alcohol related harm so that by the year 2000 the level of harm would be equivalent to or lower than the national level of harms.

An earlier evaluation of the LWA program suggested there had been a marked reduction in harm associated with alcohol use since the program's introduction. For example, the per capita consumption of absolute alcohol was reported as having fallen by an estimated 18%. In addition, fewer deaths on Territory roads (31%) and 29% fewer alcohol related accidents had been reported (Crundall, 1995). It is anticipated that these and other reductions in harms will produce changes in both the tangible and intangible costs of alcohol related harm.

This report will provide estimates of the economic impact of the LWA program on alcohol related harm during the term of the program. Comparisons will also be made where possible with national estimates of alcohol related harm. In order to estimate possible cost savings we will first test the proposition that the LWA program has had an impact on levels of alcohol related harm. To estimate the size of any such effect, time series of harm indicators will be analysed before and during the program. Consideration will then be given to the extent to which these effect sizes can be generalised across all

harm domains that are included in an evaluation of the economic impact of hazardous alcohol use.

The methodology employed has been closely informed by a set of international guidelines for economic studies associated with the economic costs of alcohol and drug misuse (Single *et al,* 1996). In addition the methodology has been informed by a 'cost of illness' approach which is commonly employed by health economists (e.g. Drummond *et al,* 1997). A number of international studies have now been conducted which estimate the social, health and economic costs of alcohol and other drug misuse. The key results of these are summarised in Table 1 below. The international guidelines were devised in order to standardise methods and reduce inconsistencies between these studies. The working group comprised the chief investigators of several of the published studies listed in Table 1.

A major cost component of alcohol misuse is the health, social and occupational costs associated with death, injury and illness. In estimating the magnitude of these costs it is crucial to have a reliable estimate of the proportion of recorded deaths and hospital admissions caused by hazardous/harmful alcohol use. In Australia we are fortunate to have a major epidemiological study which has estimated the proportion of specific conditions which are caused by alcohol. English *et al* (1995) conducted a major literature review to identify conditions which may be caused by hazardous/harmful alcohol use and then estimated an 'aetiologic fraction' for every such condition specific for age and gender sub-groups. These fractions were applied by English *et al* to prevalence data in order to estimate the total contribution of alcohol to death, injury and illness in Australia in 1992. An important feature of their methodology in calculating most of the aetiological fractions was the use of data on the prevalence of drinking at what NHMRC have defined as 'hazardous or harmful drinking' (NHMRC, 1992). For this purpose they relied mainly on data from a National Health Survey conducted in 1989.

It is also noteworthy that English *et al* estimated the relative risk of experiencing one of the identified conditions for hazardous and harmful drinking compared with what NHMRC define as 'low risk drinking' i.e. drinking on average less than 5 drinks per day for men and 3 drinks for women. The previous quantification exercise by Holman and Armstrong (1989) calculated relative risks in comparison with abstinence from alcohol.

In the present study it was necessary to re-estimate the specific age and gender aetiologic fractions for the Northern Territory to take account of the different levels and patterns of drinking in that region compared with rest of Australia. In addition, because

part of the study involved examining changing trends in alcohol related harm from before to after the introduction of the Living With Alcohol Levy, it was necessary to estimate changes in the prevalence of hazardous and harmful drinking during the entire period considered. Thus unique fractions were calculated for the NT for each age group by gender and for each year from 1980 to 1997. Following English *et al*, the fractions were based on the relative risks of hazardous and harmful drinking compared with low risk drinking as opposed to abstinence. This is because the purpose of LWA was the reduction of harm associated with hazardous and harmful drinking, not prohibition.

Table 1
Comparison of total tangible costs of substance abuse estimates for various countries

Study	Country	Year of Data	Original Total Cost Estimate[1] (millions, local currency)	Total Cost Relative to GDP[3] (%)
Tobacco				
Collishaw & Myers (1984)	Can.	1985	5,180	1.9
Raynauld & Vidal (1986)[4,5]	Can.	1986	669	0.1
Rice *et al*. (1990)	U.S.	1980	53,711	2.0
Collins & Lapsley (1996)	Aus.	1992	6,537	1.7
Single, Robson *et al* (1996)	**Can**	**1992**	**9,560**	**1.4**
Alcohol				
Adrian *et al*. (1988)[4]	Can.	1984	11,840	2.7
Rice *et al*. (1990)	U.S.	1985	70,340	1.7
Collins & Lapsley (1996)	Aus.	1992	4,537	0.9
McDonnel & Maynard (1985)	U.K.	1983	1,614	0.5
Nakamura *et al*. (1993)	Jap.	1987	664,000	1.9
Single, Robson *et al* (1996)	**Can.**	**1992**	**7,522**	**1.1**
Harwood *et al* (1999)	U.S.	1999	148,000	2.4
Drugs[6]				
Adrian *et al*. (1988)[4,a]	Can.	1984	11,506	2.6
Rice *et al*. (1990)[a]	U.S.	1985	44,050	1.1
Collins & Lapsley (1996)[b]	Aus.	1992	1,248	0.3
Fazey & Stevenson (1990)[4,b]	U.K.	1988	1,820	0.4
Institut Suisse... (1990)[b]	Switz.	1988	514	0.2
Single, Robson *et al* (1996)	**Can.**	**1992**	**1,371**	**0.2**
Harwood *et al* (1999)	U.S.	1992	98,000	1.6

[1] Total cost includes all indirect and direct costs, as specified by the author, unless otherwise indicated.
[3] Original total cost figure is divided by the national GDP for the year of the study.
[4] Estimates of external costs.
[5] Total costs are given (not the net costs, as in the final totals given by the authors).
[6] a = estimates for illicit + licit drugs; b = estimates for illicit drugs only.

The last economic cost study on alcohol in Australia was conducted by Collins and Lapsley (1996). They relied on relative risks derived from an abstinence based contrast and prevalence derived from 1989 National surveys. Any comparisons drawn between their estimates and ours should note that their cost estimates were (i) of the costs of

drinking alcohol versus abstaining and (ii) using estimates of the prevalence of drinking in Australia from the late 1980s.

Objectives

The primary objectives of the project were as follows:

1. To identify appropriate harm indicators for the assessment of the costs associated with alcohol related harm in the NT.

2. To estimate the tangible (direct and indirect) health economic and social costs of alcohol related harm on the NT community during the term of LWA.

3. Where feasible, to compare these to projections if LWA did not exist and if possible, the national per capita rate for the same period.

4. To estimate the cost savings involved in the reduction in costs associated with selected harm indicators in the NT during the course of LWA.

5. To include consideration of the intangible costs arising from alcohol related harm.

Summary of Methods

In order to achieve the above objectives, the project proceeded through the following analytic steps:

1. A specification of the range of interventions incorporated in LWA (in most general terms), their timing and likely effectiveness in relation to existing evidence regarding harm reduction strategies for alcohol related harm.

2. A statement of hypotheses regarding timing of main expected impacts of LWA in terms of dates for the start of major initiatives likely to have immediate effects (e.g. alcohol tax increases and increased expenditure on treatment and prevention programs in NT).

3. Identification of available harm indicators and a description of the time periods for which they were available.

4. Presentation of descriptive data on trends in harm indicators before and during LWA implementation with adjustments for changes in population.

5. Conduct of appropriate statistical analyses of trend data on those indicators for which sufficient data are available. A summary of observed population adjusted trends in indicators and (where available) statistically established effect sizes following introduction of LWA. Estimates of effect sizes for each major harm domain within confidence intervals for each year from 1992/93 to 1995/96.

6. Applying the methodology of Single *et al* (1996) to estimate costs of hazardous and harmful drinking for each of the years 1992/93 to 1995/96 for the NT with two important variations:

7. Age, sex and NT specific aetiologic fractions used for calculating alcohol related morbidity and mortality for each of the years considered;

8. Prevalence of 'low risk' drinking not abstinence used as the reference point for estimates of relative risk of alcohol related conditions.

9. Expression of estimated cumulative cost savings in total and within each major harm domain for the period 1992/93-1995/96.

The following sections address each of the above steps in the order listed above.

1. The range of interventions associated with LWA

In order to formulate hypotheses about the likely timing of the impact of LWA, a number of key informants from NT Liquor Licensing, Police and LWA were interviewed. In addition, published reports were examined including annual reports from the Liquor Licensing Commission. A summary of significant interventions is provided below in Table 2.

Table 2
Liquor licensing, drink driving and other interventions with the potential to impact on alcohol related harm in the NT 1983 to 1997

Pre-LWA	
1983/84	• Change of closing time for takeaways from 9.00pm to 10.00pm.
1984/85	• Increase in liquor license fees
	• Increase in number of liquor licences- mostly tourist and restaurants.
1985/86	• 7 new licences.
	• 6 more restricted areas approved.
1987	• 56% increase in special licences.
	• 1 more restricted licence.
1989	• fees for renewal of liquor store licences reduced on 31st May 1989 from 16% to 11%, staggered by equal components over a two year period commencing 1st July 1989 exceptions are some roadside inns and non-profit clubs.
1990	• requirement to collect prescribed fees under section 35 of Liquor Act was changed from an annual to a quarterly basis. The sale of alcohol on Christmas day was prohibited.
	• Increase in liquor store fees.

- During the Easter period, Police and Liquor Inspectors involved in a ten day exercise called Operation Boom. It paid particular attention to licensed premises and other trouble spots around the Todd Mall area of Alice Springs resulting in numerous arrests and summons for a wide range of offences.

1991

- Increased enforcement by police and liquor commission of offences relating to the sales of alcohol to underage and intoxicated customers.
- Increase in the number of vehicles seized in restricted areas for breaches of liquor act.
- November 1991 LWA initiated though funding mechanism and distribution not established until 1992.

LWA Began

1992

- Levy on beverages over 3 % alcohol collected from 1st April 1992. State taxes on beverages 3% and under reduced. This levy was not implemented until the beginning of April 1992 and funds were first paid to LWA in August that year. The money is allocated exclusively for projects and activities expected to reduce levels of alcohol related harm. The new levies were as follows:
- Beer including mixed drinks $0.20 a litre
- Wine including cider $0.48 a litre
- Spirits including fortified wines $1.60 a litre
- Amendments to Liquor Act:
- Application for a cancelled licence can not be lodged within 3 years of cancellation.
- Guidelines prohibiting media advertising which would induce irresponsible consumption of liquor.
- Cancellation of a licence where a premises has not traded for 90 days.
- Minors misrepresenting age are guilty of an offence.
- Prohibition of entry to habitual heavy drinkers who cause injury to self or others or have been arrested more than 3 times in the last 6 months.
- Commission can suspend a licence related to the conviction of a licensee.
- Reductions in prescribed takeaway hours.

1993

- Policy changes make it easier to obtain a licence but also easier to lose a licence for breaches of the provisions of the Liquor Act.
- Amendments to the Act;
- Power to exclude or remove intoxicated or quarrelsome persons from the licensed premises- includes licensees and inspectors. no 121.
- No. 124 gave Commission power to determine which part of licensed

premises are to be suspended from trading in liquor and for how long.- related to selling to intoxicated, minors and failure to remove intoxicated or violent persons.

- May and June audit of three financial operations by the Auditor general.
- Until July 1993 the program was developed and administered by the Alcohol Policy Unit within the Department of the Chief minister.
- Campaigns: "Lighten up", Fair Go for Bar Staff, Only Rats drink and Drive and Bloody Idiot and How Will You Feel Tomorrow,
- Community Education – industry, youth and workplace. Batchelor College Course.
- Expanded treatment services, funded with an additional with $1.7 - $2 million per year.
- Night Patrol established in some areas.
- Work with Alcohol industry in April 1993- Operation Drinksafe in Darwin and Nhulunbuy. Following Drinksafe also established in Alice Springs and Katherine.
- Increased worksite programs and assistance. End June programs developed for staff of Nabalco, Public Service Maritime Union and Defence force.
- June 1993 grants for camping activities around AS and youth festival in Katherine workshops etc.
- June 1993 Darwin and Katherine- Youth and Substance misuse workshop.
- Sobering Up Shelters for intoxicated persons operational in 1993.

1993/4

- 1st July 1993 no liquor to be sold in Darwin nightclubs after 4am. Two clubs permitted to trade to 6am on Friday and Saturday and only till 3am on other nights.

1994/5

- Review of Darwin night club closing hours resulting in earlier closing times.
- 1993-1995 Community meetings in Tenant Creek to address social problems related to alcohol consumption.
- 5 June 1995 restrictions on the supply of liquor in Tennant Creek on Thursday of each week. Takeaway sales restricted and alcohol only permitted in conjunction with a substantial meal. Restriction began from 14th August 1995 for trial of six months.
- Sept 1994 working party established to examine the issue of underage drinking and strategies for Gov. policies.
- Changes to Act:

  Code 67 which highlights which promotional practices are not acceptable and are therefore discouraged.

- 1st July 1995 Wine Cask levy $0.35 a litre

- Introduction of 0.05mg/ml as blood alcohol limit for drivers bringing NT in line with the rest of Australia in December 1994. Included increased penalties for Drink Driving offences, license suspension for drink driving and mandatory education/treatment for drink drivers.

- Commercials:

  Sept /Nov 1994 The Last Thing You Need is a Drink TV commercial repeated in mid 1995.

  Heroes Say No- intermittent running since Sept 1994.

  Road Train Lighted up Christmas 1994

  Tougher Penalties for Drink Driving Dec 1994-March 1995.

  Keep a Level Head April and may 1995. and June July

1995/6

- Alice Springs- voluntary restrictions on the sale of takeaway liquor. Limiting cask wine sales to 4 litres or less per person per day and no such sales before 4pm.

- June 30 suspension of the Kardu Numida (Port Keats) social club.

- Grog Free Day scheduled in Tennant Creek during week following 17th March.

- Tennant Creek, restrictions on 5 premises.

- Tennant Creek: 14th August to 13th Nov 1995 - public bars closed on Thursday, no takeaway sales on Thursday.

- Tennant Creek: 14th Nov 1995- 14th Feb 1996 -trading hours restricted to 3pm- 9pm Takeaway Sunday to Thursday between 12 and 9pm sat and public holidays 10 and 9pm and Thursday 3 and 9pm.

- Tennant Creek: In both above periods, public bar sales from 10 to 12 were restricted to light beer only. Wine could only served with a substantial meal. Takeaway usually only allowed from 12noon to 9pm. Sales of cask Riesling or Moselle greater than 2 litres prohibited. Casks less than 2 litres restricted to one cask only per person.. Wine in glass containers greater than 1 litre prohibited and sales to third party eg taxi drivers prohibited.

- Tennant Creek: 20th April 1996 - takeaway closed Thursday at other times casks greater than 2 litres prohibited, only one cask less than 2 litres per person, no sales over 1 litre in glass containers, no third party sales. Public bars closed all Thursdays. Lounge bars to open 12 noon on Thursday and Fridays – food to be available and well signed.

1996/97

- Restrictions in Tenant Creek remain.

- Feb; Alice Springs voluntary restrictions limit the sale of 4 and 5 litre casks to one cask per purchase with no sales before 4.00pm.

- Restrictions apply to takeaway sales in Jabiru area.- cease sales from 31st march.

	• Late Oct 1996 policy of regular, random and with out notice inspections of all licensed premises. To target presence and service to intoxicated persons, underage and cleanliness of premises. • Restrictions of sales from Curtin Springs Roadhouse- only 6 drinks could be served as takeaways hours of service 1-4pm. 1st six months consumption on premise, second six months takeaways only. • 1st Jan 1997- all licensees must have completed a patron care course. • Northern Territory University, Alcohol and Other Drugs course introduced. • LWA funded Alcohol and Other Drugs Unit in Northern Territory Corrections which commenced 1995/96. • Commercials Say When November 1996 Drink Less Live More May 1997 The Impact Lasts a Lifetime Choose Yourself Believe in Yourself, Be Strong. Tough Penalties advertisement
1997/98	• 5 August High Court decision prohibits all State and Territory levies and licensing fees and hence the LWA levies and pre-existing licensing fees scrapped and replaced with an overall increase of 15% in the Wholesales Tax collected by the Commonwealth government. This resulted in a net drop in the price of cask wine and a reduction in the price differences that had been established between low and regular strength beers. • Commercials Binge drinking 1 June 1998 Local heroes 29th March 1998

It is readily apparent from a study of Table 2 that LWA started a remarkable period in alcohol prevention in the NT. Many of the interventions made possible by the program and its significant level of funding can claim to be evidence-based. We highlight the following features of the program in particular:

- Increases in the price of alcohol in proportion to their alcohol content as a consequence of the LWA levy introduced in April 1992. Systematic literature reviews have repeatedly identified raising the price of alcohol as one of the most

consistently effective policy interventions available to government (Edwards *et al*, 1994; Stockwell, 1995). A further increase in the price of cask wine was introduced in July 1995 as a consequence of concern about excessive drinking associated with this most cheap of alcoholic beverages (Stockwell *et al*, 1995 and 1998). It is a debatable point as to whether the impact of this levy should strictly be considered as part of LWA as the funds were not directed towards LWA per se. The funds from the cask wine levy were allocated to other specific community and police activities relating to the prevention of anti-social behaviour resulting from drinking in public places, principally by Aboriginal people. The cask wine levy had significant influence on alcohol policy during the study period. It is arguable that the same climate of concern that created LWA and which was further sustained by LWA led directly to the political conditions that enabled the cask wine levy to be introduced in 1995.

- The LWA and cask wine levies were used for a variety of treatment, education and prevention activities which can be expected to have had an effect on community levels of alcohol related harm over and above the increase they caused in the price of alcohol. Once the program was in full swing approximately $4 million per annum was expended for such activities. Holder and Blose (1994) found evidence that the amount of treatment activity for people with severe alcohol problems in a community is directly related to reductions in overall levels of problems. Even if these programs only succeed temporarily in helping such people stop or substantially reduce their drinking, this is likely to have a beneficial effect on levels of serious social, health and economic costs given the high rate of such problems among candidates for alcohol treatment. The extent of mass media education programs is also noteworthy. Reviews of mass media campaigns suggest that they can change behaviour and reduce harm when they complement significant amounts of on the ground community activity (e.g. Stewart and Casswell, 1993). A classic example is the deterrence of drinking and driving by raising drivers' perceptions of the likelihood of being breath-tested through a combination of visibly increased drink-driving enforcement activity supplemented by mass media campaigns (Homel, 1986). It is noteworthy that during the LWA period there was increased enforcement both of drink driving and liquor licensing laws as well as supporting media for both activities. There is substantial support for the harm reducing effects of both the

enforcement activities per se and also suggestive evidence that the media campaigns will further increase their efficacy (Homel, 1986; Rydon & Stockwell, 1997).

- Another important intervention which is unlikely to be attributable to LWA was the introduction of the 0.05 legal limit for drivers in December 1995. This was mainly the result of a Commonwealth initiative that tied funding for road maintenance to the introduction of a range of measures to reduce road crashes, including the introduction of 0.05. However, the ability of the NT government to use LWA funds for mass media campaigns supporting drink driving law enforcement is likely to have increased the effectiveness of this intervention for the reasons noted above.

- Special mention should also be made of the various local licensing restrictions that were introduced during the LWA period of operation. While these were mainly instigated by the actions of local residents, the amendments to the Liquor Act and provision of funding from LWA to community groups may have increased the ability of local communities to petition for licensing changes. The climate of opinion that LWA sustained is also likely to have had some influence on the decision-making processes of the Commission. There is strong support for the effectiveness of local restrictions on alcohol's availability (e.g. Edwards *et al*, 1994; Chikritzhs *et al*, 1997; d'Abbs, 1994; Gray *et al*, 1998). These studies also show that problems are not significantly exported to other areas and that an overall reduction in problems can be expected to result.

In conclusion, the Northern Territory presents a unique example of a community with exceptionally high levels of alcohol problems which then introduced a range of prevention and harm reduction measures many of which should have had a measurable impact on levels of harm.

2. Hypotheses regarding the timing of the impact of LWA and other harm reduction interventions 1991-1997

The following hypotheses were developed for the present study to confirm whether the prevention and harm minimisation potential suggested above is realised by statistical analyses of relevant harm and consumption data.

- All measures of alcohol related harm and of high risk consumption which are amenable to analysis for a sufficient period prior to and after April 1992 will demonstrate a significant reduction after this date.

- All measures of alcohol related harm and of high risk consumption which are amenable to analysis for a sufficient period prior to and after April 1992 will demonstrate a significant reduction after this date in comparison with control data from the same sources for non-alcohol related conditions.

- Where all other factors external to LWA which influence consumption remain constant, the impact of LWA should increase to a maximum immediately prior to the end of the study period.

3. Alcohol related harm indicators

The alcohol related harm indicators selected for analysis are indicative of the principle areas of concern regarding alcohol issues in the Northern Territory. The selection of indicators has been facilitated by draft international guidelines currently being established by the World Health Organisation and national guidelines as outlined by the National Expert Advisory Committee on Alcohol. The considerations also utilised evidence from epidemiological studies, which examine the strength of the relationship between hazardous/harmful use of alcohol and various harm indicators. Recent Australian studies employing and testing local level indicators of alcohol consumption and harm have been influential in the development of the national and international guidelines referred to above (e.g. Jonas *et al*, 1999; Stevenson *et al*, 1999).

The selection of indicators also reflects the availability of reliable and established data sets of alcohol related harm indicators in the Northern Territory prior to, and following the implementation of LWA. There were three main purposes to which these indicators were put in this study:

- To enable a total cost estimate to be made for the consequences of hazardous and harmful alcohol use in the NT from April 1992 till December 1997.
- To estimate from descriptive statistics the impact of LWA on alcohol related harm.
- To conduct statistical tests of the significance of changes before and after the key time periods identified above.

The initial selection of harm indicators was the following:

- Prevalence of hazardous and harmful alcohol consumption as defined by NHMRC and determined by representative surveys of the NT.
- Estimations of per capita consumption of total alcohol and of high risk alcoholic beverages (see Stockwell *et al*, 1998) calculated from liquor licensing returns.
- Numbers of serious assaults requiring hospitalisation identified from police data.
- Numbers of night-time road crash injuries and fatalities determined from police records of road crashes occurring between 6pm and 6am.
- Alcohol related conditions resulting in death from Hospital Death Unit Record files.
- Alcohol related conditions resulting in hospital admission from Hospital Morbidity records.

These are discussed in greater detail to ascertain their applicability to this particular study of alcohol related harm in the NT. Wherever possible series of equivalent non-alcohol related cases were developed to be used as controls in order to minimise the impact of recording biases in each data set.

A. Prevalence of hazardous and harmful alcohol consumption

A primary aim of LWA was to reduce harm caused by the excessive or irresponsible consumption of alcohol. Although a number of LWA initiatives are targeted at the general community, the program is focussed on responsible drinkers rather than abstainers. This project therefore will only consider the impact of LWA on the hazardous and harmful consumption of alcohol.

The recommendations of the National Health and Medical Research Council (NHMRC) 1992 are that:

- the consumption of alcohol by men should not exceed 4 standard drinks or 40 grams of absolute alcohol per day on a regular basis;
- consumption of 5 or 6 drinks per day or 29 to 42 drinks per week should be considered ‘hazardous’ and that more than 6 drinks per day or more than 42 drinks per week should be regarded as ‘harmful’;
- the consumption of alcohol by women should not exceed 2 drinks per day or 14 drinks per week on a regular basis;
- consumption of 3 or 4 drinks per day or 15 to 28 drinks per week be considered ‘hazardous’ and that more than 4 units per day or 28 per week be considered ‘harmful’.

The above definitions were used by English *et al* (1995) in their quantification methodology in relation to alcohol caused morbidity and mortality and will also be used here for the same purpose.

To monitor the consumption of alcohol in the Northern Territory, LWA has conducted major household surveys on alcohol consumption in 1992, 1993, and 1997, with a smaller survey conducted in 1994. The methodology and scope of these surveys have varied slightly between the surveys. These are summarised in Table 3. It is important to note that data collection for the 1992 survey was completed just before the initiation of LWA. This series of surveys therefore provides one means for estimating the impact of LWA on high risk drinking behaviour.

At the outset of the Living With Alcohol program it was predicted by some that the additional levy on alcohol would lead to an escalation in both home brewing and inter-state mail order purchases of alcohol (d'Abbs, 1993). Each of the above surveys inquired about whether respondents acquired alcohol by these means in order to examine the validity of this prediction.

Table 3
Drinking risk levels for males and females in the Northern Territory determined from annual urban surveys

Level of consumption	**Males**	**Females**
1992 (n = 1090)		
Did not drink in past week	22%	42%
Responsible	48%	46%
Hazardous	16%	8%
Harmful	4%	4%
1993 (n = 1296)		
Did not drink in past week	24%	45%
Responsible	52%	46%
Hazardous	11%	8%
Harmful	13%	2%
1997 (n = 1582)		
Did not drink in past week	31%	48%
Responsible	47%	42%
Hazardous	10%	8%
Harmful	12%	2%

B. Per capita consumption of alcohol

Per capita consumption of alcohol has been shown to reflect changes in patterns of harm. The actual per capita annual alcohol consumption in the Northern Territory was determined using Northern Territory Liquor Commission data. The Northern Territory Liquor Commission provided quarterly data on licensee liquor purchases by beverage

type by volume for the period July 1994 to September 1998. The alcohol content of each was calculated on the basis of the following estimates of typical percentage alcohol by volume:

Cask wine, 11.9%
High strength beer (above 3%) 4.8%
Low strength beer (below 3.1%) 2.5%
Bottled wine, 11.9%
Unmixed spirits, 38.5%

Special note for high and low beer: due to the uncertainty surrounding changes in alcohol content for Cartlon "light beer" we combined high and low beer purchases. The percentage alcohol estimate employed for all beer was 4.24% determined from a weighted average of the top 18 (14 >3%; 4 <3%) selling NT beers.

To allow for population changes, estimates of licensee purchases of pure alcohol were divided by ABS estimates of NT residential population aged 15+ years for each financial year, producing estimates of adult per capita consumption of pure alcohol.

Local surveys that were conducted in 1992 and 1993 in four urban regions of the Northern Territory, attempted to estimate the quantity of alcohol purchased interstate or made in the home. For example, a rough estimate of the quantity of homemade beer brewed in 1992 is approximately 2117884 litres, beer and/or spirits purchased interstate per year 20170 litres and inter-state wine purchases 181 533 litres per year in the Northern Territory. Although we note that the purchasing of inter-state liquor or the home brewing of beer is an important consideration in accurately estimating the consumption of all alcohol beverages in the Northern Territory, we have not included estimates of these because reliable data is not available for the entire population of Northern Territory for each year of the Living With Alcohol program.

It is interesting to note that the NT alcohol surveys suggest an increase in number of people reporting inter-state liquor purchases in 1994 (7.8%) compared to 1992 (3%). However, this has been partly offset by a decrease in the home brewing of beer in 1994 (4.5%) in comparison to 1992 (7%). In the absence of quantities consumed, however, it is not possible to adjust estimates of annual per capita consumption.

C. Road crash injuries

Evidence from the literature highlights the connection of alcohol consumption and road traffic accidents. English *et al* (1995) concluded from 44 studies on the blood alcohol levels of fatally injured drivers, that alcohol is causally related to road fatalities. In Australia alcohol is implicated in approximately 700 deaths each year. The evidence is clear that road crash risk increases with the increased consumption of alcohol. The

Quantification of Drug Caused Morbidity (English *et al* 1995) shows that the risk of injury from a road crash is 3.5 times greater with drivers BAC between .05 and .09 and approximately 9.5 times greater with driver BAC of .1mg/ml or above.

The Northern Territory Department of Transport and Works provided data on the number of injuries and fatalities resulting from road crashes collected by Northern Territory Police between 1984 and 1997. In the Northern Territory approximately 45% of all controllers involved in road traffic accidents are tested for their Blood Alcohol Content (BAC). Mandatory BAC testing is not required at the scene of all crashes in the Northern Territory, therefore to estimate the extent of alcohol involvement in road crashes surrogate measures have been applied in this study.

It has been estimated that alcohol is involved in as many as 80% of single vehicle night-time fatal and non-fatal crashes occurring between 8pm and 4am. It has been suggested that this proxy measure would be less applicable in the NT because Aboriginal drinking does not always follow the daily rhythms and routines of a White European style drinking. A typical pattern involves heavy drinking commencing on Thursdays when social security payments are received. The time of day and day of week of the occurrence of road crash data were examined to test whether the relative proportion of road crash injuries occurring at night as opposed to day increased between Thursday and Sunday compared with Monday through Wednesday. As shown in Table 4 below, among crash injuries occurring between Thursdays and Saturdays, 45% occurred at night-time. For crash injuries occurring between Sundays and Wednesdays the proportion of night-time road injuries was a lesser 37%. A test of two independent proportions indicated that the percentage of night-time injuries occurring on days of the week when alcohol consumption was likely to be affected by social security payments was significantly larger than that for all other days ($z = 10.7$, $p < 0.001$). Thus, there was supporting evidence that night-time crash injuries occurring between Thursdays and Saturdays would provide a stronger indicator of alcohol related harm than an overall night versus day comparison.

Table 4
Proportion of night-time versus day time road crash injuries for Thursdays through Saturdays and Sundays through Wednesdays occurring between 1984 and 1997

Description	Day of Week	No. night-time crash injuries[c]	No. day time crash injuries[d]	Total No. road crash injuries
Days on which alcohol consumption is likely to be affected by Social Security payments	Thurs, Fri, Sat[a]	4103 (45%)	5064 (55%)	9167 (100%)
Drinking days less likely to be affected by Social Security payments	Sun, Mon, Tues, Wed[b]	3272 (37%)	5585 (63%)	8857 (100%)
Total		7375	10649	18024

[a]between 6am Thursday and 6am Sunday.
[b]between 6.01am Sunday and 5.59am Thursday.
[c]night-time road crashes defined as between 6pm and 6am.
[d]day time injuries defined as between 6.01am and 5.59pm.

As a consequence this measure was employed to examine the impact of LWA on alcohol related road crash injuries. This surrogate method was applied for fatal crash injuries and crashes resulting in injuries requiring hospital treatment as recorded by police. Data on rates of crashes occurring between 6.01am and 5.59pm on Mondays, Tuesdays and Wednesdays were used as a control series. It should be noted that this control series is not strictly a non-alcohol related control since some cases will still be alcohol related – but at a much lower rate. It can be assumed that the contrast between these high and low alcohol rated crash series will be a conservative estimate of the overall change in alcohol related crash injuries.

D. Night-time assaults

Alcohol is implicated in assaults by either increasing the risk of becoming a victim of an assault or a potential cause in committing an assault. English *et al* (1995) concluded that 47% of assaults are attributable to alcohol. However, NT Police records of assaults are not available prior to mid 1993 or the introduction of LWA. It was therefore not possible to test the impact of LWA on levels of assault.

E. Alcohol related morbidity and mortality

Epidemiological evidence shows that hazardous and harmful alcohol use contributes substantially to death, injury and illnesses (English *et al*, 1995). In Australia, causes of these conditions are recorded according to categories defined in the International Classification of diseases, Ninth revision (ICD 9). Some conditions are explicitly related

to alcohol use, in other cases alcohol is known to be a contributing cause. For the purpose of this study the incidence of all these alcohol related conditions will be used to create composite measures of the extent of alcohol related harm over the four years of the study period. Furthermore, these alcohol related conditions will be separated into chronic and acute conditions. Acute health problems are those related to episodes of intoxication, where as overall levels of consumption are associated with chronic harms.

Both morbidity and mortality data were obtained from the NT Health Department. Mortality data included over 8800 deaths occurring between mid 1985 and mid 1996 of which approximately 28% were those classified by English *et al* (1995) as related to hazardous or harmful consumption of alcohol. Morbidity records contained over 500,000 hospital admissions occurring between 1980 and 1997, approximately 12% of which were alcohol related. Unfortunately, hospital admissions for the years 1988/89 to 1992/93 were either entirely missing or incomplete as a consequence of change to a new recording system. The effect of the missing data impacted on three different areas of the evaluation. The first problem to arise was that to a limited degree, the first year following the implementation of LWA was still suspected as a possible under representation of the actual number of hospital admissions by NT archivists – though by 1992 apparently the problem was minimal and likely to have been even less in the second half of the year which marked the beginning of the study period. Secondly, estimation of expected levels of alcohol related morbidity was based on pre 1988/89 data rather than on pre 1992/93 data. In addition, prior to 1992 it was not possible to identify admissions where the patient's place of residence was other than the NT. As a result, initial forecast estimates of expected levels of admissions were made from all admissions including non-residents and later adjusted to reflect proportion of non-residents for years following LWA. Finally, for the controlled analyses (see below), the pre LWA period had to be redefined as between 1980/81 and 1987/88 instead of all years up to and including 1991/92 and necessarily included non-Northern Territory residents which make up less than 10% of all admissions. Obviously it was necessary to include in these analyses data on the non-residents from the after-LWA series as well so that a consistent sampling strategy was used across the entire period of interest.

In order to correct for the above deficiencies in the morbidity data, a control series of cases of all non-alcohol related morbidity was created. Problems caused by changes in the recording systems should have affected this series to the same degree as the alcohol related cases. Statistical analyses were chosen which contrasted changes in the levels of

alcohol and non-alcohol related cases before and after the introduction of the Living With Alcohol program

Given the unique environmental and social factors which are characteristic of population drinking patterns in the Northern Territory, it is unlikely that nationally derived aetiologic fractions can be accurately or reliably applied to the Northern Territory. For this study aetiologic fractions have been recalculated for the Northern Territory using the 1992 Northern Territory Household Survey to determine approximate risk factor (hazardous/harmful drinking) prevalence levels. The alcohol sales data from Liquor Licensing Commission were then used to reflect changes in prevalence over the duration of LWA. Relative risks, (which should be reasonably generalisable across Australian communities), were drawn from published meta-analyses provided by English *et al*. (1995) for the various chronic and acute alcohol related indicators. These were then combined with the estimates of the prevalence of hazardous and harmful drinking for the NT to recalculate aetiologic fractions for the Northern Territory.

In the absence of annual representative survey data, estimates of prevalence of hazardous and harmful drinking were derived from levels of per capita consumption for persons aged 15+yrs which were available annually. Selecting 1991/92 as the reference year, prevalence levels of hazardous and harmful drinking were adjusted in accordance with percentage change in per capita consumption between the reference year (1991/92) and the year of interest.

The following formula was applied:

Let F = percentage change factor in per capita consumption from reference year to year of interest
And Pccref = per capita consumption for reference year (1991/92)
And PccX = per capita consumption for year of interest

Then F = ((pccX - pccref)/pccref *-1) * 100

It is thus assumed that as per capita consumption of alcohol in a community increases or decreases, so too does prevalence of hazardous/harmful consumption and therefore population aetiologic fraction – to an equivalent degree. This is a conservative

assumption as it is usually found that heavy drinkers are disproportionately affected by changes in per capita consumption of alcohol.

For conditions where a relative risk was able to be derived from published estimates (English *et al*. 1995) the following formula was applied to re-calculate year, sex and age specific population aetiologic fractions:

Let p_e= the prevalence of hazardous/harmful alcohol consumption in the NT
And RR = relative risk, the likelihood of developing a specific condition in the exposed relative to the unexposed
EF_p = population alcohol aetiologic fraction for a given condition

$EF_p = p_e(RR-1)/p_e(RR-1)+1$

For conditions where English *et al* (1995) had derived aetiologic fractions from case series and where relative risks were not directly available, adjustments were made to aetiologic fractions based on the following formula:

Let AFref = alcohol population aetiologic fraction for reference year
And AFX = estimated alcohol population aetiologic fraction for year of interest

Then AFX = ((F*AFref)+AFref)/(((F*AFref)+AFref) + (1-AFref))

Most of the recalculated aetiologic fractions were substantially higher than those calculated by English *et al* (1995) reflecting the higher prevalence of hazardous and harmful drinking in the NT.

For both mortality and morbidity data, analyses were conducted separately and combined for chronic and acute conditions. Appendix C shows how each condition was classified into these categories. Very different underlying mechanisms and drinking patterns contribute to these two broad categories. It might be expected, for example, that acute conditions that are associated with an episode of intoxication may be more responsive to an intervention such as LWA and that the incidence of chronic conditions may take longer to be affected.

For morbidity data, both acute and chronic conditions were further sub-divided into those with a high alcohol component (AF of greater than 79%), medium (20% to 79%) and low (less than 20%). Each level of association has its own strengths and weaknesses

as harm indicators. 'High' conditions are those for which there is most stigma attached and which are thought to be most affected by under-reporting by medical practitioners to protect patients and their relatives from the stigma; low conditions are most influenced by variations in other risk factors unrelated to alcohol consumption. The purpose of examining trends in conditions separated into these categories as well as in total was to see how robust observed trends might be across different categories of alcohol related harm.

F. Statistical analysis of trends in harm indicator data

Two main strategies will be used to analyse the impact of LWA on the above indicators of alcohol related harm. Firstly, the trends observed in each indicator prior to LWA will be extrapolated forwards for the years 1992/3 to 1995/6 and then compared with the observed trends for those post-LWA years. The difference between forecast and observed levels will be reported for each year post-LWA. These analyses will be called 'Forecast versus observed trends: uncontrolled analyses'.

The second strategy will be to compare trends in the harm indicators with the control data on non-alcohol related harms. Where appropriate time series ARIMA analysis will be employed, otherwise multiple regression analysis will be applied. Time series ARIMA analysis measures and controls for the degree of correlation in a temporal series of data between adjacent measures in time. This is known as serial autocorrelation. If there is no significant autocorrelation it is generally appropriate to use multiple linear regression, otherwise it is necessary to use an alternative time series approach such as ARIMA. In either case these statistical techniques will be used to test the hypotheses that the beginning of LWA was associated with a greater reduction in alcohol related harm than in non-alcohol related control data. These analyses will be referred to as the "Controlled analyses".

4. Trends in harm indicators before and during the Living With Alcohol program: uncontrolled analyses

In this section trends in available data are summarised showing levels prior to and following the start of LWA. In addition predicted levels are plotted for each indicator following the beginning of LWA by extrapolating trends prior to LWA.

Hazardous and harmful alcohol consumption

Table 5
Levels of responsible, hazardous and harmful drinking in the N.T. 1992 to 1997
(% recent drinkers, weighted data)

Drinking Level	1992 (n=1088)	1993 (n=1293)	1994 (n=401)	1997 (n=1582)
Responsible				
m	61	68	77	68
f	79	81	80	81
Hazardous				
m	20	15	10	15
f	13	15	13	16
Harmful				
m	19	17	14	17
f	7	4	6	3

The four surveys of alcohol consumption in the NT between 1992 and 1997 (see d'Abbs, 1993, Crundall, 1994; Bertram and Crundall, 1997) suggested reductions in high risk consumption following LWA, particularly for men. The first survey was completed just prior to the introduction of LWA and hence permits a limited baseline assessment of drinking levels. It should be noted that the sample size for the 1994 survey was very limited and that slightly different sampling strategies were used in different years. Table 5 shows a sustained increase in the number of male drinkers reporting drinking at responsible levels and decreases particularly in drinking at hazardous levels. Women showed smaller variations across the categories employed consistent with a tendency to

be less likely to drink at harmful levels as defined by NHMRC. The temporal pattern of the reductions suggests an immediate benefit which was then sustained.

Per capita consumption

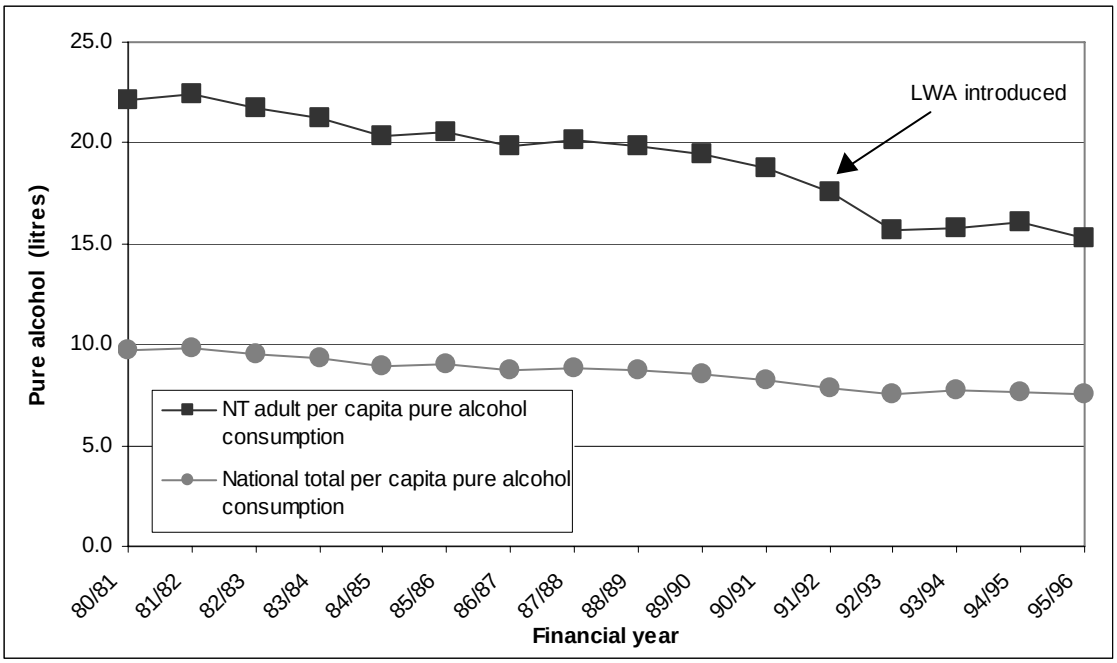

Figure 1: Annual adult (15+yrs) per capita consumption of pure alcohol in the and total National per capita consumption between 1980/81 and 1995/96

Prior to mid 1990 there were no wholesale purchase data available for the NT. Between 1980/81 and 1989/90 NT per capita consumption was modelled from national levels obtained from World Drink Trends (1998). Appendix A contains a table of national levels of per capita consumption for each financial year between 1980/81 and 1995/96 as found in World Drink Trends (1998).

It was assumed in doing this that per capita consumption in the NT maintained the same ratio to national levels as in 1990/1991, the first available year at which both national and NT data were available. As an example of how national per capita levels were used to estimate NT consumption, the formula employed for calculation of NT 1989/90 per capita consumption has been shown below:

npcc89/90: National per capita consumption 1989/90

npcc90/91: National per capita consumption 1990/91

tpcc89/90: NT per capita consumption 1990/91

tpcc89/90 = (((npcc90/91 - npcc89/90)/npcc9091)) * tpcc90/91*-1) + tpcc90/91

Figure 2 shows that NT per capita consumption of alcohol by adults declined relative to the level expected on the basis of national trends evident prior to LWA. Estimated adult annual per capita consumption in the NT is also summarised in Appendix B, which shows that there were comparatively large drops immediately after the introduction of LWA (11%) followed by a period of little change and then another year of sizeable reduction in 1995/6.

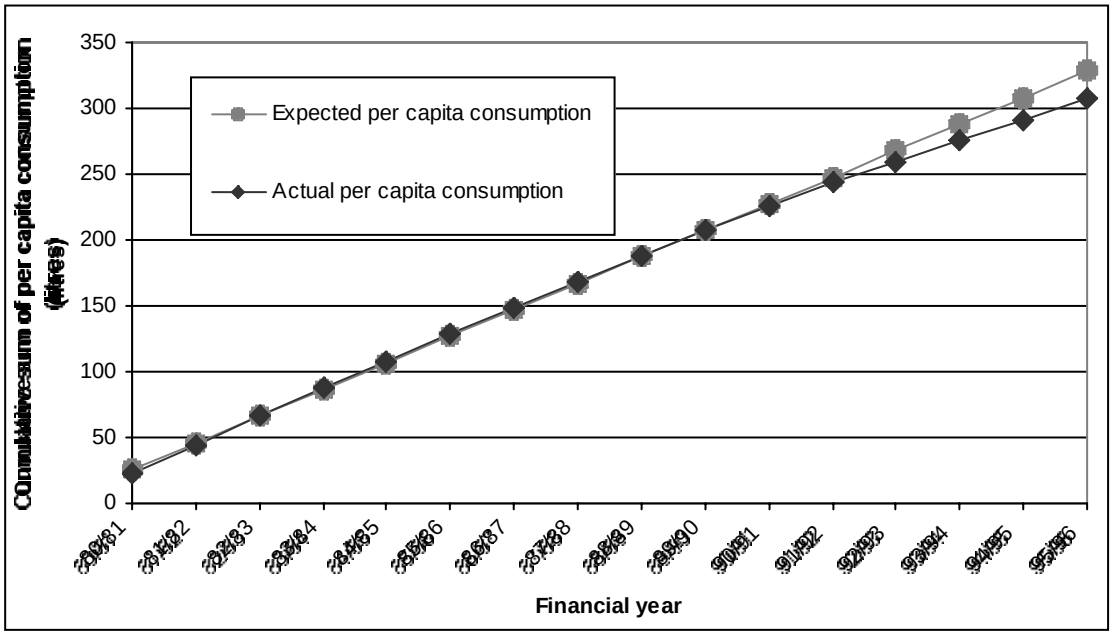

Figure 2: Actual and expected cumulative sum of per capita consumption in NT between mid 1980 and mid 1996 at the close of each financial year

Table 6
Actual and expected per capita consumption in NT for financial years following the introduction of LWA; 1992/93 to 1995/96

Year	Actual per capita consumption	Expected per capita consumption	Difference between actual and expected consumption	Difference as % of expected per capita consumption
92/93	15.7	20.18	-4.48	-22.2%
93/94	15.7	20.18	-4.48	-22.2%
94/95	16.1	20.18	-4.08	-20.2%
95/96	15.3	20.18	-4.88	-24.2%
Total	62.8	80.72	-17.92	-22.2%

The above estimates of per capita consumption are based on liquor licensing returns from retailers and wholesalers. They take no account of either home-made drinks or interstate purchases made by individuals. Table 7 summarises the responses from drinkers to the four surveys mentioned above regarding their use of these in the 3 months prior to each survey. If anything these responses suggest a slight reduction in consumption of home-brewed beer and an increase in interstate purchases. However, the

latter are still at a low level and the amounts reported to have been consumed were quite small (Bertram and Crundall, 1997). These data suggest that the reductions in recorded per capita consumption reported here are not an artefact of a compensatory increase in alcohol consumption from other sources.

Table 7
Percentage of drinkers consuming home-brewed beer or mail-order alcohol in past 3 months (Weighted data)

Type of Alcohol	1992 (n=1088)	1993 (n=1293)	1994 (n=401)	1997 (n=1582)
Home-Brew	7%	8%	4%	6%
Mail-Order	3%	3%	8%	6%

Road crash injury data

All non-fatal alcohol related road crash injuries

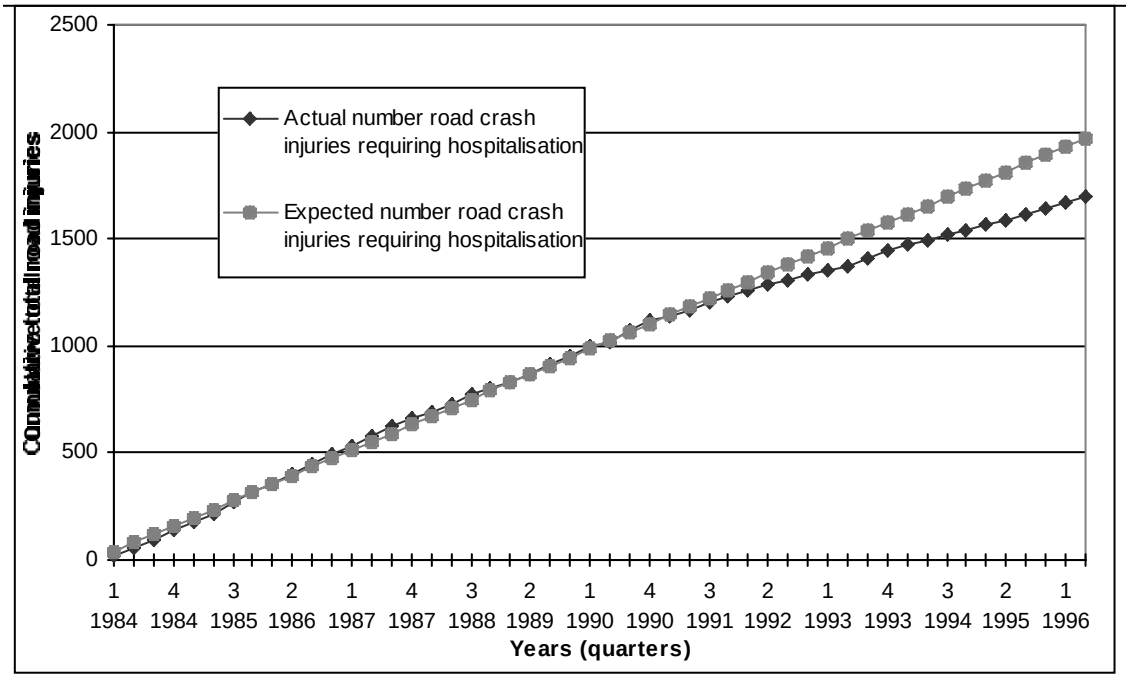

Figure 3: Cumulative sum of adjusted actual and expected road crash injuries requiring hospitalisation and not resulting in death and occurring on NT roads between 1984 and 1997, at the close of each quarter

Figure 3 shows the cumulative sum of both the actual number of alcohol fraction adjusted road injuries (not including fatalities) and the number of injuries expected to have occurred given the trend indicated from previous years. Between the financial years 1992/93 to 1995/6 there was an average of approximately 35% fewer crash resulting in non-fatal injuries requiring hospitalisation. As shown in Table 8, the estimated reduction from expected levels varied from year to year, ranging from a 26.4% reduction in 1993/94 to 42.9% in 1992/93.

Table 8
Actual and expected number of NT road crash injuries for financial years following the introduction of LWA; 1992/93 to 1995/96

Year	Actual No. injuries	Expected No. injuries	Difference between actual and expected number of injuries	Difference as % of number expected injuries in NT
92/93	90.0	157.5	-67.5	-42.9%
93/94	115.9	157.5	-41.6	-26.4%
94/95	97.5	157.5	-60.0	-38.1%
95/96	105.6	157.5	-51.9	-32.9%
Total	409.1	630.1	-221.0	-35.1%

Road crash injuries resulting in death

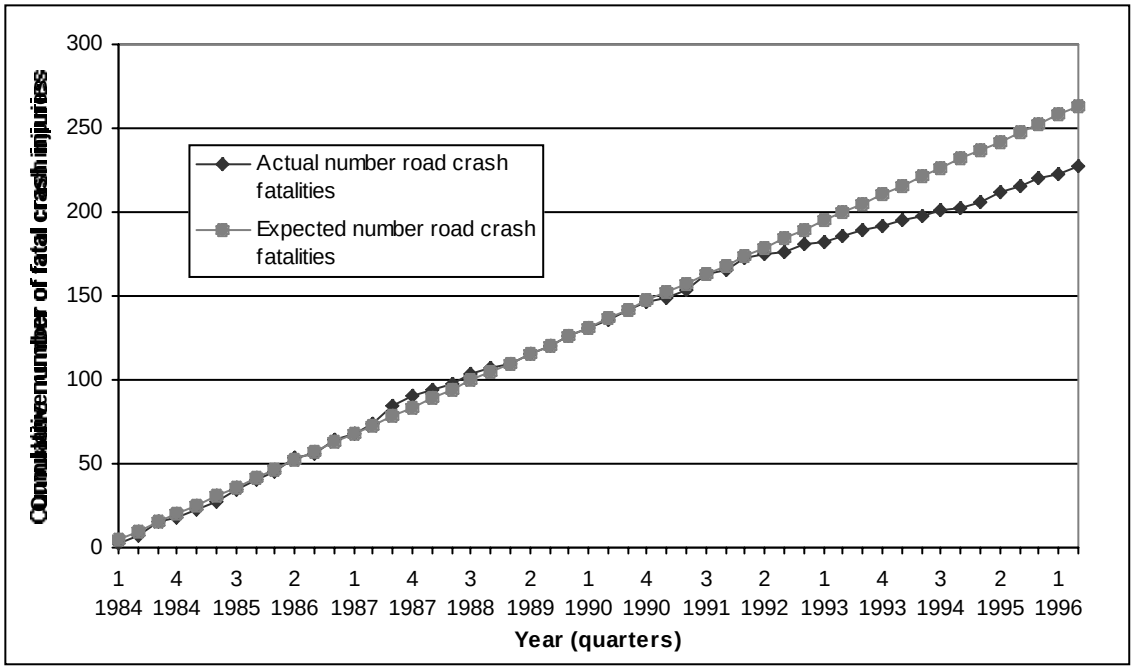

Figure 4: Cumulative sum of actual and expected number of adjusted road deaths occurring on NT roads between mid 1984 and mid 1996 at the close of each quarter

There was a substantial reduction in the number of alcohol fraction adjusted road fatalities between 1992/93 and 1995/96. The total mean reduction for the four year period examined was 38.9%, but on an annual basis the estimated reduction in fatalities was 49.2% in 1992/3 and fell each year to 28.4% in 1995/6. Figure 4 illustrates the overall trends for the entire period 1984 to 1996 and Table 9 provides data for the last four financial years.

Table 9
Actual and expected number of NT adjusted road deaths for financial years following the introduction of LWA; 1992/93 to 1995/96

Year	Actual No. crash deaths	Expected No. crash deaths	Difference between expected and actual	Difference as % of number expected road deaths in NT
92/93	10.7	21.1	-10.4	-49.2%
93/94	11.9	21.1	-9.2	-43.6%
94/95	13.8	21.1	-7.3	-34.4%
95/96	15.1	21.1	-6.0	-28.4%
Total	51.6	84.4	-32.9	-38.9%

Road crash injuries not requiring hospitalisation

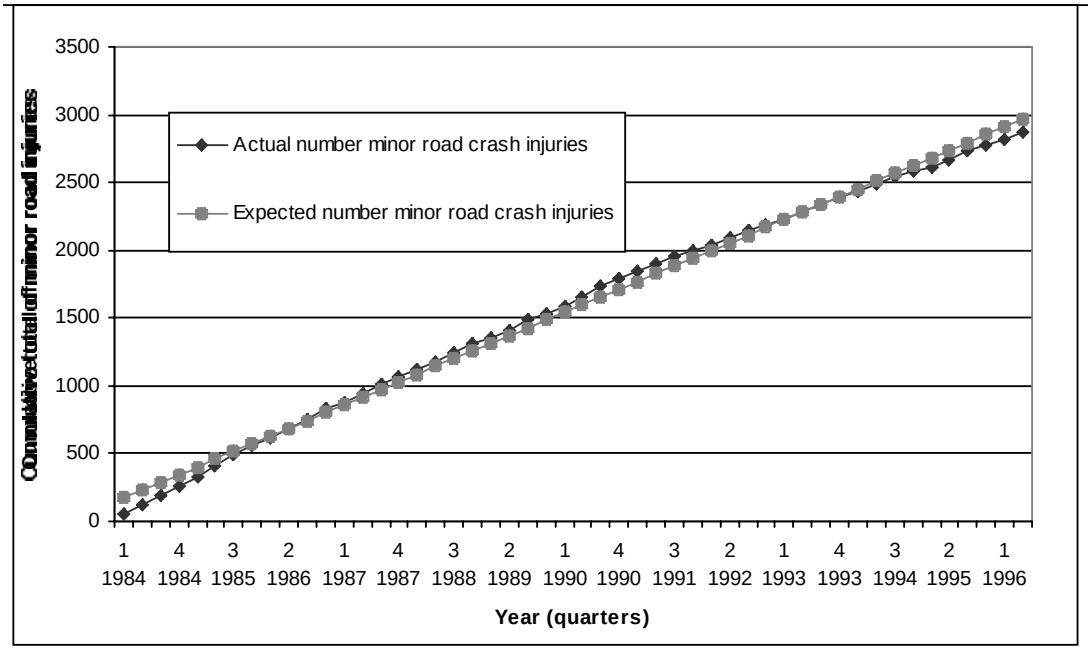

Figure 5: Cumulative sum of actual and expected number of adjusted minor road injuries occurring on NT roads between mid 1984 and mid 1996 at the close of each quarter

Figure 5 illustrates the overall trends for the entire period 1984 to 1996 and Table 10 provides data for the last four financial years following LWA implementation. There was a substantial reduction in the number of alcohol fraction adjusted minor road injuries between 1992/93 and 1995/96. The total mean reduction for the four year period examined was 14.1%, with the estimated number of minor injuries saved ranging between 20.7% in 1994/95 and 8.8% in 1995/96.

Table10
Actual and expected number of NT adjusted minor road injuries for financial years following the introduction of LWA; 1992/93 to 1995/96

Year	Actual No. minor crash injuries	Expected No. crash injuries	Difference between expected and actual	Difference as % of number expected minor road injuries in NT
92/93	194.8	227.9	-33.1	-14.5%
93/94	200.1	227.9	-27.8	-12.2%
94/95	180.6	227.9	-47.3	-20.7%
95/96	207.9	227.9	-20.0	-8.8%
Total	783.4	911.5	-128.1	-14.1%

Alcohol related mortality

All adjusted alcohol related deaths other than road fatalities

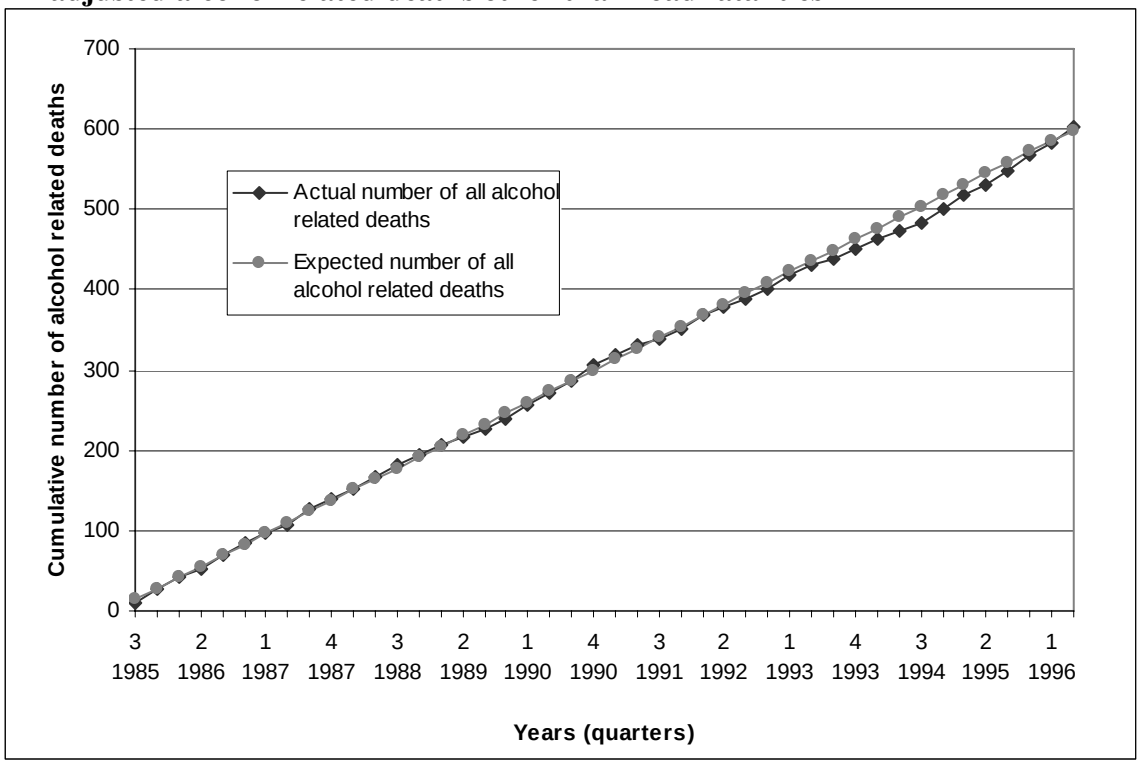

Figure 6: Cumulative number of all actual and expected adjusted alcohol related deaths excluding road deaths among Northern Territory residents between 1985 and 1996 at the close of each quarter

Table 11
Actual and expected number of *all* adjusted alcohol related deaths for four financial years following the introduction of LWA

Year	Actual No. alcohol related deaths	Expected No. alcohol related deaths	Difference between actual and expected deaths	Difference as % of all expected alcohol related deaths
92/93	52.2	54.3	-2.1	-3.9%
93/94	43.2	54.3	-11.1	-20.4%
94/95	57.5	54.3	3.2	5.9%
95/96	70.2	54.3	15.9	29.3%
Total	223.0	217.3	5.7	2.6%

During the first few years of LWA there were substantial savings in deaths due to acute alcohol related conditions, particularly in 1993/94 which indicated a saving of over 20%. However, due to a rise in the number of acute alcohol related deaths occurring in 1995/96 there was an overall increase in actual number of deaths occurring over the four years subsequent to LWA introduction.

Chronic adjusted alcohol related deaths

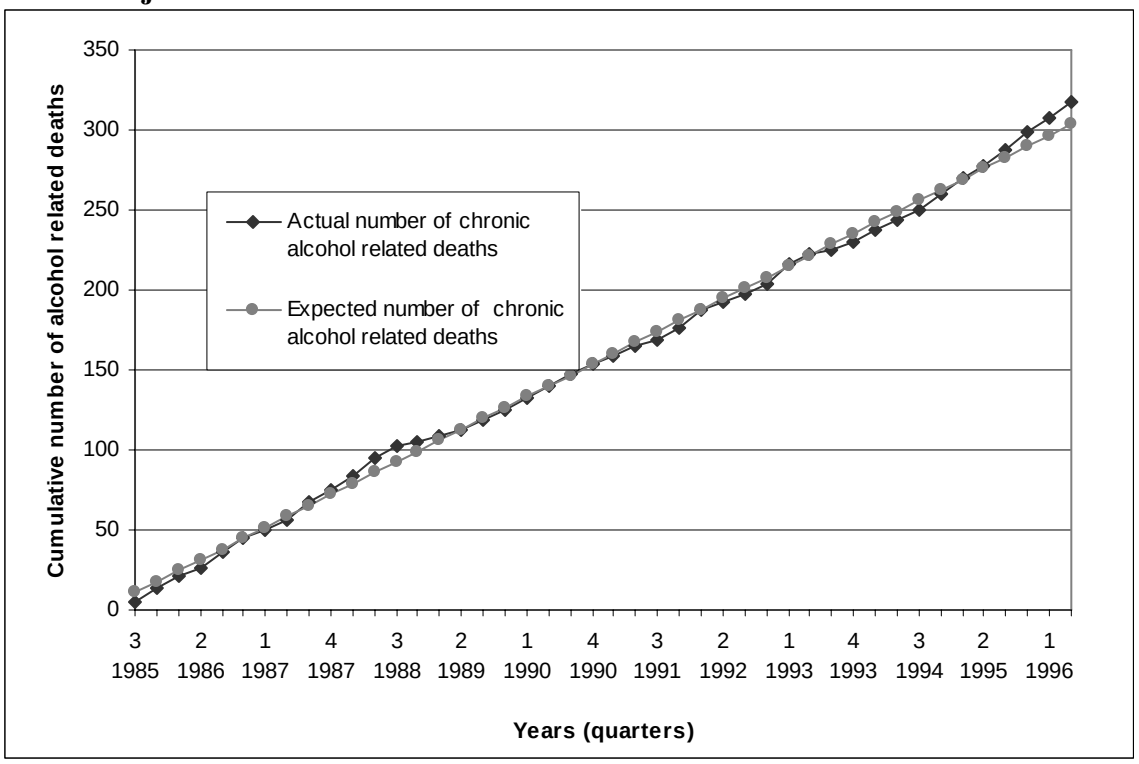

Figure 7: Cumulative number of actual and expected adjusted deaths from combined chronic alcohol related conditions among NT residents between 1985 and 1996 at the close of each quarter

Table 12
Actual and expected number of NT adjusted deaths from chronic alcohol related conditions for financial years following the introduction of LWA; 1992/93 to 1995/96

Year	Actual No. chronic alcohol related deaths	Expected No. chronic alcohol related deaths	Difference between actual and expected deaths	Difference as % of all expected alcohol related deaths
92/93	29.8	27.2	2.6	9.7%
93/94	20.8	27.2	-6.4	-23.6%
94/95	34.2	27.2	7.0	25.8%
95/96	39.9	27.2	12.7	46.6%
Total	124.7	108.8	15.9	14.6%

When estimated alcohol related deaths were categorised into those caused by long-term alcohol use (chronic conditions), these were found to have increased by 14.6% over what had been predicted from trends in previous years. The increase in such deaths was more marked at the end of the period than at the beginning.

Acute adjusted alcohol related deaths not including road fatalities

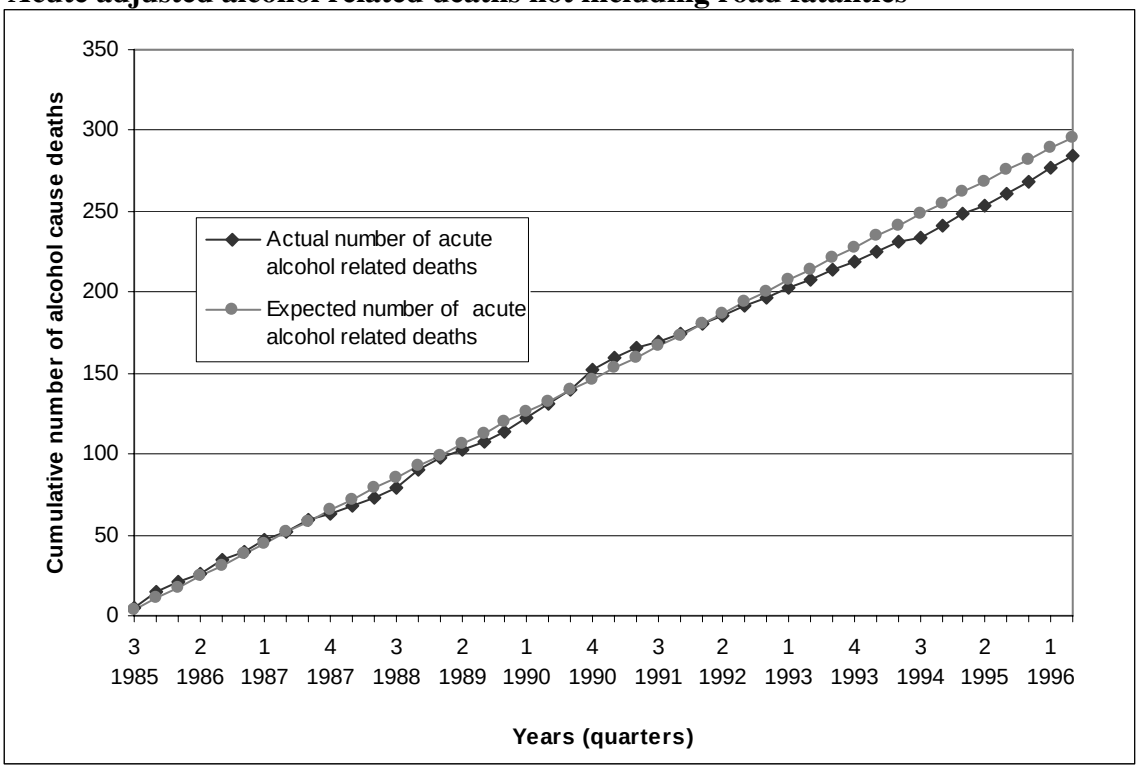

Figure 8: Cumulative number of actual and expected adjusted deaths from combined acute conditions (not including road fatalities) among NT residents between 1985 and 1996 at the close of each quarter

Table 13
Actual and expected number of NT adjusted deaths from acute conditions for financial years following the introduction of LWA; 1992/93 to 1995/96

Year	Actual No. acute alcohol related deaths	Expected No. acute alcohol related deaths	Difference between actual and expected deaths	Difference as % of all expected alcohol related deaths
92/93	22.3	27.1	-4.8	-17.7%
93/94	22.4	27.1	-4.7	-17.3%
94/95	23.3	27.1	-3.8	-14.0%
95/96	30.3	27.1	3.2	11.8%
Total	98.4	108.5	-10.1	-9.3%

When estimated alcohol related deaths were categorised into those caused by intoxication (acute conditions), these were found to have decreased by 9.3% over what had been predicted from trends in previous years. The decrease in such deaths was more marked at the beginning of the period than at the end.

Alcohol related morbidity

All adjusted alcohol caused hospital admissions combined not including road injury hospitalisations

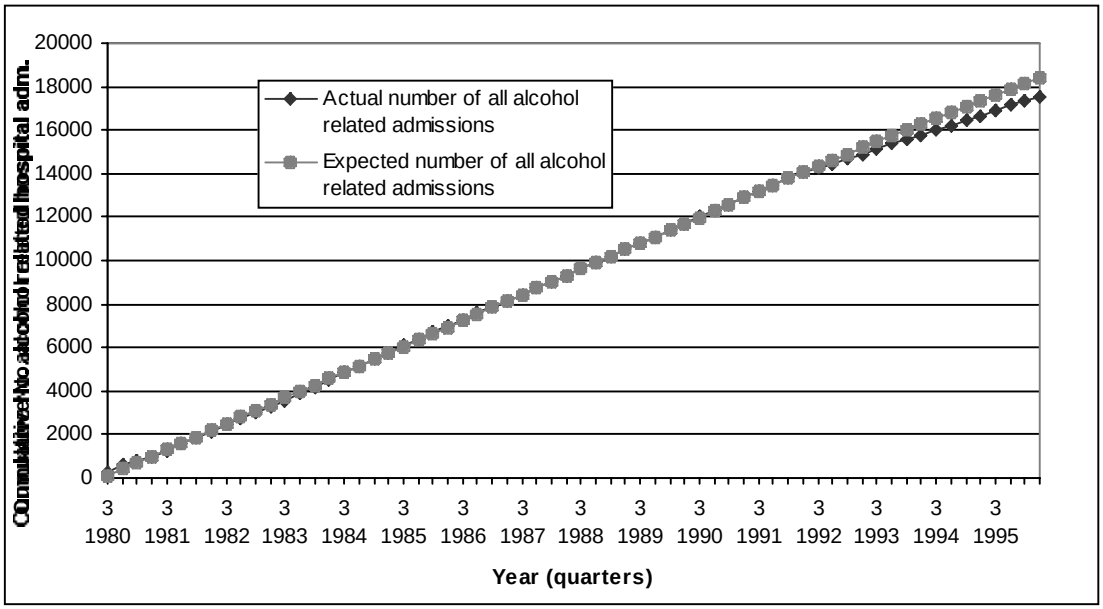

Figure 9: Cumulative number of *all* actual and expected adjusted alcohol related hospital admissions (not including road injuries) among Northern Territory residents between 1980 and 1996 at the close of each quarter for all alcohol related conditions

Table 14
Actual and expected number of *all* adjusted alcohol related admissions (not including road injuries) for financial years following the introduction of the LWA program; 1992/93 to 1995/96 in the Northern Territory

Year	Actual No. alcohol related adm.	Expected No. alcohol related adm.	Difference between expected and actual alcohol related adm.	Difference as % of all expected alcohol related adm.
92/93	817.7	1114.7	-297.0	-26.6%
93/94	893.7	1096.6	-202.9	-18.5%
94/95	877.1	1066.7	-189.5	-17.8%
95/96	887.5	1073.5	-186.0	-17.3%
Total	3476.0	4351.5	-875.5	-20.1%

As seen above for hospital admissions including road injury hospitalisations, the saving in admissions was greatest in 1992/93 but continued at substantial levels throughout the following years. Overall, the reduction in alcohol related morbidity averaged approximately 20%.

Hospital admission for combined alcohol fraction adjusted chronic conditions

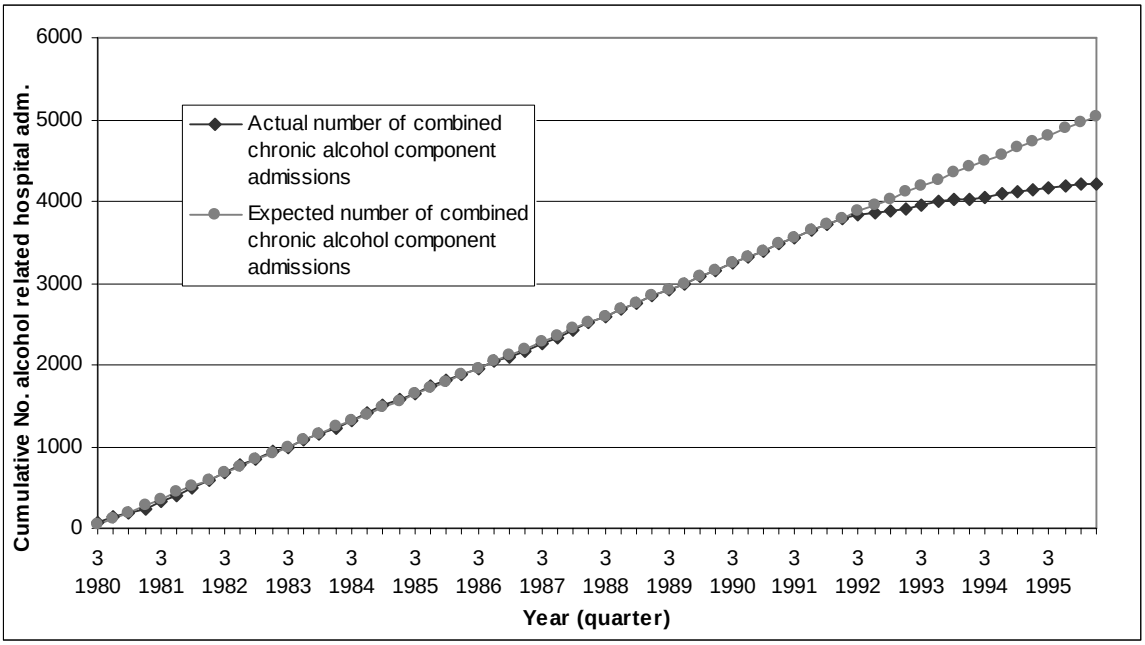

Figure 10: Cumulative number of actual and expected adjusted combined chronic condition alcohol related hospital admissions among Northern Territory residents between 1980 and 1996 at the close of each quarter for all alcohol related conditions

Table 15
Actual and expected number of adjusted combined chronic condition alcohol related admissions for financial years following the introduction of LWA; 1992/93 to 1995/96 in the Northern Territory

Year	Actual No. alcohol related adm.	Expected No. alcohol related adm.	Difference between expected and actual alcohol related adm.	Difference as % of all expected alcohol related adm.
92/93	117.6	315.4	-197.9	-62.7%
93/94	121.1	310.8	-189.7	-61.0%
94/95	99.4	306.0	-206.6	-67.5%
95/96	81.1	312.1	-231.0	-74.0%
Total	419.2	1244.3	-825.1	-66.3%

There was a substantial and consistent reduction in total alcohol related morbidity for chronic conditions which averaged 66.3% across the four years examined subsequent to LWA introduction. The difference between actual and expected number of hospital admissions was greatest in 1995/96 (74%). Notably, as shown below, the reduction in chronic condition admissions was largely the result of a marked decrease in the number of public hospital admissions for alcohol dependence.

Hospital admission for alcohol fraction adjusted chronic conditions with a high alcohol component (attributable risk for males greater than 79%)

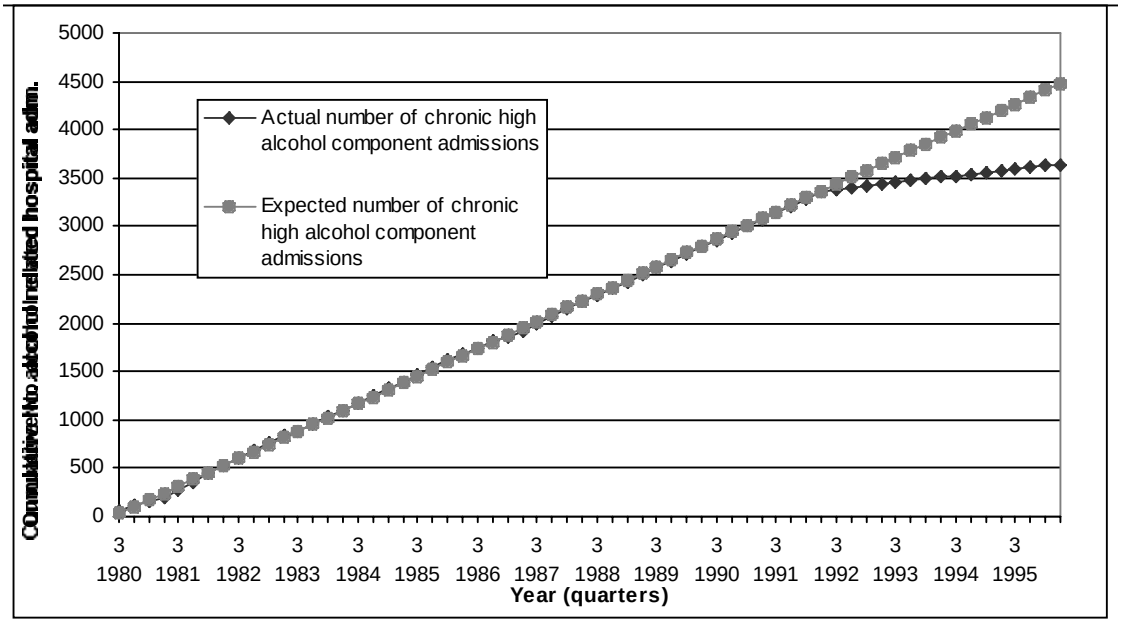

Figure 11: Cumulative number of expected adjusted admissions for chronic conditions with a high alcohol component, among Northern Territory residents between 1985 and 1996 at the close of each quarter

Table 16
Actual and expected number of Northern Territory adjusted admissions for chronic conditions with a high alcohol related component for financial years following the introduction of LWA; 1992/93 to 1995/96

Year	Actual No. alcohol related admissions	Expected No. alcohol related admissions	Difference between expected and actual	Difference as % of all expected alcohol related adm.
92/93	77.1	281.0	-203.9	-72.6%
93/94	81.1	277.3	-196.2	-70.7%
94/95	63.2	272.7	-209.5	-76.8%
95/96	58.3	278.2	-219.9	-79.0%
Total	279.8	1109.2	-829.5	-74.8%

Most chronic alcohol related morbidity conditions had a high attributable risk. These showed a large and consistent reduction in high alcohol caused conditions which averaged 74.8% across the four years examined after the start of LWA.

Interestingly, the large fall in the number of admissions for chronic conditions with a high alcohol component was almost entirely due to a sharp decrease in admissions to public hospitals for alcoholic dependence. As a proportion of all chronic conditions with a high attributable risk, prior to 1992/93, alcoholic dependence contributed to over 80% of admissions.

Chronic conditions with low and medium alcohol components (attributable risk for males between less than 20%, and between 20% and 79%)

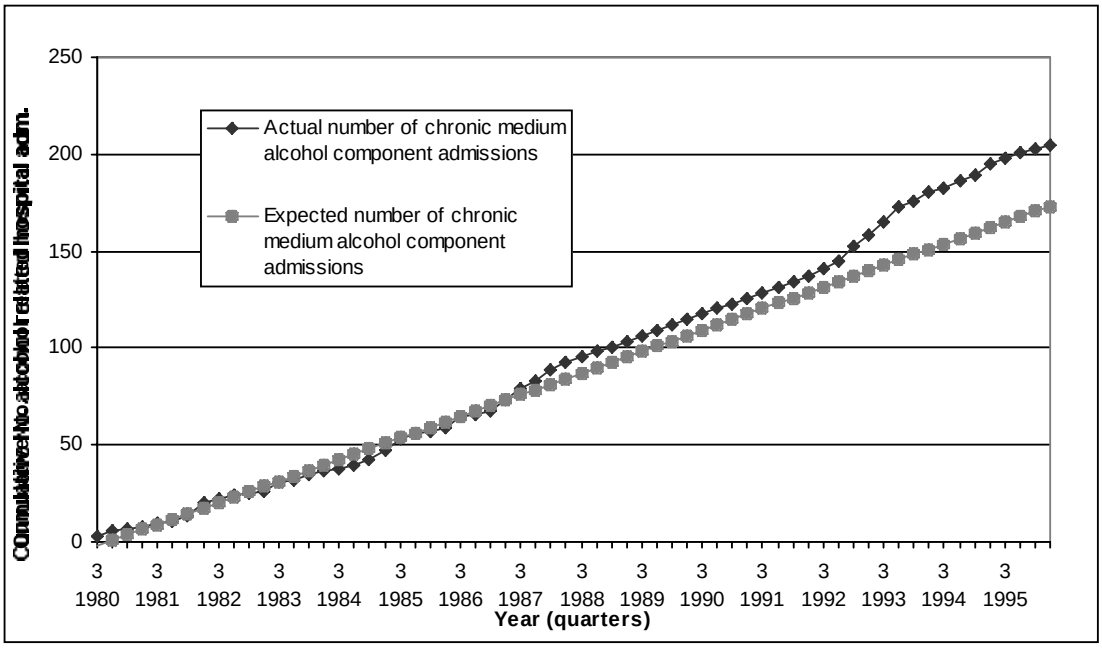

Figure 12: Cumulative number of actual and expected adjusted admissions for chronic conditions with a medium alcohol component, among Northern Territory residents between 1985 and 1996 at the close of each quarter

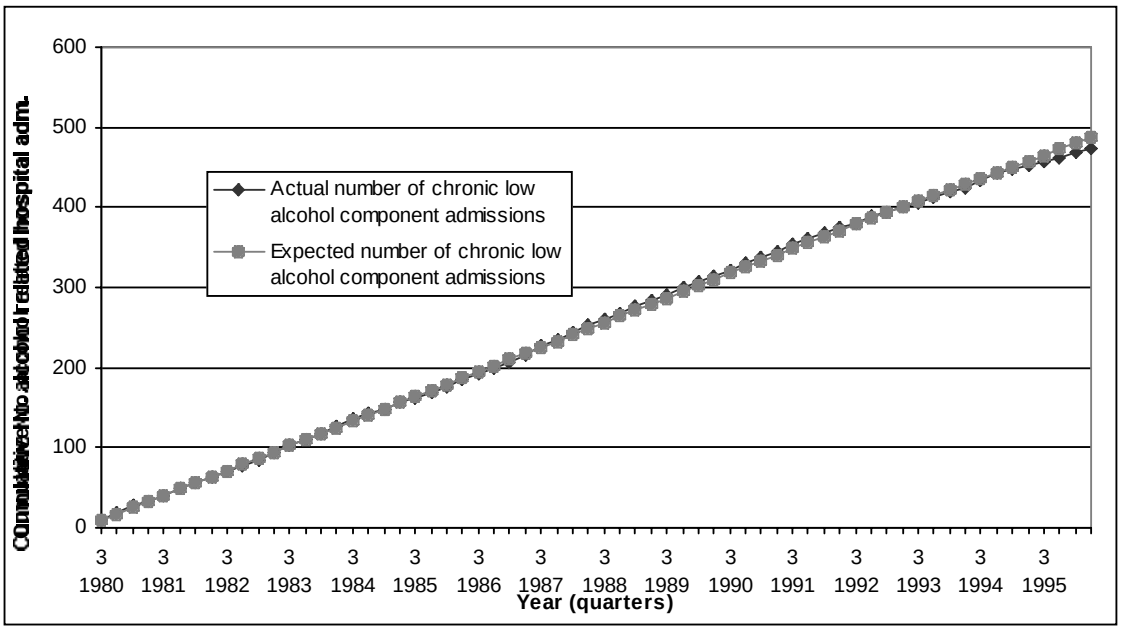

Figure 13: Cumulative number of actual and expected adjusted admissions for chronic conditions with a low alcohol component, among Northern Territory residents between 1985 and 1996 at the close of each quarter

There were relatively few cases of alcohol related morbidity in either of these categories and the summaries below should be interpreted cautiously. They show that medium alcohol component conditions were at higher than expected levels while low alcohol component conditions were lower – the respective numbers approximately cancel each other out.

Table 17
Actual and expected number of Northern Territory adjusted admissions for chronic conditions with a medium alcohol related component for financial years following the introduction of LWA; 1992/93 to 1995/96

Year	Actual No. alcohol related admissions	Expected No. alcohol related admissions	Difference between expected and actual	Difference as % of all expected alcohol related adm.
92/93	20.9	11.1	9.7	87.6%
93/94	22.3	11.1	11.2	100.7%
94/95	15.1	11.1	3.9	35.3%
95/96	9.8	11.1	-1.3	-11.9%
Total	68.1	44.0	24.1	54.7%

Table 18
Actual and expected number of Northern Territory adjusted admissions for chronic conditions with a low alcohol related component for financial years following the introduction of LWA; 1992/93 to 1995/96

Year	Actual No. alcohol related admissions	Expected No. alcohol related admissions	Difference between expected and actual	Difference as % of all expected alcohol related adm.
92/93	24.4	29.0	-4.5	-15.7%
93/94	24.5	29.1	-4.6	-15.8%
94/95	27.2	27.7	-0.6	-2.0%
95/96	21.4	29.5	-8.1	-27.5%
Total	97.5	115.3	-17.8	-15.5%

Hospital admissions for combined alcohol fraction adjusted acute conditions not including road injury hospitalisations

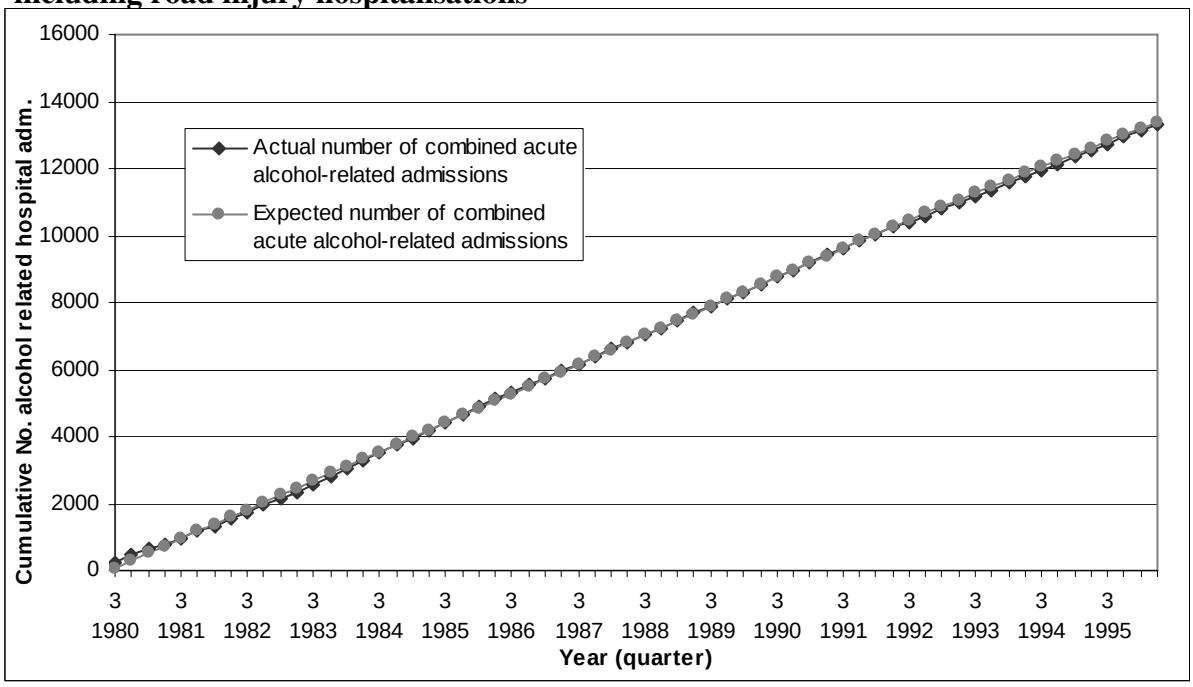

Figure 14: Cumulative number of actual and expected adjusted combined acute condition alcohol related hospital admissions (not including road injuries) among Northern Territory residents between 1980 and 1996 at the close of each quarter for all alcohol related conditions

Table 19
Actual and expected number of Northern Territory adjusted admissions for combined acute condition alcohol related hospitalisations (not including road injury hospitalisations) for financial years following the introduction of LWA; 1992/93 to 1995/96

Year	Actual No. alcohol related admissions	Expected No. alcohol related admissions	Difference between expected and actual	Difference as % of all expected alcohol related adm.
92/93	700.1	799.9	-99.8	-12.5%
93/94	772.6	787.6	-15.0	-1.9%
94/95	777.7	764.0	13.7	1.8%
95/96	806.4	767.0	39.3	5.1%
Total	3056.8	3118.5	-61.8	-2.0%

The reduction in all combined acute condition hospitalisations, excluding those for road injury, was most marked in the first year following LWA (12.5%). However 1994/95 and 1995/96 indicated increased numbers of hospitalisations above that expected from trends in previous years, thereby producing an overall reduction of only 2%.

Acute conditions with a high alcohol component (attributable risk for males greater than 79%)

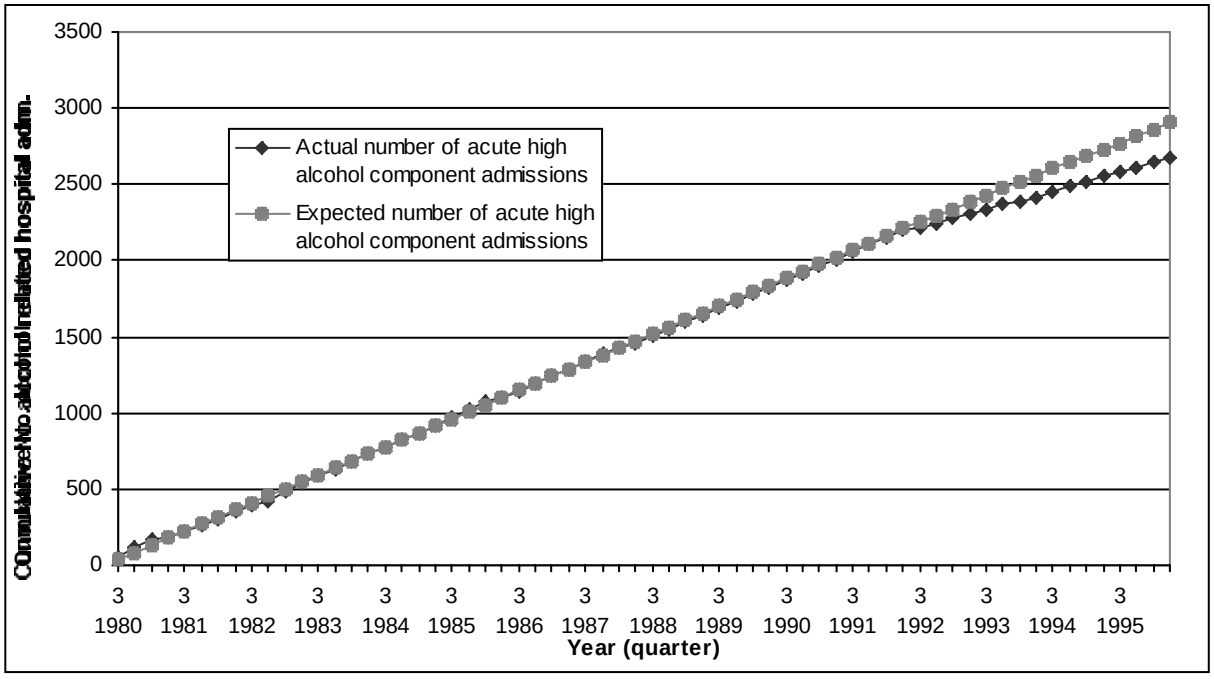

Figure 15: Cumulative number of actual and expected adjusted admissions for acute conditions with a high alcohol component, among Northern Territory residents between 1985 and 1996 at the close of each quarter

Table 20
Actual and expected number of Northern Territory adjusted admissions for acute conditions with a high alcohol related component for financial years following the introduction of LWA; 1992/93 to 1995/96

Year	Actual No. alcohol related admissions	Expected No. alcohol related admissions	Difference between expected and actual	Difference as % of all expected alcohol related adm.
92/93	106.0	173.3	-67.3	-38.8%
93/94	113.0	177.0	-64.0	-36.2%
94/95	135.0	168.5	-33.5	-19.9%
95/96	125.0	177.6	-52.6	-29.6%
Total	479.0	696.4	-217.4	-31.2%

Acute alcohol related conditions with a high alcohol component were markedly lower than expected with an average annual reduction of 31.2%. The reductions were more marked earlier in the series than later.

Acute conditions with a medium alcohol component (attributable risk for males between 79% and 20%)

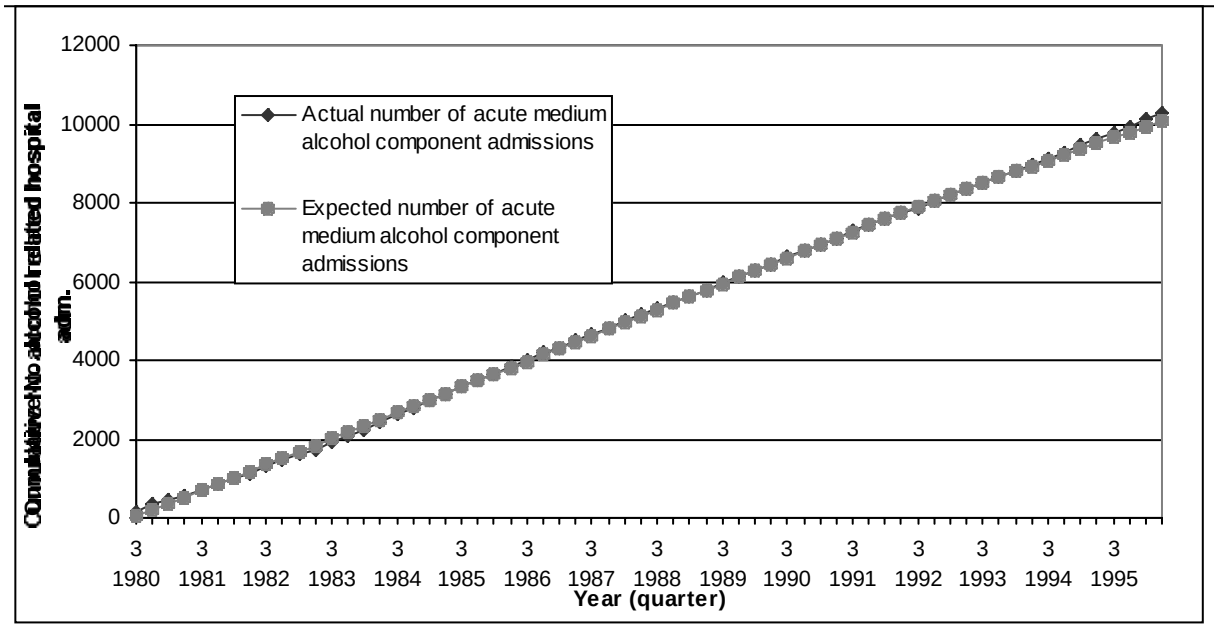

Figure 16: Cumulative number of actual and expected adjusted admissions for acute conditions with a medium alcohol component (not including road injury hospitalisations) among Northern Territory residents between 1985 and 1996 at the close of each quarter

Table 21
Actual and expected number of Northern Territory adjusted admissions for acute conditions with a medium alcohol component (not including road injury hospitalisations) for financial years following the introduction of the LWA program; 1992/93 to 1995/96

Year	Actual No. alcohol related admissions	Expected No. alcohol related admissions	Difference between expected and actual	Difference as % of all expected alcohol related adm.
92/93	574.7	602.1	-27.4	-4.6%
93/94	637.5	587.5	50.1	8.5%
94/95	622.1	573.5	48.5	8.5%
95/96	657.7	569.7	88.0	15.4%
Total	2491.9	2332.8	159.2	6.8%

Most acute alcohol related conditions had a 'medium' level alcohol component, reflecting the fact that injuries are estimated by English *et al* (1995) to be alcohol related in 30% to 40% of cases. Notably, the only reduction from expected numbers of medium level acute condition hospitalisations occurred in the first year following LWA (4.6%). All other years showed increased levels of admissions above that expected from trends in previous years, with an overall increase in alcohol related admissions of approximately 7%. It is important to note that while road injuries do in fact constitute a condition with a medium level alcohol component they have not been included here, but have been dealt with separately in a previous section.

Acute conditions with a low alcohol component (attributable risk for males less than 20%)

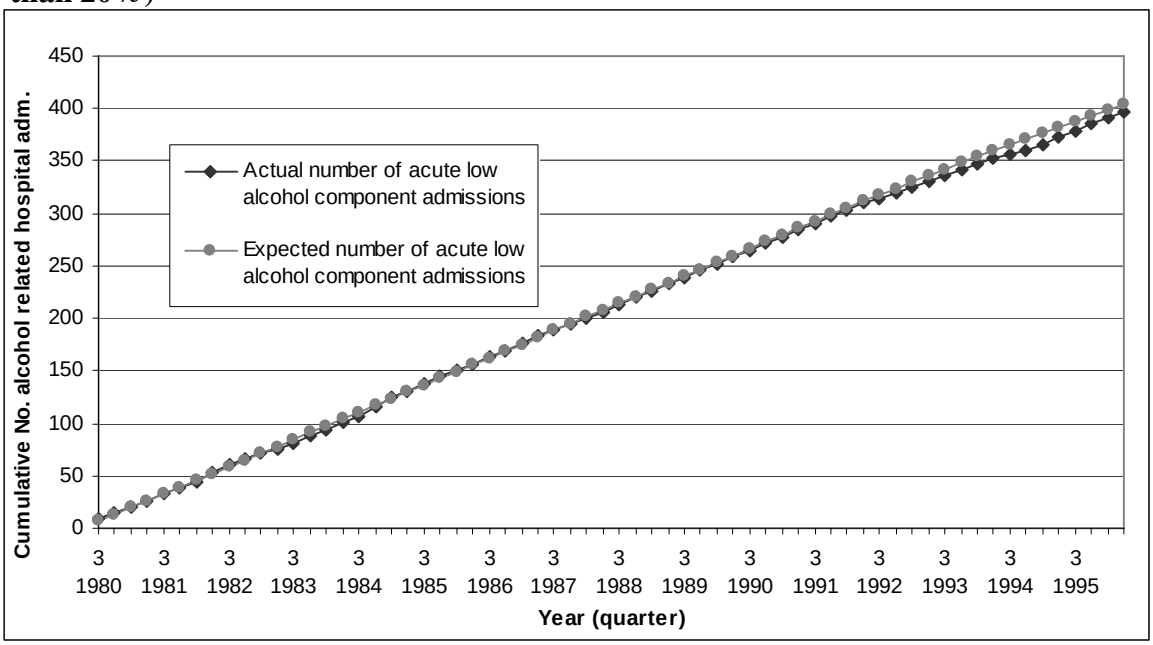

Figure 17: Cumulative number of actual and expected adjusted admissions for acute conditions with a low alcohol component, among Northern Territory residents between 1985 and 1996 at the close of each quarter

Table 22
Actual and expected number of Northern Territory adjusted admissions for acute conditions with a low alcohol related component for financial years following the introduction of LWA; 1992/93 to 1995/96

Year	Actual No. alcohol related admissions	Expected No. alcohol related admissions	Difference between expected and actual	Difference as % of all expected alcohol related adm.
92/93	19.4	24.6	-5.1	-20.9%
93/94	22.1	23.8	-1.7	-7.3%
94/95	20.6	22.6	-2.0	-8.8%
95/96	23.7	21.4	2.3	10.7%
Total	85.8	92.4	-6.6	-7.1%

There were only few acute alcohol related conditions in the categories estimated by English *et al* to have an attributable fraction lower than 20%. While these figures should be treated with caution, the average annual reduction was similar to the medium component conditions at 7.1%. The pattern across years was also consistent with other indicators with the largest reduction in the first year and an actual increase in 1995/6.

5. Controlled analyses of trend data on selected indicators

This section reports controlled analyses of observed trends in harm indicators before and after the introduction of LWA and in comparison with control data on equivalent non-alcohol related indicators. Only those indicators for which there were sufficient pre-LWA data could be selected for analysis.

Road injury data

Alcohol related non-fatal road crash injuries requiring hospitalisation

For this analysis the basic unit of analysis was rate of non-fatal road injuries requiring hospitalisation occurring at quarterly intervals over the study period. As shown in Table 23 below, the types of road users found among the injured varied. Since road injury rates were calculating per 10,000 NT licensed drivers, injuries were drawn from all cases except where the injured party was a pedestrian or a bicycle rider (approximately 13.2%).

Table 23
Percentages of non-fatal road injuries by type of road user

Road user type	Percentage of all road injuries*
Bicycle Pillion	0.02%
Bicyclist	6.20%
Driver	40.29%
Motorcycle Pillion	1.55%
Motorcyclist	12.12%
Passenger	29.34%
Pedestrian	6.96%
Rear Tray	2.80%
Unknown	0.72%
Total	100.00%

* *Percentages calculated using combined total of all non-fatal road crash injuries occurring between 1984 and 1997.*

To determine the effect of LWA on road injuries requiring hospitalisation, ie. serious crashes, the measure for alcohol related injuries was represented by injuries requiring hospitalisation (and not resulting in death) which occurred on Thursday, Friday and Saturday nights. Conversely, the 'control' condition, that is, those injuries least likely to have been affected by high risk alcohol consumption, were represented by minor crashes occurring Sundays to Wednesdays which either did not require any medical treatment or which were treated only in emergency rooms.

As evident from Figure 18, while night-time injuries requiring hospitalisation appeared to decline markedly about the time of LWA implementation, quarterly rates for day-time injuries which were less serious and less likely to involve high risk alcohol consumption, ie. injured persons did not require treatment or were treated only in emergency rooms, appeared to remain relatively stable throughout the study period.

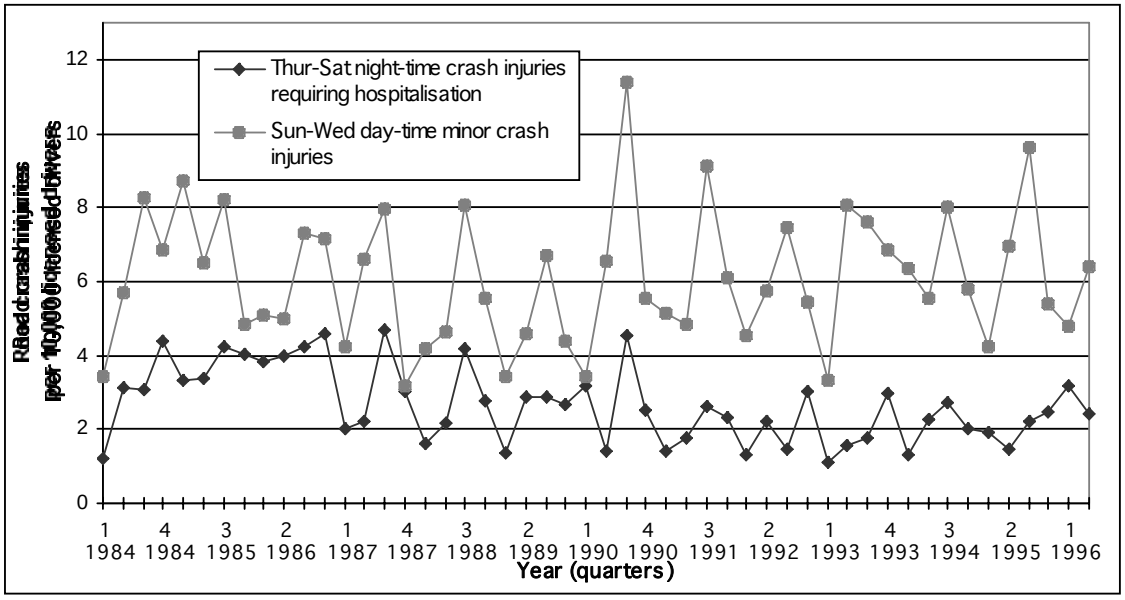

Figure 18: Trends in quarterly road crash injury rates requiring hospitalisation occurring Thur-Sat night-time and crash injury rates for minor injuries occurring Sun-Wed day-time

The relationship between the dependent variable; hospitalised injuries occurring on Thursday, Friday and Saturday nights, and the implementation of LWA was examined using multiple linear regression. The main independent variable of interest - LWA, first occurred in the second quarter of 1992 and continued to the end of the study period in the second quarter of 1996. The night-time road injury series was deseasonalized and examined for significant serial autocorrelation among residuals. Employing a Durban-Watson test of serial autocorrelation, with three regressors fitted (LWA, 05 legislation/cask wine levy and deseasonalized quarterly rates of day-time minor road

injuries) and 50 time intervals there was no evidence of significant positive or negative autocorrelation (D-W = 1.64).

Importantly, in order to control for any possible external confounders which may have affected the relationship between LWA and rate of night-time hospitalised road injuries, effect sizes were adjusted by the control variable – day-time minor crash injuries occurring on all other days of the week.

Other variables employed as regressors in order to test the adjustment effect on any association between LWA and the night-time road injury series were the introduction of .05mg/ml blood alcohol level legislation in December 1994, and the implementation of the cask wine levy in July of 1995. However, preliminary analyses revealed that there was a high degree of collinearity between the two individual variables. Given that the two events occurred within 6 months of each other this was not unexpected. Thus, a single dummy variable was created to represent the combined effect of both events, where all intervals prior to the 1st quarter of 1995 were denoted 0 and all intervals following the final quarter of 1994 were denoted 1.

Thus, it was possible to approximate the magnitude of the saving in night-time road crash injuries associated with the implementation of LWA within 95% confidence intervals while adjusting for concurrent changes in rates of day-time road injuries and other possible confounders.

Before the introduction of LWA, the mean seasonally adjusted quarterly rate of non-fatal night-time road injuries requiring hospitalisation was approximately 2.94 per 10,000 licensed drivers. Subsequent to the introduction of LWA the mean night-time road injury rate declined by 26.2% to 2.17 injuries per quarter per 10,000 licensed drivers. For day-time minor road injuries the mean rate of injury prior to LWA was 6.01 per quarter increasing slightly (6%) to 6.37 injuries per quarter per 10,000 persons in the after period.

As shown in Table 24 below, the association between LWA and night-time crash injury rates was negative and highly significant ($t = -3.3(49)$, $p < 0.005$). Importantly however, when adjusted for concurrent changes in day-time crash injury rates Beta declined only slightly and remained significant ($t = -3.2(48)$, $p < 0.005$). Additionally, after adjustment for the implementation of .05 BAL legislation/cask wine levy, the association between LWA and night-time injury rates remained significant at the 0.01 level ($t = -3.1(48)$, $p < 0.005$).

Table 24
Association between LWA and night-time Thur-Sat crash injury rates, including adjustment for day-time Sun-Wed crash injury rates and the introduction of .05 BAL legislation/cask wine levy

Variable(s) entered	Adjusted R^2 for model	Stnd. B coef.	B Estimate	95% confidence interval for B		t	Sig.
				Lower	Upper		
LWA only	13.3%	-0.388	-0.765	-1.292	-0.237	-3.311	0.002
LWA adjusted for day-time minor road injuries	17.7%	-0.420	-0.828	-1.346	-0.309	-3.211	0.002
LWA adjusted for .05 campaign/cask wine levy only	13.9%	-0.480	-0.946	-1.559	-0.332	-3.102	0.003
LWA adjusted for day-time minor road injuries and .05 legislation/cask wine levy	18.1%	-0.506	-0.999	-1.600	-0.397	-3.344	0.002

With 95% confidence, the effect of LWA on the rate of night-time road crash injuries requiring hospitalisation was to significantly decrease the rate of non-fatal serious injury from between approximately 1.2 to 5.4 injuries per 10,000 licensed drivers per year. Total annual savings in road injuries within 95% confidence intervals estimated to have occurred between 92/93 and 95/96 have been presented in Table 25 below. Over the four years subsequent to the introduction of LWA, the estimated median number of injuries saved was approximately 125, within an upper 95% confidence limit of 203 and a lower limit of 46.5 injuries. Overall, the median proportion of hospitalised road injuries saved was 28%.

Table 25
Estimated total annual saving in night-time road crash injuries requiring hospitalisation occurring on Thur-Sat nights due to LWA, between 1992/93 and 1995/96 within upper and lower 95% confidence limits

Year	Number of all Thur-Sat night-time road crash injuries requiring hospitalisation	Thur-Sat night-time road crash injuries requiring hospitalisation saved with 95% CI (% of expected injuries*)		
		Lower limit	Upper limit	Median
1992/93	64	11.2(15)	48.7(43)	30.0(32)
1993/94	76	11.4(13)	49.6(39)	30.5(29)
1994/95	76	11.8(13)	51.3(40)	31.5(29)
1995/96	100	12.2(11)	53.1(35)	32.7(25)
Total	316	46.5 (12.83%)	202.7(39.08%)	124.6(28.28%)

* *Calculated as: injuries saved/(injuries saved + total actual number injuries)*100.*

Fatal road crash injuries analysis

Fatal crashes tend to occur only infrequently, and any attempt to derive a subset of road deaths such as night-time fatalities occurring between Thursdays and Saturdays necessarily reduces the numbers further. Such small numbers of incidents introduce a great deal of variation between measurement periods and lack stability over time. Moreover, all fatalities, and not those specifically occurring during nigh-time hours are known to have a high percentage of alcohol involvement. In contrast, less serious crashes are far less likely to be alcohol related. Thus in order to determine the effect of LWA on road fatality rate, all fatal road injuries were combined thereby producing relatively stable rates and compared to those injuries least likely to have involved alcohol – minor day-time crash injuries occurring between Sundays and Wednesdays. Minor crashes were selected from two types of road injury recorded on the NT traffic data base- those which did not require any hospital treatment, and those which only required emergency room treatment but which did not require admission to hospital.

For this analysis the basic unit of analysis was rate of fatal road injuries occurring at quarterly intervals over the study period. As seen above for non-fatal road injuries, since rates were calculated from numbers of licensed drivers, those fatalities occurring among pedestrians and bicycle riders were not included.

The all fatal road injuries series was deseasonalized and examined for significant serial autocorrelation among residuals. Employing a Durban-Watson test of serial autocorrelation, with three regressors fitted (LWA, 05 legislation/cask wine levy and deseasonalized quarterly rates of minor road injuries) and 50 time intervals there was no evidence of significant positive or negative autocorrelation (D-W = 2.26).

Thus, employing LWA as an independent variable in multiple linear regression, it was possible to approximate the magnitude of the saving in fatal road crash injuries while adjusted for external factors including; concurrent trend in rate of minor crash injuries occurring between Sundays and Wednesdays during day-time hours and, the implementation of the .05 campaign/introduction of the cask wine levy.

As indicated in Figure 19, prior to the introduction of LWA the mean quarterly crash fatality rate was 1.48 deaths. Subsequent to LWA introduction the mean quarterly rate was reduced by 34% to approximately 0.98 deaths. For minor control injuries the rate prior to LWA was 6.01 injuries per quarter, which increased slightly by 6% to 6.37 injuries per quarter.

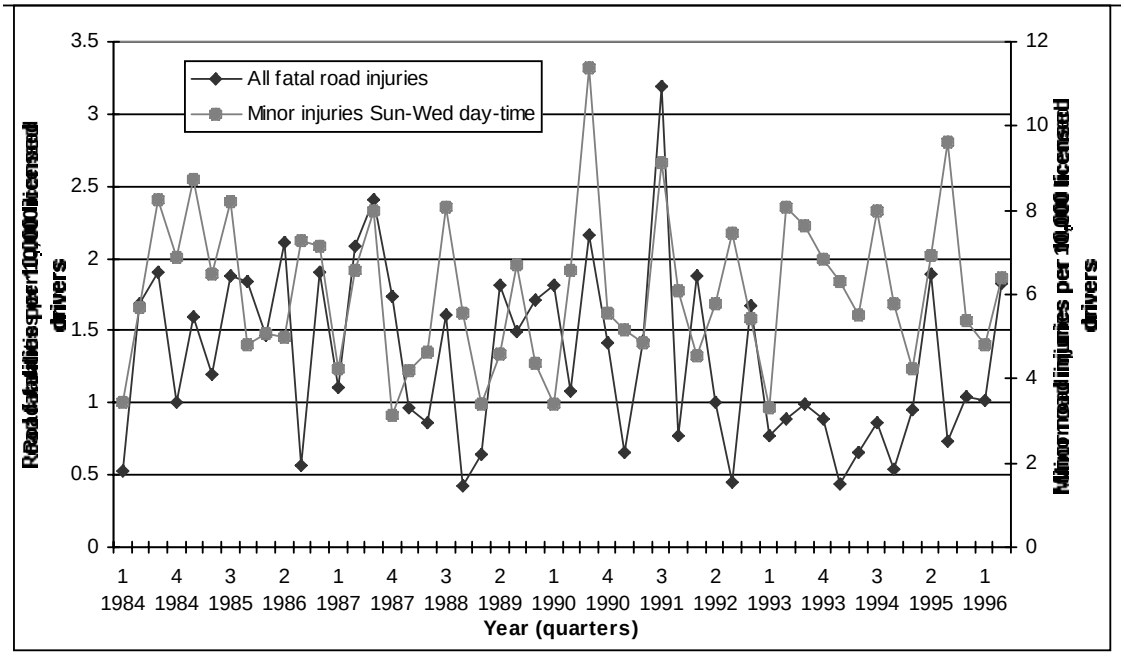

Figure 19: Trends in quarterly fatal road crash injury rates and rates of minor injuries occurring during day-time hours between Sun-Wed

As shown in Table 26 below, the association between LWA and crash fatality rates was negative and highly significant at the 0.05 level ($t = -3.2(49)$, $p < 0.005$). Adjustment for concurrent trend in day-time crash fatalities and the implementation of the 05 campaign/cask wine levy did not affect the significance of the relationship between LWA and fatality rates ($t = -3.3(48)$, $p < 0.005$).

Table 26
Association between LWA and all fatal road crash injury rates, including adjustment for day-time minor road crash injury rates occurring Sun-Wed and the introduction of .05 BAL legislation/cask wine levy

Variable(s) entered	Adjusted R^2 for model	Stnd. B coef.	B Estimate	95% confidence interval for B **Lower**	Upper	t	Sig.
LWA only	15.7%	-0.418	-0.497	-0.811	-0.183	-3.184	0.003
LWA adjusted for minor crash injuries occurring during day-time Sun to Wed only	15.4%	-0.433	-0.515	-0.833	-0.194	-3.268	0.002
LWA adjusted for .05 campaign/cask wine levy only	19.0%	-0.550	-0.655	-1.014	-0.296	-3.670	0.001
LWA adjusted for minor day-time injuries and .05 legislation/cask wine levy	18.6%	-0.563	-0.670	-1.013	-0.308	-3.726	0.001

With 95% confidence, the effect of LWA on the rate of fatal crash injuries was to significantly decrease fatality rates from between approximately 2 to 8 deaths per 10,000 licensed drivers per year. Total annual savings in road deaths within 95% confidence intervals estimated to have occurred between 92/93 and 95/96 have been presented in Table 27 below. Over the four years subsequent to the introduction of LWA, the estimated median number of lives saved was approximately 77, within an upper 95% confidence limit of 125 and a lower limit of 29 lives. An average of 35% of expected road fatalities were saved over the four year period due to LWA.

Table 27
Estimated total annual saving in road fatalities due to LWA, between 1992/93 and 1995/96 within upper and lower 95% confidence limits

Year	Number of all fatal road crash injuries[1]	Number of road crash fatalities saved with 95% CI (% of expected injuries*)		
		Lower limit	Upper limit	Median
1992/93	34	7(17)	30(47)	19(36)
1993/94	27	7(21)	31(53)	19(41)
1994/95	40	7(15)	32(44)	20(33)
1995/96	45	8(15)	33(42)	20(31)
Total	146	29 (16.57%)	125 (46.13%)	77 (34.53%)

* *calculated as: injuries saved/(injuries saved + total actual number injuries)*100. 1does not include pedestrians or bicycle riders.*

Road crash injuries not requiring hospitalisation

The Northern Territory road traffic database also contains records of road injuries which did not require hospitalisation. Their were two main types of minor injuries: (1) those injuries where the individual did not require any treatment and hence data on these individuals will not be present in hospital morbidity records and (2) those individuals who's injuries required some treatment, such as treatment which might occur in an emergency room but which did not require official hospital admission and which would not appear in morbidity records. It is also possible to examine the possible impact of LWA on these minor crash injuries. By again utilising night-time injuries occurring between Thursdays and Saturdays as the dependent variable of interest or alcohol related road crash indicator, it was possible to measure the impact of LWA on less serious road injuries. As seen previously for hospitalised injuries and road fatalities, the control conditions selected were represented by day-time crash injuries which occurred on other days of the week

Utilising a Durbin-Watson test of serial autocorrelation it was determine that due to there being no evidence or either positive or negative autocorrelation (D-W = 1.82) that multiple linear regressions analysis would provide the appropriate relationship test. Prior to analysis both series were deseasonalized.

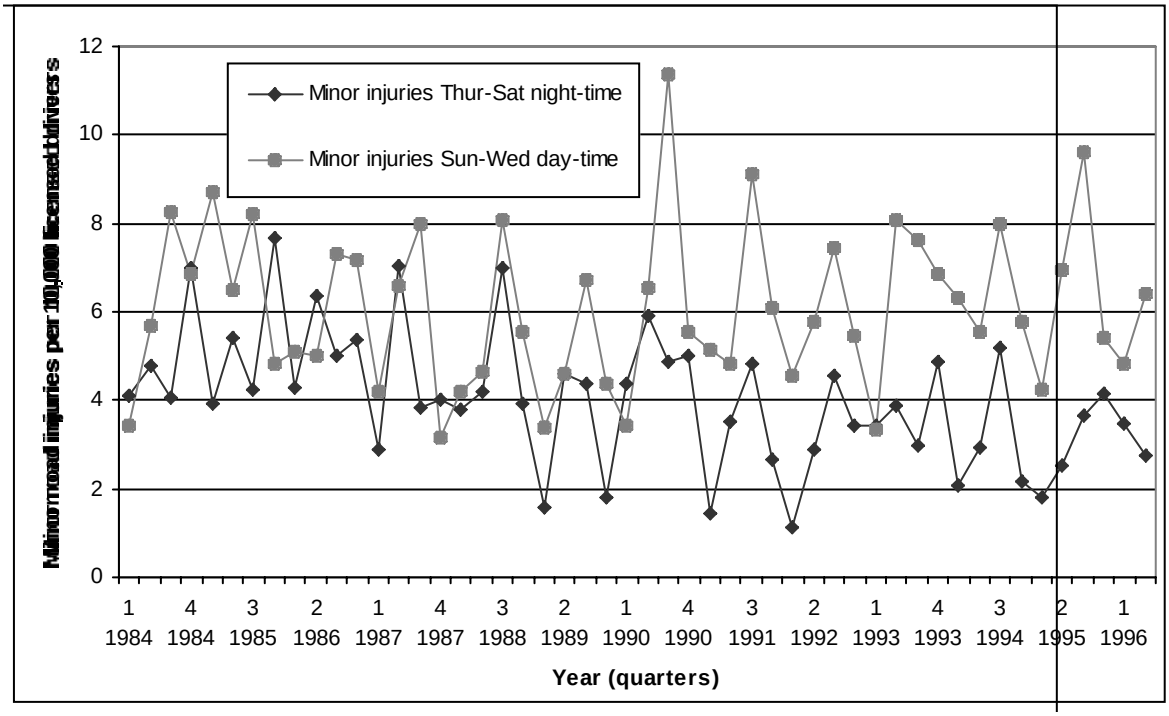

Figure 20: Trends in quarterly rates of minor night-time road crash injuries occurring Thur-Sat and rates of minor injuries occurring during day-time hours between Sun-Wed.

As indicated in Figure 20, prior to the introduction of LWA the mean quarterly rate of minor road injuries occurring between Thursdays and Saturdays was 4.43. Following LWA the mean rate of minor injury was reduced by approximately 23% to 3.36 injuries per quarter. For the control conditions – day-time minor injuries occurring between Sundays and Wednesdays the pre rate was 6.01with a post LWA rate of 6.37.

As indicated in Table 28, the relationship between LWA and night-time minor injuries occurring between Thursdays and Saturdays without further adjustment for trend in day-time minor crashes was negative and significant ($t = -2.7(49)$, $p < 0.01$). After adjustment for concurrent trend in day-time minor crashes occurring on Sundays through Wednesdays the association between LWA and night-time minor crash injuries remained significant at the 0.01 level ($t = -2.8(48)$, $p <0.01$). However, it was noted that following adjustment for the .05 campaign/cask wine levy th at the standardized beta for LWA was reduced by almost 10% from that estimated by adjustment for day-time injuries only. Thus, as a conservative estimate, the Beta estimate for LWA after adjustment for both day-time minor crash injuries and the .05 campaign/cask wine levy was assumed as the final model ($t = -2.2(47)$, $p < 0.05$)

Table 28
Association between LWA and night-time minor road crash injury rates occurring Thur-Sat, including adjustment for day-time minor road crash injury rates occurring Wed-Sun and the introduction of .05 BAL legislation/cask wine levy

Variable(s) entered	Adjusted R^2 for model	Stnd. B coef.	B Estimate	95% confidence interval for B		t	Sig.
				Lower	Upper		
LWA only	11.5%	-0.364	-1.071	-1.865	-0.277	-2.712	0.009
LWA adjusted for minor crash injuries occurring during day-time Sun to Wed only	11.2%	-0.381	-1.119	-1.921	-0.316	-2.804	0.007
LWA adjusted for .05 campaign/cask wine levy only	9.7%	-0.343	-1.009	-1.945	-0.074	-2.170	0.035
LWA adjusted for minor day-time injuries and .05 legislation/cask wine levy	9.4%	-0.357	-1.050	-1.993	-0.108	-2.245	0.030

Table 29 below outlines the annual saving in minor road injuries estimated within 95% confidence limits between 1992/93 and 1995/96. Overall, the mean number of minor injuries saved due to LWA was estimated at approximately 158, with an upper 95% confidence interval of 300 and a lower limit of 16. Over the four years following LWA the median percentage of minor road crash injuries saved was approximately 24%.

Table 29
Estimated total annual saving in minor road injuries due to LWA, between 1992/93 and 1995/96 within upper and lower 95% confidence limits

Year	Number of night-time Thurs-Sat minor road crash injuries[1]	Number of Thur-Sat night-time minor road crash injuries saved with 95% CI (% of expected injuries*)		
		Lower limit	Upper limit	Median
1992/93	138.0	3.9(3)	72.1(34)	38.0(22)
1993/94	117.0	4.0(3)	73.5(39)	38.7(25)
1994/95	109.0	4.1(4)	75.9(41)	40.0(27)
1995/96	136.0	4.3(3)	78.7(37)	41.5(23)
Total	500.0	16.3 (3.16%)	300.2 (37.52%)	158.2 (24.04%)

* *calculated as: injuries saved/(injuries saved + total actual number injuries)*100.*
[1] *does not include pedestrians or bicycle riders.*

Alcohol related mortality

All alcohol related mortality not including fatal road injuries

Prior to the introduction of LWA the mean death rate for all alcohol related conditions (adjusted by aetiologic fraction) was 1.21 deaths per quarter per 10,000 persons over the age of 15 years (de-seasonalised). Subsequent to LWA the mean quarterly death rate of all alcohol related conditions was reduced by 10.7% to 1.08. For deaths from all other conditions the mean quarterly mortality rate was 12.5 prior to April 1992 and 11.3 following the introduction of the project, a reduction of 9.6%.

Quarterly rates of all combined alcohol related deaths, adjusted by aetiologic fraction and expressed as a rate per 10,000 NT resident persons over the age of 15 years comprised the dependent variable in multiple linear regression analysis. The implementation of LWA was examined as an independent variable while controlling for the corresponding trend in quarterly death rates from all other conditions as well as the implementation of the 05 campaign/cask wine levy. Residuals were examined for significant serial auto-correlation with no evidence of negative or positive correlation apparent (D-W = 1.8).

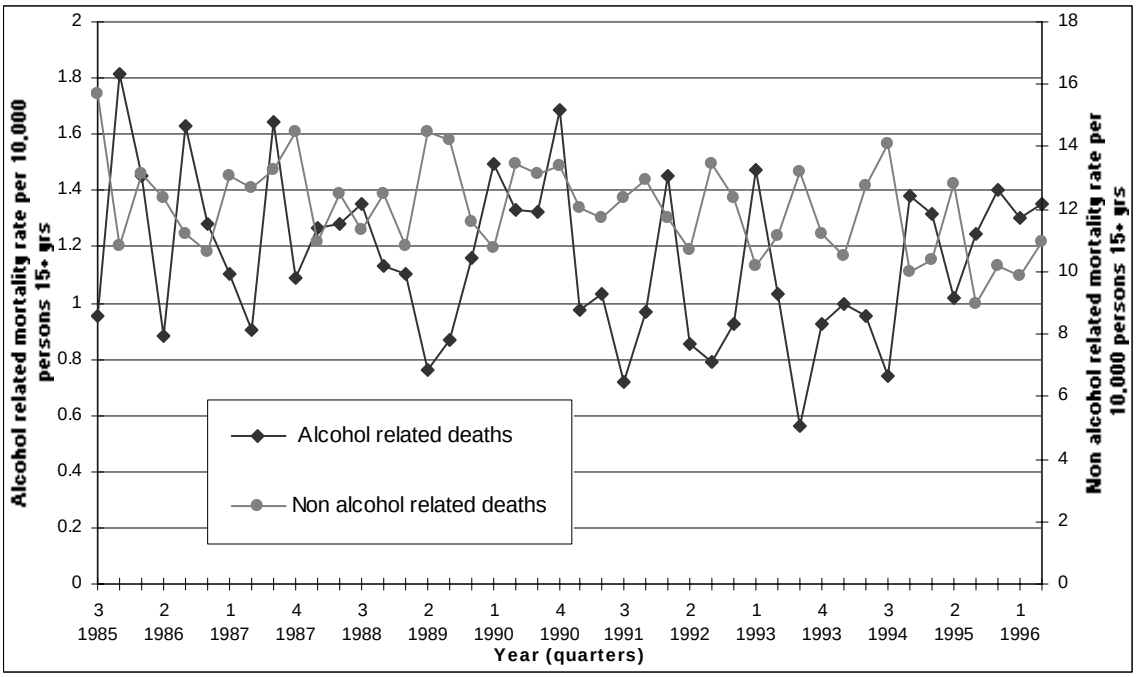

Figure 21: Trends in quarterly mortality rates for all combined adjusted alcohol related deaths (not including road fatalities) and non-alcohol related deaths

As shown in Table 30 below, the association between LWA and alcohol related mortality rate without further adjustment for trend in non-alcohol related conditions was negative but failed to reach significance at the 05 level ($t = -1.54(43)$, ns). However, as indicated in Figure 21, shortly after LWA was introduced, quarterly alcohol related death rates declined while by comparison, non-alcohol related controls remained relatively stable. Thus, when adjusted for concurrent trends in overall non-alcohol related quarterly death rates, the adjusted standardised Beta indicating the strength of the association between LWA and the decline in alcohol related deaths was increased producing a significant result ($t = -3.03(42)$, $p = < 0.005$). As apparent from Figure 21, at about the time of the introduction of .05 legislation and the cask wine levy, over two and a half years after the introduction of LWA, alcohol related mortality rates began to rise. Subsequently, adjustment for the .05 legislation/cask wine period only, also had the effect of increasing the strength of the association between LWA and the decline in quarterly alcohol related death rates ($t = -2.55(42)$, $p < 0.05$).

Table 30
Association between LWA and adjusted quarterly alcohol related mortality rates (not including road fatalities), including adjustment for non-alcohol related mortality rates and the introduction of .05 BAL legislation/cask wine levy

Variable(s) entered	Adjusted R^2 for model	Stnd. B coef.	B Estimate	95% confidence interval for B		t	Sig.
				Lower	Upper		
LWA only	3%	-0.232	-0.130	-0.299	0.040	-1.545	0.130
LWA adjusted for trend in death rate among all other conditions only	22.4%	-0.454	-0.254	-0.423	-0.085	-3.035	0.004
LWA adjusted for .05 campaign/cask wine levy only	12.1%	-0.422	-0.236	-0.423	-0.049	-2.553	0.015
LWA adjusted for all above	25.4%	-0.553	-0.310	-0.489	-0.130	-3.484	0.001

Thus, with 95% confidence, it can be concluded that the effect of LWA on mortality was to significantly decrease the rate of alcohol related deaths from between approximately 0.3 and 1.7 deaths per year per 10,000 persons over the age of 15 years. Total annual numbers of lives saved calculated from Estimated Residential Population within 95% confidence intervals estimated to have occurred between 92/93 and 95/96 have been presented in Table 31 below. Over the four years subsequent to the introduction of LWA, the estimated median number of lives saved was approximately 52, within an upper 95% confidence limit of 86 and a lower limit of 17 lives.

Table 31
Estimated total annual number of lives saved from death by alcohol related conditions (not including road fatalities) due to LWA, between 1992/93 and 1995/96 within upper and lower 95% confidence limits

Year	Number of all alcohol related deaths	Number of deaths by alcohol related conditions saved (% of expected deaths*)		
		Lower limit	Upper limit	Median
1992/93	52.2	4.2(7)	20.9(29)	12.6(19)
1993/94	43.2	4.3(9)	21.3(33)	12.8(23)
1994/95	57.5	4.4(7)	21.8(27)	13.1(19)
1995/96	70.2	4.5(6)	22.4(24)	13.5(16)
Total	223.0	17.4(7.24%)	86.4(27.93%)	51.9 (18.88%)

* *calculated as: lives saved/(lives saved + total actual number lives lost)*100.*

Figures 22 and 23 below show trends in quarterly mortality rate for acute and chronic alcohol related conditions.

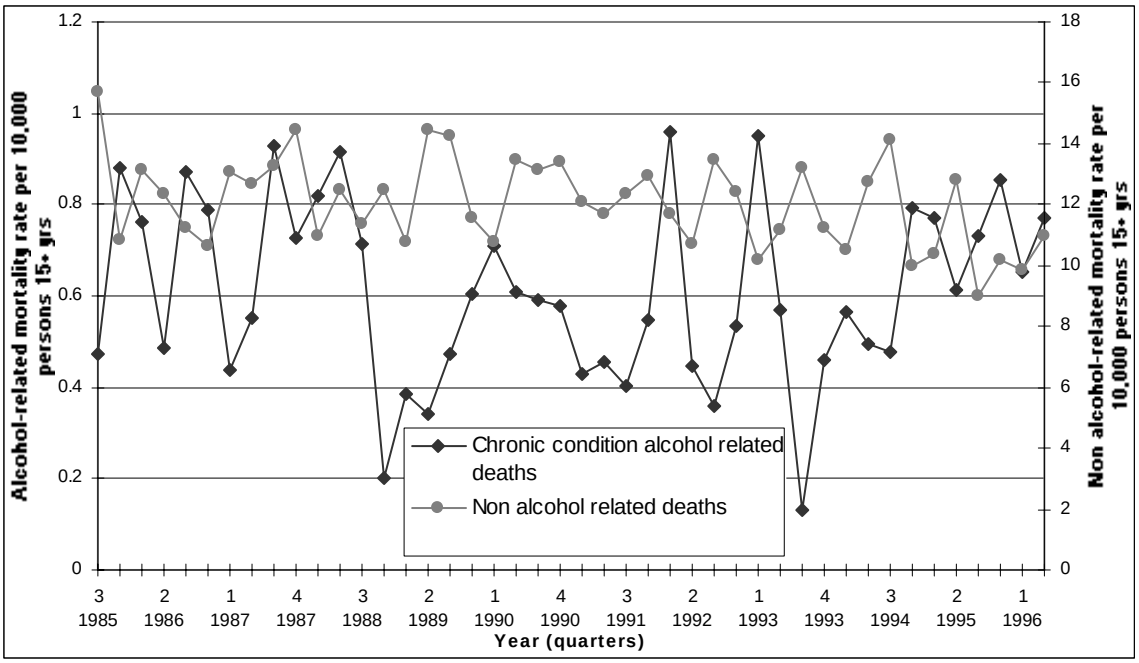

Figure 22: Trends in adjusted mortality rate for chronic conditions

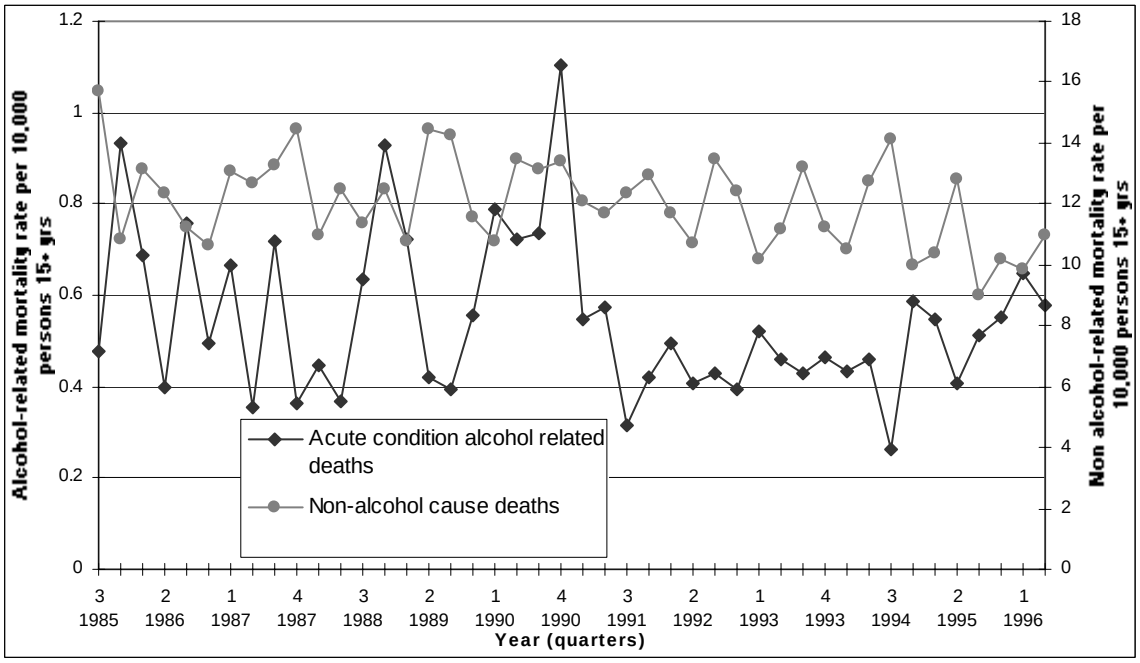

Figure 23: Trends in adjusted mortality rate for acute conditions (not including fatal road injuries)

Tables 32 presents the results of separate multiple linear regression tests of the association between LWA and quarterly mortality rated due to chronic and acute alcohol related conditions while adjusted for concurrent changes in quarterly death rate from non-alcohol related conditions.

Table 32

Association between LWA and seasonally adjusted quarterly mortality rates due to chronic and acute conditions (not including road fatalities) adjusted for concurrent trends in mortality rate for non-alcohol related conditions

Level of alcohol component	Adjusted R^2 for model	Stnd. B coef.	B Estimate	95% confidence interval for B		t	Sig.
				Lower	Upper		
Chronic	14.8%	-0.255	-0.101	-0.227	0.024	-1.629	0.111
Acute	12.1%	-0.439	-0.147	-0.255	-0.039	-2.759	0.009

The relationship between mortality rate from chronic alcohol related conditions and LWA failed to reach significance at the 0.05 level (t = -1.63(45), ns). However, the association between LWA and death rate from acute alcohol related conditions was found to be significant at the 0.01 level (t = -2.76(42), $p < 0.01$).

Table 33
Estimated total annual number of lives saved from death by acute alcohol related conditions (not including road fatalities) due to LWA, between 1992/93 and 1995/96 within upper and lower 95% confidence limits

Year	Number of all acute alcohol related deaths	Number of deaths by alcohol related conditions saved (% of expected deaths*)		
		Lower limit	Upper limit	Median
1992/93	22.3	1.9(8)	12.6(36)	7.3(25)
1993/94	22.4	2.0(8)	12.8(36)	7.4(25)
1994/95	23.3	2.0(8)	13.2(36)	7.6(25)
1995/96	30.3	2.1(6)	13.5(31)	7.8(20)
Total	98.4	8.0(7.52%)	52.1(34.62%)	30.0(23.36%)

* *calculated as: lives saved/(lives saved + total actual number lives lost)*100.*

As Table 33 indicates, over the four years following the introduction of LWA, an estimated average of 30 lives were saved from death by acute alcohol related conditions (not including road fatalities).

Alcohol related morbidity

All alcohol related morbidity not including road injuries

Quarterly rates of admissions made to NT public hospitals were calculated for years 1980/81 to 1995/96. In the NT, the bulk of hospital admissions are made to public hospitals (NT health key informants estimate 98%). Unfortunately however, hospital admission data were completely unavailable for the following financial years; 1988/89, 1989/90, 1990/91 and 1991/92,. As a result, the following intervention analysis necessarily excludes those years for which data was unavailable and assumes a continuation of rates from 1988/87 to 1992/93. It was also revealed that records entered in 1992 were suspected by NT health officials to be partially incomplete due to a change

in recording systems. No approximation of the number of missing admissions could be identified by NT health services, however the degree of under reporting is expected to be minor. Thus, while interpreting the following outcomes it should be borne in mind that rates of admission for 1992/93 may be slightly underestimated.

Additionally over the same time period, quarterly rates of admission for conditions unrelated to alcohol consumption were identified in order to create a control variable by which to adjust any association between LWA and alcohol related admission rates. Hospital admissions for the following conditions were selected as controls; acute appendicitis, diverticulitis, genital prolapse, local osteoarthrosis, hyperplasia of the prostate, constipation, dental caries, non-infective gastroenteritis and pterygium.

Finally, it should also be noted that for this analysis, quarterly rates are based on all recorded hospital admissions and not restricted to NT residents. Unfortunately, while non-resident admissions were able to be identified among 1992/93 data and subsequent years, admission records prior to this time did not allow the identification of non-residents. Thus in order that rates over time were to remain comparable, it was necessary to calculate overall rates rather than NT resident rates of admission. Notably, non-residents make up less than 10% of NT public hospital admissions.

Figure 24 below shows the trends in all combined alcohol fraction adjusted morbidity not including road injuries with trend in non-alcohol related control conditions between July 1980 and June 1996.

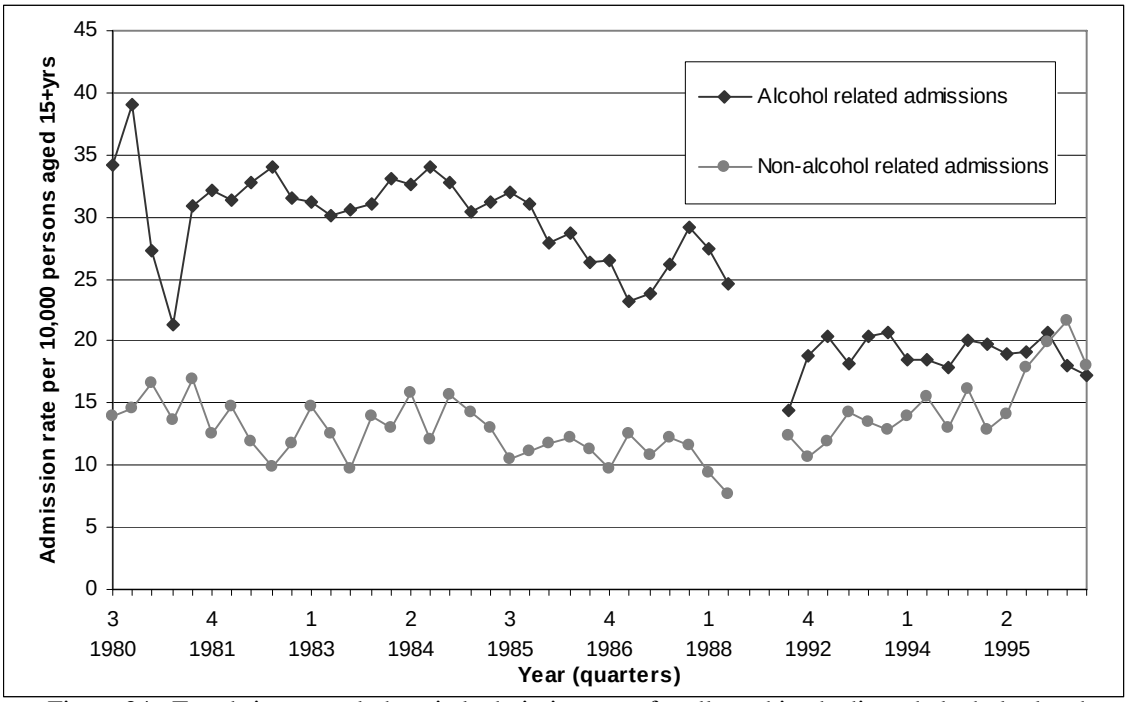

Figure 24: Trends in quarterly hospital admission rates for all combined adjusted alcohol related admissions (not including road injuries) and non-alcohol related admissions

Between mid 1980 and mid 1988, the mean number of adjusted hospital admissions for alcohol related conditions per 10,000 persons (15+yrs) was approximately 30 per quarter. Following the introduction of LWA in the second quarter of 1992, the mean quarterly rate of admission for alcohol related conditions was reduced by approximately 31% to 20.7. Comparatively, the mean quarterly rate for control conditions increased by almost 19% rising from approximately 12.5 prior to 1988/89 to 15 admissions per quarter between 1992/93 and 1995/96.

Due to the presence of significant serial autocorrelation (D-W = 0.953), the analysis of choice was ARIMA time series analysis. The basic ARIMA model was indicated as a first order moving average process (MA1), with a first order autoregressive seasonal component (SAR1) requiring seasonal differencing. The residuals for the model were white noise as demonstrated by random, non-significant, autocorrelations from lags one through 36.

Table 34
ARIMA analysis estimating the association between LWA and alcohol related hospital admissions (not including road injuries) adjusted for concurrent changes in non-alcohol related conditions and the introduction of .05 legislation/cask wine levy

	Beta estimate	S.E. Beta	95% confidence interval		t-ratio	Sig.
			Lower	Upper		
ARIMA process components						
MA(1)	-0.709	0.12	-0.94	-0.47	-5.92	0.000
SAR(1)	-0.452	0.13	-0.71	-0.20	-3.44	0.001
Variables of interest						
LWA only	-6.35	1.92	-10.11	-2.59	-3.29	0.002
LWA adjusted for non-alcohol conditions	-6.25	2.02	-10.21	-2.29	-3.09	0.003
LWA adjusted for non-alcohol conditions and 05legislation/cask wine levy	-6.21	2.07	-10.27	-2.15	-3.00	0.005

Thus, with 95% confidence, it could be concluded that the effect of LWA on the rate of admission to hospital for alcohol related conditions was to significantly decrease admissions from between approximately 9 and 40 per year per 10,000 persons aged 15 years and over. Total annual numbers of admissions saved calculated from Estimated Residential Population within 95% confidence intervals estimated to have occurred between 1992/93 and 1995/96 have been presented in Table 35 below. Over the four years subsequent to the introduction of LWA, the estimated median number of admissions saved was approximately 1277 within an upper 95% confidence limit of 2085 and a lower limit of 468.

Table 35
Estimated total annual number of alcohol related hospital admissions (not including road injuries) saved due to LWA, between 1992/93 and 1995/96
within upper and lower 95% confidence limits

Year	Number of all alcohol related admissions[1]	Number of admissions for alcohol related conditions saved (% of expected admissions*)		
		Lower limit	Upper limit	Median
1992/93	888.5	113.2(11)	504.5(36)	308.8(26)
1993/94	980.5	115.1(11)	513.0(34)	314.0(24)
1994/95	991.2	118.2(11)	527.0(35)	322.6(25)
1995/96	993.4	121.4(11)	541.2(35)	331.3(25)
Total	3853.7	467.8 (10.80%)	2085.6 (35.12%)	1276.7 (24.88%)

* *calculated as: admissions saved/(admissions saved + total actual number admissions)*100*
[1] *including non-residents*

Figures 25 through 29 show trends in admission for all acute and all chronic conditions combined as well as by level of relative degree of estimated alcohol involvement, ie. conditions with high, medium and low alcohol components as determined by alcohol aetiologic fraction (see Appendix C).

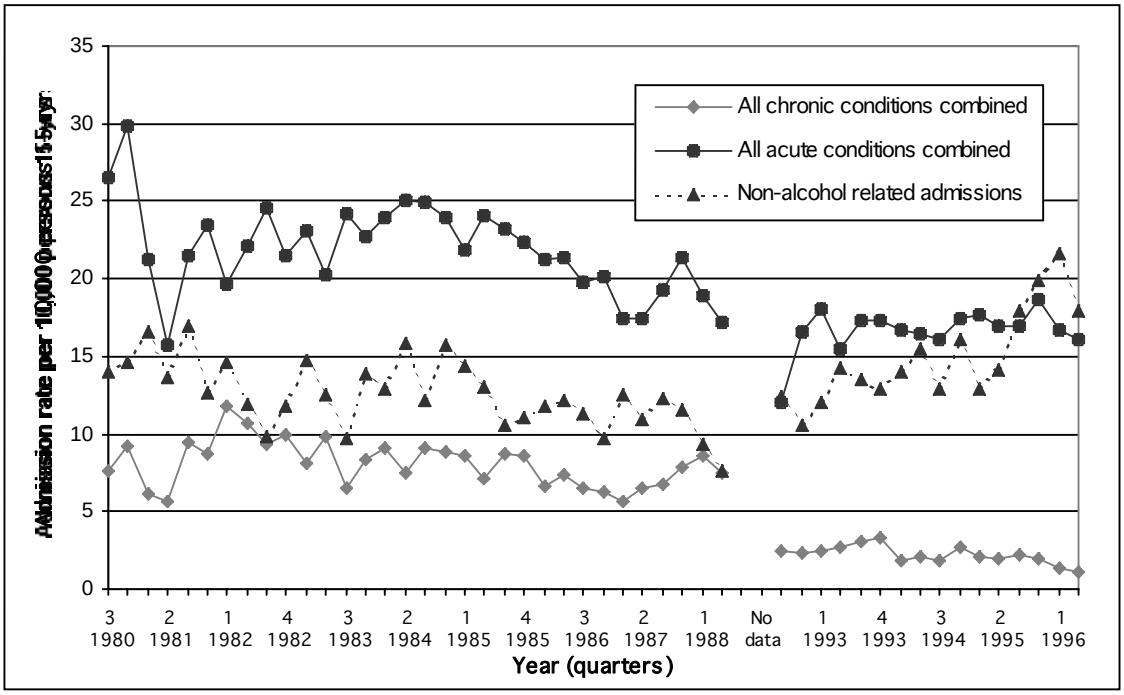

Figure 25: Trends in quarterly hospital admission rates for alcohol fraction adjusted all chronic and all acute (not including road injuries) alcohol related conditions rates with hospitalisation rate for non-alcohol related control conditions

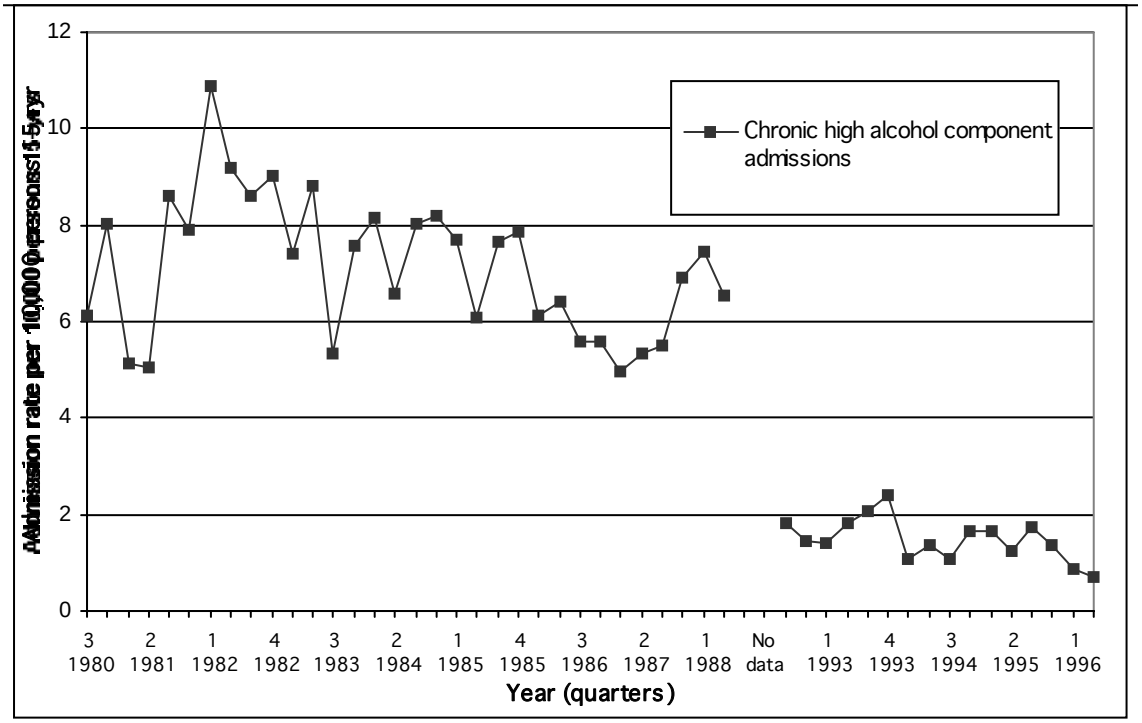

Figure 26: Trends in quarterly hospital admission rates for adjusted chronic high level alcohol component admissions

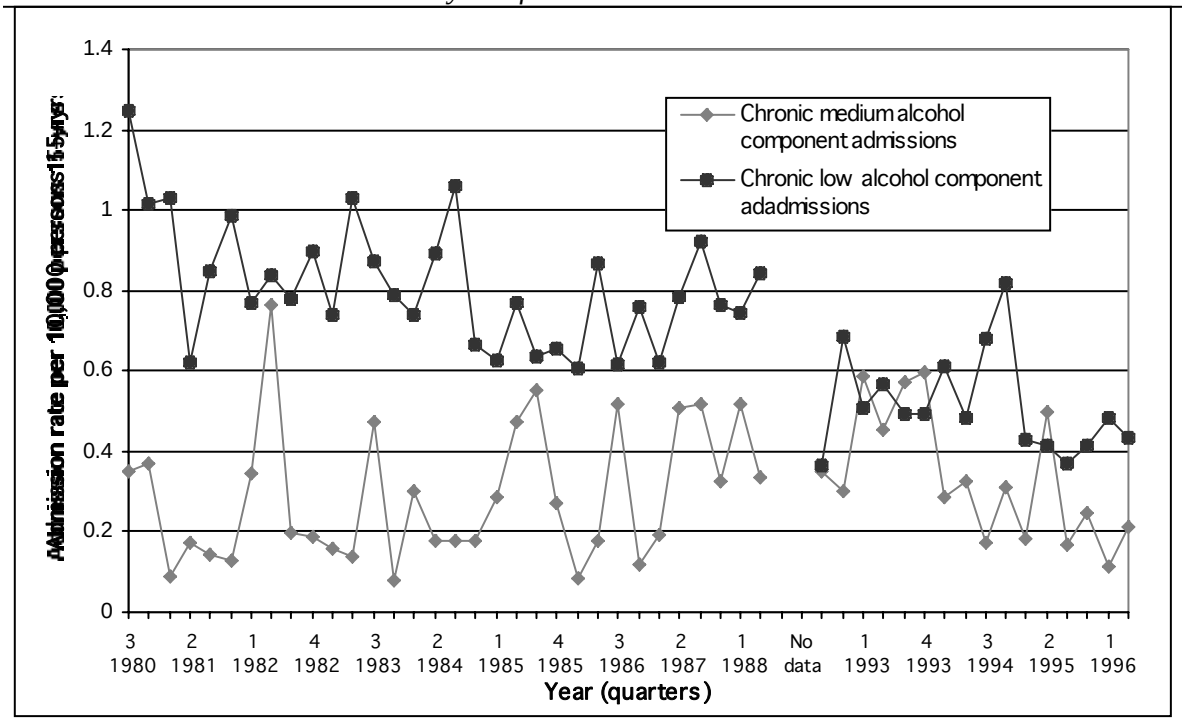

Figure 27: Trends in quarterly hospital admission rates for adjusted chronic medium and low level alcohol component admissions

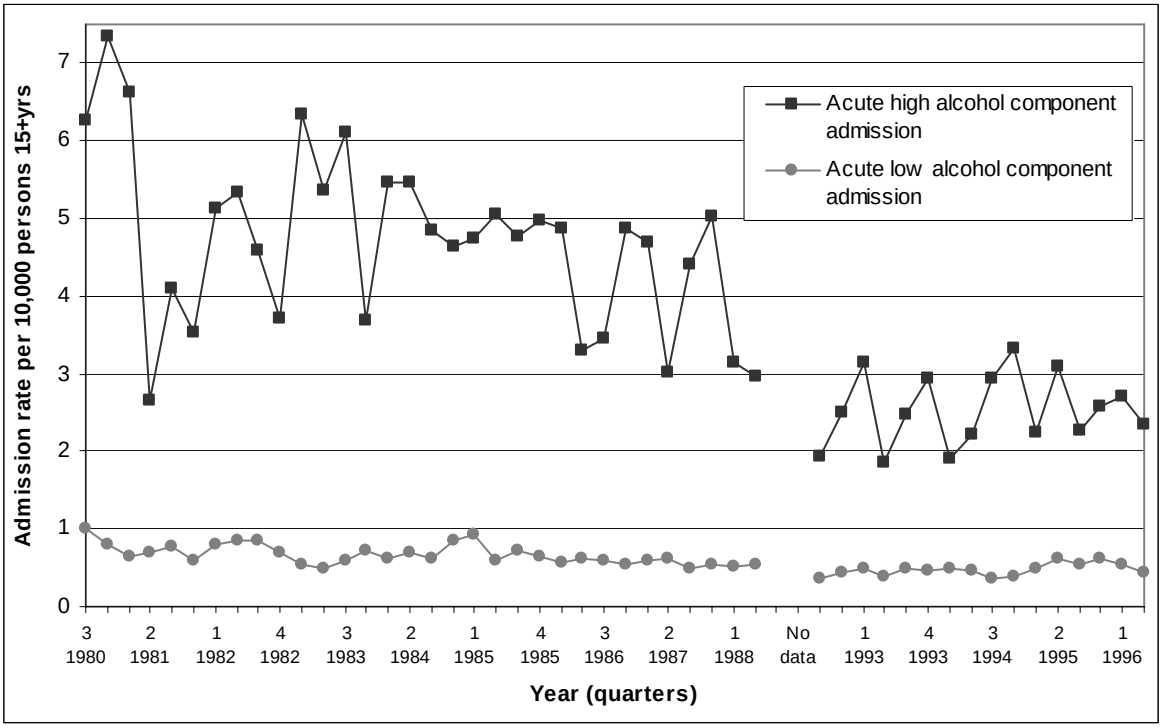

Figure 28: Trends in quarterly hospital admission rates for adjusted acute high and low level alcohol component admissions

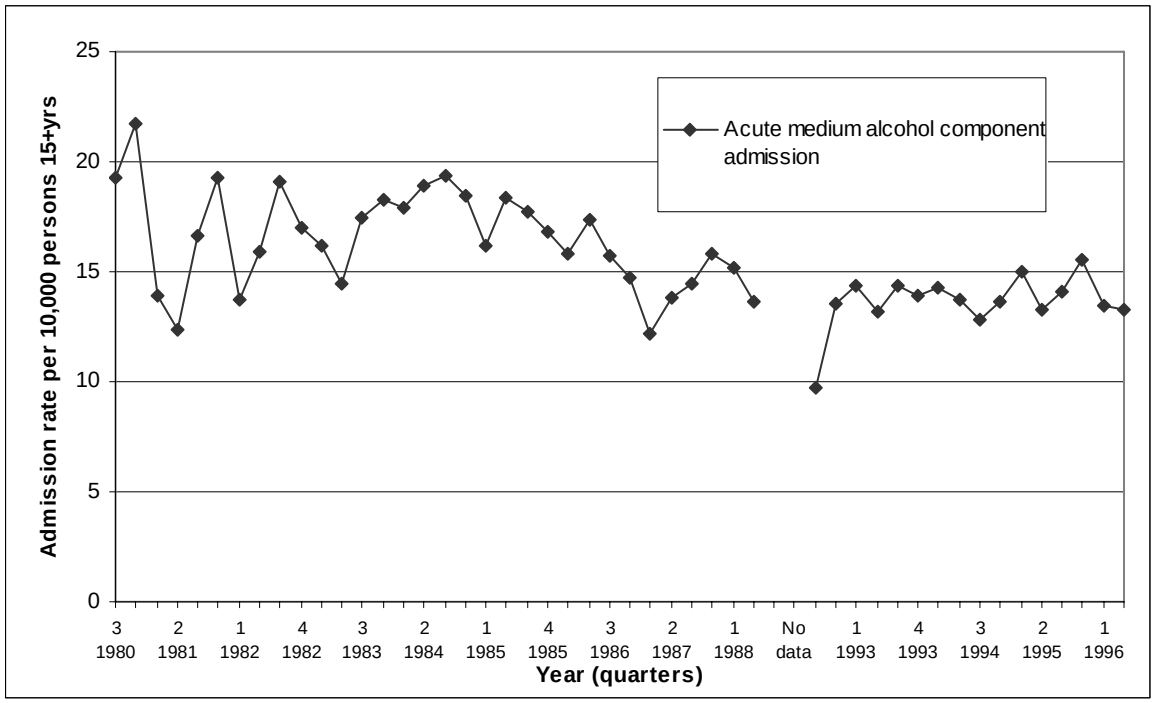

Figure 29: Trends in quarterly hospital admission rates for adjusted acute medium level alcohol component admissions (not including road injuries)

When examined separately, degree of auto-correlation varied between admissions for acute/chronic conditions and by level of alcohol involvement. Tables 36 and 37 below indicate the strength of association between LWA and quarterly hospital admission rates for acute and chronic conditions by level. While admissions for chronic low and medium level conditions as well as high level alcohol involvement acute conditions were treated using multiple linear regression, all other series (including all chronic and all acute) indicated some level of significant auto-correlation and were treated using ARIMA analysis.

Table 36
Association between LWA and quarterly seasonally adjusted admission rates due to chronic conditions with high, medium and low alcohol components adjusted for concurrent trends in admission rates for non-alcohol related control conditions

	Beta estimate	S.E. Beta	95% confidence interval		t-ratio	sig.
			Lower	Upper		
High	-4.246	0.711	-5.640	-2.852	-5.974	0.000
Medium	0.119	0.050	0.018	0.220	2.368	0.022
Low	-0.306	0.049	-0.404	-0.207	-6.260	0.000
All chronic combined	-4.144	0.737	-5.589	-2.699	-5.621	0.000

Table 37
Association between LWA and quarterly admission rates due to acute conditions with high, medium and low alcohol components adjusted for concurrent trends in admission rates for non-alcohol related control conditions

	Beta estimate	S.E. Beta	95% confidence interval		t-ratio	Sig.
			Lower	Upper		
High	-2.381	0.311	-3.007	-1.755	-7.659	0.000
Medium	-3.107	1.381	-5.814	-0.400	-2.251	0.030
Low	-0.123	0.106	-0.331	0.085	-1.159	0.253
All acute combined	-4.970	1.800	-8.498	-1.442	-2.766	0.008

There were significant declines in the rate of hospital admission associated with the implementation of LWA for acute conditions with both high and medium alcohol component and for chronic conditions with both high and low level alcohol involvement. Only admission rates for chronic medium level alcohol component conditions were found to increase significantly with the advent of LWA. Medium level chronic conditions include liver cancer, laryngeal cancer, oesophageal varices, and oro-pharyngeal cancer. Notably, measures of chronic and acute conditions where all cases were combined both indicated significant declines in hospital admission rates. Tables 38 through 44 indicate the estimated annual saving for each of the above conditions which indicated a significant change in mean quarterly rate of admission with the introduction of LWA.

Table 38
Estimated annual number of all combined chronic alcohol related hospital admissions saved due to LWA, between 1992/93 and 1995/96
within upper and lower 95% confidence limits

Year	Number of all chronic alcohol related admissions[1]	Number of admissions for alcohol related conditions saved (% of expected admissions*)		
		Lower limit	Upper limit	Median
1992/93	122.0	133.4(52)	276.2(69)	204.8(63)
1993/94	129.4	135.6(51)	280.8(68)	208.2(62)
1994/95	111.2	139.3(56)	288.5(72)	213.9(66)
1995/96	86.7	143.1(62)	296.2(77)	219.7(72)
Total	449.2	551.3(55.10%)	1141.7(71.76%)	846.5 (65.33%)

* *calculated as: admissions saved/(admissions saved + total actual number admissions)*100*
[1] *including non-residents*

Table 39
Estimated annual number of chronic alcohol related hospital admissions with a high alcohol component saved due to LWA, between 1992/93 and 1995/96 within upper and lower 95% confidence limits

Year	Number of chronic high level alcohol related admissions[1]	Number of admissions for alcohol related conditions saved (% of expected admissions*)		
		Lower limit	Upper limit	Median
1992/93	79.9	140.9(64)	278.7(78)	209.8(72)
1993/94	87.0	143.3(62)	283.4(77)	213.3(71)
1994/95	72.4	147.2(67)	291.1(80)	219.1(75)
1995/96	62.1	151.2(71)	298.9(83)	225.1(78)
Total	301.4	582.6(65.90)	1152.1(79.26)	867.3 (74.21%)

* *calculated as: admissions saved/(admissions saved + total actual number admissions)*100*
[1] *including non-residents*

Table 40
Estimated annual number of additional chronic alcohol related hospital admissions with a medium alcohol component following implementation of LWA, between 1992/93 and 1995/96 within upper and lower 95% confidence limits

Year	Number of chronic medium level alcohol related admissions[1]	Increase in number of admissions for alcohol related conditions (% of expected admissions*)		
		Lower limit	Upper limit	Median
1992/93	20.9	0.9(4)	10.9(34)	5.9(22)
1993/94	22.3	0.9(4)	11.1(33)	6.0(21)
1994/95	15.1	0.9(6)	11.4(43)	6.1(29)
1995/96	9.8	1.0(9)	11.7(54)	6.3(39)
Total	68.1	3.7(5.15%)	44.9(39.73%)	24.3 (26.30%)

**calculated as: number admissions increased/(number admissions increased + total actual number admissions)*100*
[1]*including non-residents*

Table 41
Estimated annual number of chronic alcohol related hospital admissions with a low alcohol component saved due to LWA, between 1992/93 and 1995/96 within upper and lower 95% confidence limits

Year	Number of chronic low level alcohol related admissions[1]	Number of admissions for alcohol related conditions saved (% of expected admissions*)		
		Lower limit	Upper limit	Median
1992/93	26.2	10.2(28)	20.0(43)	15.1(37)
1993/94	26.1	10.4(28)	20.3(44)	15.3(37)
1994/95	30.2	10.7(26)	20.9(41)	15.8(34)
1995/96	22.6	11.0(33)	21.4(49)	16.2(42)
Total	105.2	42.3(28.68%)	82.5(43.95%)	62.4(37.23%)

** calculated as: admissions saved/(admissions saved + total actual number admissions)*100*
[1]*including non-residents*

Table 42
Estimated annual number of all combined acute alcohol related hospital admissions (not including road injuries) saved due to LWA, between 1992/93 and 1995/96 within upper and lower 95% confidence limits

Year	Number of all acute alcohol related admissions[1]	Number of admissions for alcohol related conditions saved (% of expected admissions*)		
		Lower limit	Upper limit	Median
1992/93	766.6	71.3(9)	419.9(35)	245.6(24)
1993/94	851.1	72.4(8)	427.0(33)	249.7(23)
1994/95	880.1	74.4(8)	438.6(33)	256.5(23)
1995/96	906.7	76.4(8)	450.4(33)	263.4(23)
Total	3404.5	294.6(7.96%)	1735.9(33.8%)	1015.2(22.97%)

* *calculated as: admissions saved/(admissions saved + total actual number admissions)*100*
[1] *including non-residents*

Table 43
Estimated annual number of acute alcohol related hospital admissions with a high alcohol component saved due to LWA, between 1992/93 and 1995/96 within upper and lower 95% confidence limits

Year	Number of acute high level alcohol related admissions[1]	Number of admissions for alcohol related conditions saved (% of expected admissions*)		
		Lower limit	Upper limit	Median
1992/93	117.0	86.7(43)	148.6(56)	117.7(50)
1993/94	120.0	88.2(42)	151.1(56)	119.6(50)
1994/95	150.0	90.6(38)	155.2(51)	122.9(45)
1995/96	131.0	93.0(42)	159.4(55)	126.2(49)
Total	518.0	358.5(40.9%)	614.2(54.25%)	486.4(48.43%)

**calculated as: admissions saved/(admissions saved + total actual number admissions)*100*
[1]*including non-residents*

Table 44
Estimated annual number of acute alcohol related hospital admissions (not including road injuries) with a medium alcohol component saved due to LWA, between 1992/93 and 1995/96 within upper and lower 95% confidence limits

Year	Number of acute medium level alcohol related admissions[1]	Number of admissions for alcohol related conditions saved (% of expected admissions*)		
		Lower limit	Upper limit	Median
1992/93	628.8	19.8(3)	287.3(31)	153.5(20)
1993/94	706.9	20.1(3)	292.1(29)	156.1(18)
1994/95	706.2	20.6(3)	300.1(30)	160.4(18)
1995/96	747.4	21.2(3)	308.2(29)	164.7(18)
Total	2789.3	81.7(2.85%)	1187.6(29.86%)	634.7(18.54%)

**calculated as: admissions saved/(admissions saved + total actual number admissions)*100*
[1]*including non-residents*

6. Summary of estimates of impact of Living With Alcohol program on harm indicators

The percentage change estimates from the above trend analyses, with and without allowance for control variables, are summarised in Table 43. When interpreting these data, greater weight should be given to the outcomes of the controlled analyses. There are likely to be numerous sources of variance in these indicator data other than from changes in alcohol consumption patterns. The control variables have been chosen on the basis of being likely to be influenced to a similar degree by these external factors and thereby allowing the opportunity to control for these in estimates of effect sizes for the alcohol indicators. In addition, greater weight should be placed on trends within both series that are based on larger numbers of cases.

Overall impact of living with alcohol

When taking the above points into account, it is apparent that these variously sourced sets of data all point towards the occurrence of a substantial reduction in alcohol related harm in the NT following the introduction of the Living With Alcohol program. The controlled analyses of trends resulted in estimated effect sizes of between 19% for alcohol related deaths other than from road crashes and 65% for chronic alcohol related hospital admissions. These large and highly significant changes are consistent with the observed reductions in per capita alcohol consumption over the period of 22% and substantial reductions in self-reported consumption in survey data following introduction of LWA. The drop in the percentage of males drinking at hazardous or harmful levels between 1992 and 1997 is 27% (or a drop from 30% to 22% of all males).

For morbidity and mortality data, the controlled estimates of the impact of LWA were larger than those observed in the simple forecasted expected and observed trend analyses. It is important to note, however, that even the latter were indicative of reductions in alcohol related harm for most of the major domains. The controlled

estimates allowed for the fact that in some instances the non-alcohol related control variables showed increases during the study period that our statistical models assumed should also have occurred in the alcohol harm indicators to the same degree. This was most marked in relation to trends in non-alcohol related hospital admissions which *increased* during the study period while alcohol related admissions decreased.

The road crash data were all indicative of significant and substantial declines for each level of severity of crash injury, ranging from 24% for minor injuries to 34.5% for fatalities.

In relation to the hospital admission (morbidity) data, for both the observed and controlled series and for both acute and chronic alcohol conditions the largest reductions post-LWA were for those with a high alcohol association. In fact only acute conditions with a low alcohol component (there were only 86 estimated for the whole period) failed to show a significant reduction in the controlled trend analyses. This pattern of results is highly consistent with there having been a reduction specifically in *alcohol* related harm.

The three exceptions to the overall trend for a reduction in alcohol related harm warrant some discussion. There was an increase in chronic alcohol related deaths over the period observed though this was not significant when tested taking into account the parallel trends in non-alcohol related deaths. There was also an increase in 'medium' chronic alcohol related morbidity. Although there were only a very small number of cases in this category this was a significant increase compared with the control conditions. There was a small increase observed in the 'medium' acute alcohol conditions during the study period but this was significantly smaller than the larger increase that occurred for the control conditions.

Common sense suggests that reductions in *acute* alcohol related harm are more likely to be observed in the *short-term* and that it may take many years for *long-term* benefits to be observed for conditions like liver cirrhosis. However, there are well documented instances in which chronic harms have responded promptly to reductions in per capita consumption (see Edwards *et al*. 1994). Also there were substantial reductions evidenced for rates of chronic alcohol related *morbidity*, especially among alcohol specific conditions (the 'high' alcohol conditions). While the forecasted trends for chronic mortality and morbidity are in opposite directions, numbers in the former case are small. Moreover, when tested against a trends in non-alcohol related mortality, deaths from chronic conditions were found to indicate a decline rather than an overall increase during the LWA period.

It is interesting to note that nearly 80% of chronic alcohol related admissions with 'high' alcohol involvement were cases with a diagnosis of alcohol dependence syndrome. One possible explanation for the dramatic drop in these cases is that LWA was able to establish a stronger set of treatment programs for such people that diverted them from the hospital treatment system. If true, this would essentially mean that the direct benefits of LWA might be slightly overestimated for this restricted category of health data, although the cost of funding such treatment programs has been accounted for.

Suffice it to say that there is not a consistent picture of reductions in alcohol related harm for illnesses caused by long-term drinking. The benefits of LWA appear to be more certain for problems, illnesses and death resulting from alcohol intoxication.

It was not possible to use the four years of morbidity data between 1988 and 1992 due to problems caused by a new health data system in the NT at that time. It is possible that if the decline in alcohol related morbidity evident for the years prior to 1988 continued up to the start of LWA, then our estimate of the benefits here may be an overestimate. In particular, for the 1992 calender year, key Health Department informants advised that there may have been some degree of under reporting which occurred in 1992, thus affecting estimated savings for the 1992/93 financial year. However, although it was not possible to obtain any firm approximation of the size of this deficit, it was not thought to have been large, with any possible under recording being further reduced by the use of the financial year approach whereby only half of 1992 was utilized. Furthermore it should be noted that (i) there was an increasing trend in the rate of non-alcohol related conditions during LWA by which all estimates were adjusted and (ii) in terms of costs, this study made no attempt to estimated the police and legal costs associated with alcohol related violence and hence underestimated the benefits flowing from a reduction in these.

If one adopts the view that changes in acute alcohol related harm are likely to be i) most immediately apparent and ii) most likely anyway to result from a program like LWA, then it would appear that most of the benefits of the program were distributed evenly across the period studied. There was no evidence of an increasing trend of benefits since the initiation of the program. This pattern of improvement is likely to reflect a strong and immediate benefit flowing directly from the imposition of the alcohol levy at the very beginning of the program. There are a priori reasons for supposing that the dampening effect of the alcohol levy on alcohol consumption would

begin to decline as a function of increasing incomes and the establishment of cross-border purchase patterns. The extent of this, however, is hard to determine. The fact that there was evidence of benefits in some areas being sustained throughout the study period is at least consistent, therefore, with there having been some material benefit from the programs implemented by LWA.

In relation to the separate effects of the introduction of the .05 legal limit and the cask wine levy, there was in fact limited opportunity in the time series of data available to test for specific effects from these. Longer term studies are required to examine the impact of these potentially important initiatives. A separate study (Gray *et al*, 1999) has found that sales of cask wine dropped by about one third following the introduction of the cask wine levy in the NT in 1995.

Table 45
Summary of observed vs forecast trends in harm indicators and (where available) statistically established effect sizes following introduction of LWA

Harm Indicator	**Actual versus forecasted % change**		**Statistically derived estimates of % change against control variables**
Mortality	%	n	
Road deaths only	-38.9%	84.4	-34.5%, p<0.005 (95%CI:12.8 – 39.1)
Other deaths			
Acute	-9.3%	108.5	-23.4%, p<0.01 (95%CI: 7.5 – 34.6)
Chronic	+14.6%	108.8	ns
Total other deaths	-2.6%	217.3	-18.9%, p<0.05 (95%CI: 7.2 – 34.6)
Morbidity	%	n	
Acute morbidity			
Road injury only	-35.1%	630.1	-28.3%, p<0.005 (95%CI: 12.8 – 39.1)
Other low acute	-7.1%	92.4	ns
Other medium acute	+6.8%	2332.8	-17.9%, p<0.05 (95%CI: 2.7 – 28.9)
Other high acute	-31.2	696.4	-50.4%, p<0.001 (95%CI: 42.8 – 56.2)
All other acute	-2.1%	3118.5	-22.6%, p<0.01 (95%CI: 7.8 – 33.3)
Chronic morbidity	%	n	
Low chronic	-15.5%	115.3	-39.0%, p<0.001 (95%CI: 30.3– 45.8)
Med chronic	+54.7%	44.0	+26.3%, p<0.05 (95%CI: 5.2 – 39.7)
High chronic	-74.8%	1109.2	-75.6%, p<0.001 (95%CI: 67.6 – 80.5)
All Chronic	-66.3%	1244.3	-66.9%, p< 0.001

Total non-road injury morbidity	-20.1%	4351.5	(95%CI: 56.8 – 73.1) -26.9%, p<0.005 (95%CI: 11.9 – 37.5)
Other	%	n	
Road injuries not needing hospitalisation	-14.1%	911.5	-24.0% (95%CI: 3.2 – 37.5)
Alcohol consumption	%	n	
% males drinking hazardously+	-27%	2670	-
Per capita cons. pure alcohol	-22%	N/A	-

In Summary, there is evidence of substantial health benefits associated with the period following the introduction of LWA which were especially evident in relation to acute morbidity and mortality. Both road safety and health data independently substantiate this conclusion. The next section provides an estimate of the overall costs associated with hazardous and harmful use of alcohol in the NT which, in combination with the estimates of the impact of LWA on alcohol related harm discussed in this section, will allow estimates of the benefits of LWA in dollar terms.

7. Estimated costs of hazardous and harmful drinking for 1992/93 to 1995/6 for the NT

Methodological approach

The approach adopted in this study to estimate the cost of hazardous and harmful alcohol consumption was that commonly used in cost-of illness studies. It involved calculating the cost incurred in a given year from hazardous and harmful drinking during or prior to that year. In this study, a societal perspective was adopted and the following types of costs were included:

- direct costs (i.e. those for which resources were used);
- indirect costs (i.e. those relating to productivity losses); and
- intangible costs (i.e. loss of quality of life).

Past studies that have estimated the cost of substance abuse have used two main methods to calculate the productivity losses from premature mortality– the 'human capital' approach and the 'demographic' approach. The human capital approach calculates the present value of future production costs of premature deaths that occur in the present year. The demographic approach calculates the present production costs of deaths that have occurred in past and present years (Single *et al* 1996). Given that (i) the cost of harmful and hazardous drinking was being calculated to evaluate the cost-effectiveness of , and (ii) this program could obviously not have impacted on deaths in the years prior to its introduction, this study adopted the human capital approach to calculate productivity losses from premature deaths from hazardous and harmful drinking.

Scope of the cost estimates

Table 46 shows the cost components that were included in the estimates of the cost of hazardous and harmful drinking. The main cost categories were health-related costs, an 'other' direct cost category, productivity losses and loss of quality of life.

Health-related costs included the cost of hospital treatment, medical treatment, pharmaceuticals, dental and allied health, and nursing home costs. The only 'other' direct cost included in the cost calculations was the incident costs resulting from road crashes, which included vehicle repair costs, insurance administration, legal costs, delay to traffic, alternate transport, and accident reporting and investigation. Productivity costs included loss of output at work, in the household and in the community, and these were calculated for the loss of productivity from premature death and morbidity from hazardous and harmful drinking. Due to data limitations, productivity losses for people with conditions or injuries other than road injuries, who were not hospitalised but sought medical treatment or were unable to work as a result of hazardous and harmful drinking, were not included. Productivity losses from impaired performance at work from hazardous and harmful levels of drinking were also not included. The loss of quality of life from hazardous and harmful drinking was only calculated for road crash casualties involved in alcohol related crashes since no estimates were available for the intangible value of life for other causes of mortality and morbidity.

The main cost category that was excluded from this study was the cost to the criminal justice system from hazardous and harmful drinking. This includes Police costs, court costs, legal costs, the cost of correction services, and also the loss of productivity to victims of crime resulting from hazardous and harmful drinking and criminals who were imprisoned for events committed following hazardous and harmful drinking. These costs were omitted from the cost calculations due to data limitations relating to alcohol related criminal offences.

In calculating costs, three levels of adverse health outcomes from hazardous and harmful drinking were identified: mortality, hospital admission, and all other morbidity (i.e. those not resulting in a death or hospital admission). For each level, the total cost of all cost components was calculated, and these were then added to give the total cost of hazardous and harmful drinking in a given year.

The time period over which the cost of hazardous and harmful drinking was calculated for the Northern Territory was 1992/93 to 1995/96.

Table 46
Cost components included in the calculations of the cost of hazardous and harmful drinking

Main Cost Categories	**Cost Components**
Health-related costs	Hospital episodes Medical treatment Pharmaceuticals Dental and allied health Nursing homes
Other direct costs	Incident-related costs of road crashes i.e. vehicle repair costs, insurance administration, legal costs, delay to traffic, alternate transport, and accident reporting and investigation
Productivity losses	Workplace, household and community loss of output from premature death Workplace, household and community loss of output from morbidity
Loss of quality of life	Intangible costs e.g. pain and suffering

Cost calculations

The methods used to calculate each component of the cost of hazardous and harmful drinking are discussed below.

(a) Hospital episodes

The number of hospital admissions attributable to hazardous and harmful drinking was calculated by applying the aetiological fractions calculated for the Northern Territory to the number of hospital admissions for those conditions having a non-zero aetiological fraction.

The unit cost per hospital admission in the Northern Territory was estimated for each Diagnostic Related Group (DRG) by multiplying the DRG cost weights for public sector hospitals greater than 50 beds (KPMG Peat Marwick, 1994) by the average cost of a hospital admission in the Northern Territory (personal communication). Total hospital cost for each condition was then calculated by multiplying the estimated number of hospital admissions attributable to hazardous and harmful drinking, grouped by DRG, by the appropriate DRG cost. Finally, the cost of hospital admissions from hazardous and harmful drinking was calculated by adding the hospital costs for each DRG.

(b) Medical treatment, pharmaceuticals, dental and allied health, and nursing homes

The Australian Institute of Health and Welfare (AIHW) has calculated the health system costs by health sector for diseases and injury by ICD-9 chapter (Mathers *et al.*

1998). This data was used to estimate the non-hospital health system costs of hazardous and harmful drinking. First, the hospital cost of hazardous and harmful drinking in the Northern Territory was calculated by ICD-9 chapter. Second, the AIHW relativities between each non-hospital health system cost (i.e. medical treatment, pharmaceuticals, dental and allied health and nursing homes) and hospital costs was calculated for each ICD-9 chapter, and these relativities were then used as the basis to estimate non-health system costs attributable to hazardous and harmful drinking.

(c) Other direct costs

The only component in the 'other' direct cost category was the incident-based costs of road crashes. These were calculated primarily from the crash-related costs in a study of the cost of road crashes by crash-type (Andreassen, 1992). In order to convert Andreassen's crash-based costs by crash type to incident costs for each level of severity on a per person basis, assumptions regarding the distribution of crashes by crash-type, the number of people involved in crashes, and the distribution of incident costs by level of severity were made based on the best available data.

(d) Productivity losses

Productivity losses were calculated for premature death and morbidity from hazardous and harmful drinking. In calculating productivity losses from mortality, a framework developed by the Bureau of Transport Economics (BTE) (1999) was adopted. In brief, this method calculates the present value of the loss of future workplace, household and community output on the basis of (i) the probable remaining length of life had the fatality not occurred at that particular age from hazardous and harmful drinking, and (ii) statistical data relating to the value of lost output and the amount of time spent at work and in household and community activities. The calculations were based on life expectancy tables (ABS, 1997a), age-specific employment rates (ABS, 1996), age-specific earnings rates (ABS 1995 and 1997), and time spent involved in paid work, household activities and community activities (ABS, 1997b). A 2% annual growth rate was applied to output to take account of real increases in productivity over time. A base discount rate of 4% was employed.

In the case of productivity losses from morbidity – either while people are in hospital or at home recuperating from conditions attributable to hazardous and harmful drinking – the costs were calculated using the following two assumptions:

- For people admitted to hospital, three days of lost productivity were assumed to be associated with each hospital bed-day (Collins and Lapsley, 1996).
- For road crash casualties who were injured but not admitted to hospital, one day of lost productivity was allocated (BTE, 1999).

(e) Loss of quality of life

As discussed above, loss of quality of life was only calculated for road crash casualties. Different values were assumed to apply for the loss of quality of life associated with a fatality, a hospital admission, a road injury requiring medical treatment, and a road injury requiring no treatment. The loss of quality of life associated with a fatality was obtained from a study of the cost of civil aviation accidents and incidents by the BTE (1999). This value was calculated from court awards for non-economic loss (sometimes also referred to as general damages or pain and suffering), and a fatality was allocated a loss of quality of life amount equal to the average of a series of non-economic awards for 100 per cent impairment cases over the period 1973 to 1996 (Britts, 1973-1996). This is equivalent to equating the loss of quality of life for a fatality with that of permanent incapacity. This method resulted in an estimated mean award of $214 000 for loss of quality of life associated with a road fatality.

In the case of road injuries not resulting in a fatality, the loss of quality of life associated with these was estimated on the basis of non-economic loss payouts by third party motor vehicle personal injury insurers (Andreassen, 1992). The amounts paid out for non-economic loss for a hospital admission, an injury requiring medical treatment and an injury requiring no treatment were $48 300, $3 200 and $350 respectively.

Estimates of the cost of hazardous and harmful drinking in the Northern Territory

The cost of hazardous and harmful drinking in the Northern Territory is presented in Tables 45 and 46 in current and constant dollars respectively. The base year for the constant dollar calculations is 1995/96.

Using a discount rate of 4%, the total cost of hazardous and harmful alcohol consumption from 1992/93 to 1995/96 was $459.1 million in current values, and $477.5 million in constant values. A discount rate of between 3% and 5% is most widely used in Australia for cost of illness studies. These cost estimates are clearly

sensitive to the choice of annual discount rate. If, for example, a discount rate of 6% is applied, the cost of hazardous and harmful drinking over the four-year period would decrease to $320.4 million and $332.3 million in current and constant dollars respectively.

The annual cost of hazardous and harmful drinking increased each year between 1992/92 and 1995/96 – in constant dollars the increase was from $98.6 million in 1992/93 to $136.8 million in 1995/96.

The major share of the total cost of hazardous and harmful drinking was accounted for by premature mortality. In constant dollars, the cost associated with premature mortality was $385.2 million or approximately 80% of the total cost of hazardous and harmful drinking. Costs associated with people who were admitted to hospital with conditions attributable to hazardous and harmful drinking accounted for 14% of total costs, while all other morbidity associated for just 1%. The cost of the Living With Alcohol program in constant dollars over this period was $18.4 million (3.9%).

Table 47
Cost of hazardous and harmful drinking in the Northern Territory, current prices: 1992/93-1995/96

Level of Outcome	Cost of Hazardous and Harmful Drinking				
	1992/93	1993/94	1994/95	1995/96	1992/93 to 1995/96
	($000)	($000)	($000)	($000)	($000)
DISCOUNT RATE OF 4%					
Mortality[1]					
Excluding road fatalities	56 646	62 786	77 641	86 405	283 478
Road fatalities	13 443	23 219	24 150	26 162	86 974
All alcohol related fatalities	70 089	86 005	101 791	112 567	370 452
Patients admitted to hospital[1]					
Excluding people with road injuries	8 398	8 479	9 176	9 510	35 563
Road injured people	6 746	7 533	7 709	8 056	30 044
All alcohol related hospital admissions	15 144	16 012	16 886	17 566	65 608
All other morbidity					
Road injuries	1 279	1 328	1 265	1 512	5 384
Total excluding LWA program	86 512	103 345	119 942	131 645	441 444

LWA program	3 979	3 684	4 892	5 114	17 669
Total cost	90 491	107 029	124 834	136 759	459 113

1. Includes share of the cost of medical, treatment, pharmaceuticals, dental and allied health, and nursing homes for all other morbidity group.

Table 48
Cost of hazardous and harmful drinking in the Northern Territory, constant prices: 1992/93-1995/96 (Base year = 1995/96)

Level of Outcome	Cost of Hazardous and Harmful Drinking				
	1992/93	1993/94	1994/95	1995/96	1992/93 to 1995/96
	($000)	($000)	($000)	($000)	($000)
DISCOUNT RATE OF 4%					
Mortality[1]					
Excluding road fatalities	61 775	66 626	79 948	86 405	294 754
Road fatalities	14 668	24 676	24 901	26 162	90 407
All alcohol related fatalities	76 443	91 302	104 849	112 567	385 161
Patients admitted to hospital[1]					
Excluding people with road injuries	9 017	8 898	9 405	9 510	36 830
People with road injuries	7 361	8 060	8 001	8 055	31 477
All alcohol related hospital admissions	16 378	16 958	17 406	17 566	68 307
All other morbidity					
Road injuries	1 397	1 417	1 308	1 512	5 634
Total excluding LWA program	94 217	109 677	123 563	131 645	459 102
LWA program	4 340	3 910	5 037	5 114	18 401
Total	98 557	113587	128 600	136 759	477 503

1. Includes share of the cost of medical, treatment, pharmaceuticals, dental and allied health, and nursing homes for all other morbidity group.

Table 49 shows the component costs for hazardous and harmful drinking in the Northern Territory in constant dollars over the period from 1992/93 to 1995/96. The major share of the total cost of hazardous and harmful drinking was accounted for by losses in productivity (84%). Health-related costs and loss of quality of life comprised 1% and 7% of total cost respectively.

Table 49
Components of the cost of hazardous and harmful drinking in the Northern Territory for 1992/93 to 1995/96, constant prices (Base year = 1995/96)

Cost Component	Cost of Hazardous and Harmful Drinking	
	Millions $	%
Health-related		
Hospital	10.24	2.1
Medical	2.67	0.6
Other	5.06	1.1
Productivity loss	400.15	83.8
Loss of quality of life	35.48	7.4
Other	5.51	1.9
LWA program	18.40	3.9
Total	477.50m	100.0%

8. Estimated total cost savings from LWA by harm domain, 1992/3 to 1995/6

Table 50 below combines the key information from the previous sections to enable an estimation within approximate 95% confidence limits of the savings attributable to the Living With Alcohol program between 1992/3 and 1995/6. The estimated percentage reductions are in each case derived from the estimates of LWA's impact from controlled analyses of time series data. For road crash deaths and injuries the estimated impacts from these analyses are actually lower than those observed without controls taken into account. For other morbidity and mortality the controlled analyses result in estimates of larger reductions than those immediately apparent in the uncontrolled data series.

The large estimates in reduction of serious alcohol related harm are supported by the independently measured reductions in per capita alcohol consumption and also high risk alcohol consumption. The diverse sources of data employed and types of harm domain also lend confidence to the assumption of large reductions in harm and hence large savings in dollar terms.

The total estimated net saving of $124.30 million corresponds to $31.08 million per year. It should be noted that there were not sufficient data to estimate beneficial consequences of the program on reduced crime, Police, corrections and legal time. There is a substantial literature identifying links between alcohol use and violent crime in particular (e.g. Graham *et al*, 1996; Bushman, 1997). It is highly likely, therefore, that the total estimated costs and savings presented here are under-estimates.

Table 50
Estimated total cost of alcohol related harm in NT 1992/3 to 1995/6 and estimated savings from LWA program in adjusted constant dollars (1995/96 reference year)

Harm domain	Total cost millions $'s	Estimated % change (and approximate 95% CIs)	Estimated saving millions $'s (and approximate 95% CIs)
Mortality			
Road deaths	$90.41m	-34.53% (-16.57, -46.13)	$47.68m ($17.96, $77.42)
Other deaths	$294.75m	-18.88% (-7.24, -27.93)	$68.60m ($23.01, $114.23)
Total mortality	$385.16m		$116.28m ($78.62, $153.93)
Morbidity			
Road injuries	$31.48m	-28.32% (-12.83, -39.08)	$12.44m ($4.42, $19.27)
Other morbidity	$36.83m	-24.88% (-10.80, -35.12)	$12.20m ($4.31, $19.25)
Total morbidity	$68.31m		$24.63m ($17.18, $32.08)
Road crash injuries not requiring hospitalisation			
Other road injuries	$5.63m	-24.04% (-3.16, -37.52)	$1.78m ($0.18, $3.38)
Total savings from LWA			**$142.70m**
Costs of LWA			$18.40m
Net savings of LWA program			*$124.30m*

The method of applying the estimated percentage reductions in harm to the corresponding estimates of costs involves application of the following formula:

If C= total cost of a particular harm and p = percentage reduction attributed to LWA program, then the estimated savings from LWA is calculated as [100C/(100-p) - C].

The estimated reductions in harm by this method which underlie the cost savings calculations are: 77 road deaths, 52 deaths from other causes, 1394 road crash injuries and 1277 hospital admissions for all other causes.

9. The intangible costs arising from alcohol related harm

Some alcohol related harm cannot be quantified reliably in terms of economic costs. Such intangible costs arising from alcohol related harm will nevertheless be considered in the discussion of the report. We should not discount these intangible costs because of measurement difficulties, however our study unfortunately could not include aspects such as:

- Loss in Quality of life
- Family disruption / divorce
- Non-reported domestic violence
- Pain and suffering
- Suffering of others

Many of the known harmful consequences of excess alcohol consumption are harder to quantify. This study has concentrated on illness, injury and crash data recorded by Health and Police in the NT. However, it is well established that many minor road crashes are never reported to the police and also that many victims of violence do not present to Police or hospitals. For example, a survey of violent incidents in and around licensed premises in Melbourne found that only 22% of victims sought medical assistance (Victorian Community Council Against Violence, 1990). Aside from the physical trauma of such injuries which vary from the most minor to death, there are frequently psychological sequelae as well as implications for family members, friends and colleagues which are harder to quantify. These are known as 'intangible costs' and frequently measured by quality of life instruments.

Quality of Life (QoL) measures the subjective satisfaction of individuals and their respective valuation of this satisfaction with their overall health. This valuation can measure both psychological and physical intangible costs that are less readily obtainable through measurement of objectively defined health status. QoL studies

require individuals to rate their satisfaction levels for a particular health state or circumstance relative to a baseline of 'perfect' or 'best possible imaginable quality. Most scales commonly use 'best possible health' and 'death' as extreme end-points on a 100cm Visual Analogue Scale (VAS) or by other well validated methods. Subjects then mark on the VAS their subjective feeling of overall well-being as well as other 'domains' of QoL eg. pain, fatigue, psychological well-being, physical well-being, functional well-being, social interaction etc. It is rare to find such costs valued in monetary terms, although some willingness-to-pay have experimentally attempted to place a dollar value on the avoidance of such intangible costs.

In addition to the direct social costs reported in the paper, it is not hard to see what private (and even social) intangible impact there might be among excessive drinkers and their friends/family. We are not aware of much QoL research using such instruments having been undertaken among problem drinkers specifically, although there is a growing body of QoL evidence among psychiatric patients. Excessive drinkers may experience physical malaise during or after a bout of drinking which, although often being resolved without medical intervention, nonetheless has a negative impact on well-being and hence, QoL. The same argument can apply to psychological well-being although at low levels of drinking there may be transient positive QoL gains as people become 'happily intoxicated'. At higher levels of consumption alcohol acts a depressant and life can be seen much more negatively than would be the case if the subject were sober. Many long-term psychological problems also result from excessive alcohol consumption even though these may not always become apparent to the health system. Alcohol dependence imposes a private intangible cost on drinkers and their families. There is much argument in the theoretical economic literature as to whether dependence on a drug such as to alcohol is rational or is an irrational state, although neither of these theories denies the personal physical and psychological harm borne by alcohol dependent individuals. Empirical evidence would seem to suggest that dependence imposes intangible (and sometimes very tangible) costs on both the addict and their close family and friends whose own QoL is negatively affected.

No attempt has been here to quantify or cost the broader social problems associated with excess alcohol use. Alcohol related problems are often cited as the

cause of family breakdown and conduct disorder in children (e.g. Edwards *et al*, 1997; Zeitlin, 1994).

10. Summary and conclusions

An analysis has been presented of reductions in alcohol consumption, related harm and associated costs during the period of operation of the Living With Alcohol (LWA) program in the Northern Territory.

The activities introduced by the Living With Alcohol program started a remarkable period in harm minimisation in the Northern Territory. Many of the interventions made possible by the program and its significant level of funding can claim to be evidence-based. In particular:

- Increases in the price of alcohol in proportion to their alcohol content as a consequence of the LWA levy introduced in April 1992.

- The increase in treatment, education and prevention activities funded from these levies, in particular public education campaigns supporting enforcement of drink-driving and liquor licensing laws.

It should be noted that towards the end of the study period other positive initiatives unrelated to Living With Alcohol were introduced. These include the lowering of the legal limit for drivers in the last 6 months of the study period and the introduction of local licensing restrictions in some rural areas of the NT. These may have contributed to the observed benefits for the last 6 months of the study period.

The level and timing of impacts of LWA were estimated through controlled analyses of data supplied to the National Centre for Research into the Prevention of Drug Abuse by the NT Liquor Commission, NT Department of Transport and Works and Health Departments. Known indicators of serious alcohol related harm were tracked from 1980 to June 30 1996 subject to availability of reliable data. In each case appropriate control data from the same source that was much less alcohol related was employed to control for other possible confounding effects.

An important methodological feature of the study was the calculation of aetiologic fractions for major alcohol related causes of death and hospital admission for the Northern Territory. These were also adjusted for variations in the estimated prevalence of hazardous and harmful alcohol consumption during the course of the study period. These calculations were based on relative risk data from the major review by English *et al* (1995).

These analyses revealed large, consistent and significant reductions in alcohol related harm from the introduction of LWA. There were reductions in estimated alcohol caused deaths (n = 129), hospital admissions for non-road injuries (n = 1277) road crash injuries (n = 1394). In addition there were substantial reductions in per capita alcohol consumption and self-reported hazardous and harmful consumption via surveys. These reductions were evident immediately from the outset of the introduction of LWA and were sustained throughout the four years studied. For some harm indicators the benefits were most pronounced in the first two years after introduction of LWA. For others the benefits were sustained throughout the period examined. There are reasons for supposing that if the benefits were entirely due to the alcohol levy then this effect would lessen with time. The results are consistent with there being some sustained benefits to which the LWA may have contributed through its programs.

A cost-of-illness methodology was adopted in order to estimate the total economic costs of alcohol misuse in NT. It was estimated that the annual costs associated with hazardous and harmful alcohol use varied between $98.56 million and $136.76 million per year.

Estimates of the economic benefits of were obtained by combining the evidence of the effectiveness of the program in achieving reductions in harm with estimates of the total costs of alcohol misuse in NT between 1992/3 and 1995/6. The median estimate of total savings over the four years following the program was $124.30 million.

In conclusion, the data reported here suggest that significant economic, health and safety benefits accrued to the people of the Northern Territory as a consequence of the Living With Alcohol program.

11. References

Adrian, M., Jull, P. & Williams, R. (1988) Statistics on Alcohol and Drug Use in Canada and Other Countries, vol. II: *Statistics on Drug Use*. Toronto: Addiction Research Foundation.

Andreassen, D. C. (1992) *Preliminary Costs for Accident-types*, Research report ARR 217, Australian Road Research Board, Melbourne.

Australian Bureau of Statistics (1995 and 1997) *Unpublished data on weekly earnings of employees*, Canberra: ABS.

Australian Bureau of Statistics (1996) *Unpublished data labour force participation rates,* Canberra: ABS.

Australian Bureau of Statistics (1997a) *Deaths 1997, Cat. No. 3302.0,* Canberra: ABS.

Australian Bureau of Statistics (1997b) *Unpublished data on time use,* Canberra: ABS.

Bertram, S. & Crundall, I. (1997) *Summary of Household Survey of Alcohol Consumption and Related Attitudes in the Northern Territory. Living With Alcohol Program*, Darwin, NT.

Ritts, M.G. (1973-1996). *Comparative Verdicts in Personal Injury Claims*, Sydney: The Law Book Company.

Bureau of Transport Economics (1998) *Cost of Civil Aviation Accidents and Incidents*, Report 98, BTE, Canberra.

Bushman, B. J., & Cooper, H. M. (1990) Effects of alcohol on human aggression: An integrative research review. *Psychological Bulletin*, 107, 341-354.

Chikritzhs, T. (1996) *Alcohol and Violence: a temporal association between frequency/type of assault and location? in and around licensed premises.* National Centre for Research into the Prevention of Drug Abuse, Curtin University of Technology, Western Australia.

Collins, D.J. & Lapsley, H.M. (1991) *Estimating the Economic Costs of Drug Abuse in Australia*, National Campaign Against Drug Abuse Monograph No. 15. Canberra: Commonwealth of Australia.

Collins, D.J. & Lapsley, H.M. (1996) *The social costs of drug abuse in Australia in 1988 and 1992*. Canberra: Australian Government Publishing Service.

Collishaw, N. & Myers, G. (1984) Dollar estimates of the consequences of tobacco use in Canada, 1979. *Canadian Journal of Public Health,* 75, 192-199.

Crundall, I. (1994) *1994 Household Survey of Alcohol Consumption in the Northern Territory.* Darwin, NT Department of Health and Community Services.

Crundall, I. (1994) *The Northern Territory Living With Alcohol program: Progress to July 1993.* .Darwin, NT Department of Health and Community Services.

Crundall, I, (1995) *The NT Living With Alcohol Program: Climbing Through a Window of Opportunity, in Dealing with Drugs: Ethics, Economics and Efficiency.* Qld., Alcohol and Drug Foundation, 98-105.

d'Abbs, P. (1993) *Alcohol consumption in the Northern Territory, 1992-1993: An analysis of trends revealed by two surveys*. Menzies School of Health Research, Northern Territory.

d'Abbs, P., Forner, J. & Thomsen, P. (1994*) Darwin Nightclubs: A review of trading hours and related issues*. Menzies School of Public Health, Darwin, Australia.

d'Abbs, P., Togni, S. & Crundall, I. (1997) *The Tennant Creek Liquor Licensing Trial, August 1995 - February 1996: An Evaluation.* Menzies Occasional Papers Issue No 2/96, Darwin: Menzies School of Health Research.

Drummond, M.F., O'Brien, B., Stoddart, G.L. & Torrance, G.W. (1997) *Methods for the economic evaluation of health care programs.* (2nd ed). Oxford: Oxford University Press.

Edwards, G. *et al*, (1994) *Alcohol policy and the public good*. Cambridge University Press, UK.

Edwards, G., Marshall, E. & Cook, C. (1997) *The Treatment of Drinking Problems: A guide for the helping professions*. Cambridge University Press, UK.

English, D.R., Holman, C.D.J., Milne, E., Winter, M.G., Hulse, G.K., Codde, J.P., Bower, C.I., Corti, B., de Klerk, N., Knuiman, M.W., Kurinczuk, J.J., Lewin, G.F. & Ryan, G.A. (1995) *The quantification of drug caused morbidity and mortality in Australia 1995.* Canberra: Department of Human Services and Health.

Fazey, C. & Stevenson, R. (1990) *The Social and Economic Costs of Drug Abuse in the UK and the Netherlands.* London: Commission of the European Communities.

Graham, K., Schmidt, G., & Gillis, K. (1996) Circumstances when drinking leads to aggression: An overview of research findings. *Contemporary Drug Problems,* 23, 493-557.

Gray, D., Saggers, S., Atkinson, D., Sputore, B. & Bourbon, D. (1998) *Evaluation of the Tennant Creek Liquor Licensing Restrictions: A Report Prepared for the Tennant Creek Beat the Grog Sub-Committee.* Perth: National Centre for Research into the Prevention of Drug Abuse, Curtin University of Technology.

Harwood, H. J., Fountain, D. & Livermore, G. (1999) Economic cost of alcohol and drug abuse in the United States, 1992: a report. *Addiction*, 94, 5, 631-647.

Holder, H.D. & Blose, J.O. (1994) The reduction of health care costs associated with alcoholism treatment: a fourteen year longitudinal study. Annual review, *Addictions Research and Treatment*, 3, 367-380.

Holman, C.D.J., Armstron, B.K., Arias, L.N., Martin, C.A., Hatton, W.M., Haywood, L.D., Salmon, M.A., Shean, R.E. & Waddell, V.P. (1990) *The quantification of drug caused morbidity and mortality in Australia 1988, Parts 1 and 2.* Canberra: Commonwealth Department of Health, Housing, Local Government and Community Services, AGPS.

Homel, R. (1998*) Policing and punishing the drinking driver: study of general and specific deterrents*. New York: Springer-Verlag.

Institute Suisse de Prophylaxie de L'Alcoolisme (1990) *Le Problème de la Drogue—en Particulier en Suisse—Considere Sous son Aspect Social et Preventif.* Lausanne: Office fédéral de la sante publique.

Jonas, H. Dietze, P. Rumbold, G., Hanlin, K., Cvetkovski, S. & Laslett, A. (In press) Associations between alcohol related hospital admissions and alcohol consumption in Victoria, Australia: Influence of sociodemographic factors. *Australian Journal of Public Health.*

KMPG Peat Marwick (1994) *National Costing Study: Production of Cost Weights for AN-DRGs Version2, Summary Report*, Commonwealth Department of Human Services and Health, 1994.

Legislative Assembly of the Northern Territory (1991) *Measures for reducing alcohol use and abuse in the Northern Territory: Interim report of the sessional Committee on Use and Abuse of Alcohol by the Community.* Darwin: Northern Territory Government.

Mathers, C., Penn, R., Carter, R. & Stevenson, C. (1998) *Health System Costs of Diseases and Injury in Australia 1993-94.* Canberra: Australian Institute of Health and Welfare.

McDonnel, R. & Maynard, A. (1985) The costs of alcohol misuse. *British Journal of Addiction,* 80, 27-35.

Mcknight, A.J. & Streff, F.M. (1992) *The effect of enforcement upon service of alcohol to intoxicated patrons of bars and restaurants.* Landover, Maryland: National Public Services Research Institute.

Nakamura, K., Tanaka, A. & Takano, T. (1993) The social costs of alcohol abuse in Japan. *Journal of Studies in Alcohol,* 54, 618-625.

National Health Medical Research Council (1992) *Is there a safe level of daily consumption of alcohol for men and women? Recommendations regarding responsible drinking behaviour,* 2nd Edition. Canberra: Australian Government Publishing Service.

Raynauld, A. &Vidal, J.P. (1992) Smokers' burden on society: myth and reality in Canada, *Canadian Public Policy,* 18, 300-317.

Rice, D., Kelman, S., Miller, L. & Dunmeyer, S. (1990) *The Economic Cost of Alcohol and Drug Abuse and Mental Illness 1985.* DHHS Publication No. (ADM) 90, 1694. San Francisco: Institute for Health and Ageing, University of California.

Single, E., Collins, D., Easton, B., Harwood, H., Lapsley, H. & Maynard, A. (1996) *International guidelines for estimating the costs of substance abuse.* Ottawa: The Canadian Centre of Substance Abuse.

Single, E., Robson, L., Xie, X. & Rehm, J. (1996) *The Costs of Substance Abuse in Canada.* Ottawa: Canadian Centre on Substance Abuse.

Stevenson, R.J., Lind, B. & Weatherburn, D. (1999) The relationship between alcohol sales and assault in New South Wales, Australia. *Addiction*, 94, 3, 397-410.

Stewart, L. & Casswell, S. (1993) Media advocacy for alcohol policy support: Results from the New Zealand community action project. *Health Promotion International*, 8, 3, 167-175.

Stinson, R. & DeBakey, S. (1992) Alcohol related mortality in the United States 1979-1988. *British Journal of Addiction,* 87, 777-783.

Stockwell, T. (1995) *Alcohol misuse and violence: Report 5.* An evaluation of the appropriateness and efficacy of liquor licensing laws across Australia. Canberra: Australian Government Publishing Service.

Stockwell, T., Masters, L., Philips, M., Daly, A., Gahegan, M., Midford, R. & Philp, A. (1995) *The Measurement of alcohol problems for policy (MAPP): a first report of research in progress.* Perth: National Centre for Research into the Prevention of Drug Abuse, Curtin University of Technology.

Stockwell, T., Masters, L., Philips, M., Daly, A., Gahegan, M., Midford, R. & Philp, A. (1998) Consumption of different alcoholic beverages as predictors of local rates of night-time assault and acute alcohol related morbidity. *Australian and New Zealand Journal of Public Health,* 22, 2, 237-242.

Victorian Community Council Against Violence (1990) *Violence in and around licensed premises.* Melbourne :Victorian Community Council Against Violence.

World Drink Trends (1998) *International Beverage Alcohol Consumption and Production Trends*. Henly-on-Thames: NTC Publications.

Zeitlin, H. (1994) Children with alcohol misusing parents. In: *Alcohol and Alcohol Problems*. Edwards, G. and Peters, T. (Eds) 131-151, *British Medical Bulletin 50*, Edinburgh: Churchill Livingstone.

Appendix A

Table 51
World Drink Trends (1998) annual estimated per capita consumption of pure alcohol in Australia 1980/81 to 1995/96

Financial year	National per capita pure alcohol consumption
1980/81	9.7
1981/82	9.8
1982/83	9.5
1983/84	9.3
1984/85	8.9
1985/86	9.0
1986/87	8.7
1987/88	8.8
1988/89	8.7
1989/90	8.5
1990/91	8.2
1991/92	7.8
1992/93	7.5
1993/94	7.7
1994/95	7.6
1995/96	7.5

Appendix B

Table 52
Annual pure alcohol adult per capita consumption between 1980/81 and 1995/96 in the Northern Territory

Year	Pure alcohol per capita consumption	Percentage change
1980/81	22.2	-
1981/82	22.4	1.0%
1982/83	21.7	-3.1%
1983/84	21.3	-2.1%
1984/85	20.3	-4.3%
1985/86	20.6	1.1%
1986/87	19.9	-3.3%
1987/88	20.1	1.1%
1988/89	19.9	-1.1%
1989/90	19.4	-2.3%
1990/91	18.7	-3.5%
1991/92	17.6	-6.2%
1992/93	15.7	-10.9%
1993/94	15.7	0.6%
1994/95	16.1	2.3%
1995/96	15.3	-5.0%

Appendix C

Table 53
Alcohol related conditions by acute and chronic causation and by level of alcohol involvement

Acute/ Chronic	Level of alcohol involvement	Condition
Acute	High	Alcoholic psychosis
Acute	High	Alcohol abuse
Acute	High	Alcoholic gastritis
Acute	High	Alcoholic beverage poisoning
Acute	High	Other ethanol and ethanol poisoning
Acute	High	Aspiration
Acute	High	Ethanol toxicity
Acute	High	Methanol toxicity
Acute	Medium	Stroke
Acute	Medium	Gastro-oesophageal haemorrhage
Acute	Medium	Acute pancreatitis
Acute	Medium	Road injuries
Acute	Medium	Fire Injuries
Acute	Medium	Drowning
Acute	Medium	Suicide
Acute	Medium	Assault
Acute	Low	Child abuse
Acute	Low	Supraventricular cardiac Dysrhythmias
Acute	Low	Spontaneous abortion
Acute	Low	Low birthweight
Acute	Low	Occupational and machine injuries
Chronic	High	Alcoholic poly neuropathy
Chronic	High	Alcoholic cardiomyopathy
Chronic	High	Chronic pancreatitis
Chronic	High	Alcoholic liver cirrhosis
Chronic	High	Alcoholic dependence
Chronic	Medium	Oropharyngeal cancer
Chronic	Medium	Liver cancer
Chronic	Medium	Laryngeal cancer
Chronic	Medium	Oesophageal varices
Chronic	Low	Female breast cancer
Chronic	Low	Hypertension
Chronic	Low	Unspecified liver cirrhosis
Chronic	Low	Psoriasis
Chronic	Low	Oesophageal cancer
Chronic	Low	Epilepsy

Appendix D

Table 54
Northern Territory, 1991/92 age and sex specific alcohol aetiologic fractions for conditions where Relative Risk provided in English *et al.,* 1995

Condition	Sex	Age	Aetiologic fraction (%)
Oropharyngeal cancer	male	15-24yrs	38.45%
Oropharyngeal cancer	male	25-34yrs	37.81%
Oropharyngeal cancer	male	35-44yrs	27.86%
Oropharyngeal cancer	male	45-64yrs	27.29%
Oropharyngeal cancer	male	65yrs+	14.10%
Oropharyngeal cancer	female	15-24yrs	5.66%
Oropharyngeal cancer	female	25-34yrs	11.89%
Oropharyngeal cancer	female	35-44yrs	14.38%
Oropharyngeal cancer	female	45-64yrs	16.45%
Oropharyngeal cancer	female	65yrs+	3.85%
Oesophageal cancer	male	15-24yrs	16.65%
Oesophageal cancer	male	25-34yrs	17.01%
Oesophageal cancer	male	35-44yrs	14.02%
Oesophageal cancer	male	45-64yrs	13.06%
Oesophageal cancer	male	65yrs+	7.21%
Oesophageal cancer	female	15-24yrs	2.15%
Oesophageal cancer	female	25-34yrs	5.54%
Oesophageal cancer	female	35-44yrs	6.78%
Oesophageal cancer	female	45-64yrs	6.97%
Oesophageal cancer	female	65yrs+	4.24%
Liver cancer	male	15-24yrs	31.89%
Liver cancer	male	25-34yrs	34.42%
Liver cancer	male	35-44yrs	32.81%
Liver cancer	male	45-64yrs	30.04%
Liver cancer	male	65yrs+	18.49%
Liver cancer	female	15-24yrs	4.96%
Liver cancer	female	25-34yrs	13.88%
Liver cancer	female	35-44yrs	16.81%
Liver cancer	female	45-64yrs	16.08%
Liver cancer	female	65yrs+	13.47%

Condition	Sex	Age	Aetiologic fraction (%)
Laryngeal cancer	male	15-24yrs	34.65%
Laryngeal cancer	male	25-34yrs	37.18%
Laryngeal cancer	male	35-44yrs	34.98%
Laryngeal cancer	male	45-64yrs	32.18%
Laryngeal cancer	male	65yrs+	19.69%
Laryngeal cancer	female	15-24yrs	5.43%
Laryngeal cancer	female	25-34yrs	14.89%
Laryngeal cancer	female	35-44yrs	18.02%
Laryngeal cancer	female	45-64yrs	17.42%
Laryngeal cancer	female	65yrs+	13.90%
Female Breast cancer	female	15-24yrs	1.45%
Female Breast cancer	female	25-34yrs	3.72%
Female Breast cancer	female	35-44yrs	4.56%
Female Breast cancer	female	45-64yrs	4.73%
Female Breast cancer	female	65yrs+	2.78%
Hypertension	male	15-24yrs	20.61%
Hypertension	male	25-34yrs	21.14%
Hypertension	male	35-44yrs	17.64%
Hypertension	male	45-64yrs	16.44%
Hypertension	male	65yrs+	9.17%
Hypertension	female	15-24yrs	3.11%
Hypertension	female	25-34yrs	8.12%
Hypertension	female	35-44yrs	9.91%
Hypertension	female	45-64yrs	10.03%
Hypertension	female	65yrs+	6.54%
Stroke	male	15-24yrs	33.72%
Stroke	male	25-34yrs	34.25%
Stroke	male	35-44yrs	27.89%
Stroke	male	45-64yrs	26.44%
Stroke	male	65yrs+	14.58%
Stroke	female	15-24yrs	19.76%
Stroke	female	25-34yrs	31.65%
Stroke	female	35-44yrs	36.07%
Stroke	female	45-64yrs	42.54%
Stroke	female	65yrs+	-2.49%
Cholelithiasis	male	15-24yrs	-10.28%
Cholelithiasis	male	25-34yrs	-10.34%
Cholelithiasis	male	35-44yrs	-8.14%
Cholelithiasis	male	45-64yrs	-7.50%
Cholelithiasis	male	65yrs+	-3.99%
Cholelithiasis	female	15-24yrs	-1.12%
Cholelithiasis	female	25-34yrs	-3.00%
Cholelithiasis	female	35-44yrs	-3.71%
Cholelithiasis	female	45-64yrs	-3.78%
Cholelithiasis	female	65yrs+	-2.49%
Psoriasis	male	15-24yrs	7.60%
Psoriasis	male	25-34yrs	7.10%
Psoriasis	male	35-44yrs	4.11%
Psoriasis	male	45-64yrs	4.17%
Psoriasis	male	65yrs+	1.80%

Condition	Sex	Age	Aetiologic fraction (%)
Psoriasis	F	15-24yrs	0.79%
Psoriasis	female	25-34yrs	1.58%
Psoriasis	female	35-44yrs	1.94%
Psoriasis	female	45-64yrs	2.42%
Psoriasis	female	65yrs+	0.14%
Suicide	male	15-24yrs	19.50%
Suicide	male	25-34yrs	21.13%
Suicide	male	35-44yrs	20.45%
Suicide	male	45-64yrs	18.48%
Suicide	male	65yrs+	11.29%
Suicide	female	15-24yrs	2.85%
Suicide	female	25-34yrs	8.30%
Suicide	female	35-44yrs	10.12%
Suicide	female	45-64yrs	9.52%
Suicide	female	65yrs+	8.62%
Supraventricular cardiac Dysrhythmias	male	15-24yrs	12.28%
Supraventricular cardiac Dysrhythmias	male	25-34yrs	13.33%
Supraventricular cardiac Dysrhythmias	male	35-44yrs	13.53%
Supraventricular cardiac Dysrhythmias	male	45-64yrs	12.10%
Supraventricular cardiac Dysrhythmias	male	65yrs+	7.70%
Supraventricular cardiac Dysrhythmias	female	15-24yrs	1.87%
Supraventricular cardiac Dysrhythmias	female	25-34yrs	5.59%
Supraventricular cardiac Dysrhythmias	female	35-44yrs	6.80%
Supraventricular cardiac Dysrhythmias	female	45-64yrs	6.23%
Supraventricular cardiac Dysrhythmias	female	65yrs+	6.42%
Oesopahgeal varices	male	15-24yrs	65.71%
Oesopahgeal varices	male	25-34yrs	67.80%
Oesopahgeal varices	male	35-44yrs	68.17%
Oesopahgeal varices	male	45-64yrs	65.32%
Oesopahgeal varices	male	65yrs+	53.33%
Oesopahgeal varices	female	15-24yrs	20.65%
Oesopahgeal varices	female	25-34yrs	44.77%
Oesopahgeal varices	female	35-44yrs	49.97%
Oesopahgeal varices	female	45-64yrs	47.64%
Oesopahgeal varices	female	65yrs+	48.42%