

School of Nursing, Midwifery and Paramedicine

Integrated Pharmacology in an Undergraduate Nursing Curriculum: The Nursing Students' Perceptions of Their Readiness for Clinical Placement

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Declaration

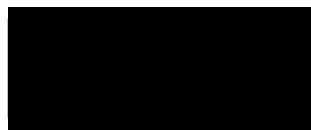
To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Human Ethics

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2014). The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Number SONM41-2014.

I acknowledge that I have read and understood the University's rules, requirements, procedure and policy relating to my higher degree research award and to my thesis. I certify that I have complied with the rules, requirements, procedures and policy of Curtin University.



Katie A. Sutton
6th December, 2018.

Acknowledgements

I dedicate this thesis to my family, “Happiness comes when your work and words are of benefit to yourself and others” – Buddha.

Nursing education is my passion. I would like to acknowledge Curtin University Graduate Research School for the provision of course and fieldwork funding to support the conduct of this study. It was fulfilling to undertake research in this area of pharmacology learning from the UG nursing student perspective. Student involvement made this research possible and I would like to sincerely thank them for their contribution. I also acknowledge the input received from my colleagues in tertiary nursing education and their ongoing commitment to education delivery. I would especially like to thank my supervisors Professor Gavin Leslie and Dr Janie Brown, whose brilliance and direction will be forever appreciated. My sincerest thanks to you both for providing me with invaluable guidance, keeping me on track and for inspiring me to become a better researcher throughout this study and into my future academic career.

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Abstract

Background: Pharmacology is a key learning area within undergraduate (UG) nursing curricula. Pharmacology content delivery may take one of two main forms, discrete units in pharmacology or an integrated approach with content addressed across curricula. The integrated pharmacology curricula delivery method has not been widely evaluated in relation to UG nursing student readiness for pharmacology practice during clinical placement.

Aim: The aim of this study was to explore the effectiveness of a curriculum that uses an integrated approach to pharmacology teaching in meeting students' expectations and perceptions of the pharmacology learning required to support their readiness for clinical placement.

Methods: An integrative review was undertaken to define the topic of integrated pharmacology and determine whether integrated pharmacology nursing curricula adequately prepares UG nursing students for clinical placement, compared to curricula that have discrete pharmacology units. This literature review did not conclusively determine whether one delivery method was better than another. Review of key papers outlining previously developed tools and methods of evaluation further informed methods for this study. Two concurrent phases were undertaken:

1. A verified exercise was undertaken for pharmacology content and structure within an existing curriculum, utilising document mapping, subsequent Unit Coordinator (UC) verification and pharmacology curriculum content review across the UG nursing course. NVivo™ was utilised as a tool to identify and map the pharmacology subject matter and pharmacology related concepts across the curriculum, with findings then confirmed by UC using a verification tool. This explored where the pharmacology subject matter and related concepts were delivered in core units of study within the existing integrated curriculum model. Phase one also assessed the level of pharmacology integration vertically and horizontally across curriculum,

- and resulted in the development of a verified curriculum diagram (VCD) for pharmacology.
2. A quantitative online student questionnaire was developed to explore students' perceptions of how effectively integrated pharmacology content met clinical placement needs. The questionnaire used existing published measurement tools that were adapted, modified and consolidated, then validated by an expert panel of six curriculum experts prior to use. The questionnaire contained 27 questions utilising dichotomous (yes/no), Likert rating scales and ten or eleven point visual analogue scales. Following relevant Ethics Committee approval, the questionnaire was administered to UG nursing students across four semesters of enrolment from April to June 2015, using a non-probability, purposive sampling approach. Data were then analysed according to students' level of study across the program and timing of clinical placement in relation to pharmacology content delivery.

Results: All 27 core units provided across the UG nursing curriculum were examined, which outlined where pharmacology was provided in the integrated curriculum model. Fourteen units were found to include either pharmacology subject matter ($n = 8$) or pharmacology related concepts ($n = 6$). All 23 UC confirmed the mapping undertaken and supported findings as an accurate reflection of the pharmacology structure within this integrated model. Horizontal and vertical integration of pharmacology across core units of study was demonstrated as a result of the pharmacology curriculum review. The verified curriculum diagram confirmed the inclusion of pharmacology subject matter, medication mathematics, medico-legal, safety and quality pharmacology related concepts across the curriculum, identifying linkages between core units of study to support pharmacology learning. Pharmacology subject matter was prominent in the bioscience and nursing practice stream units. Pharmacology related concepts were identified within the inquiry and nursing practice stream units. The majority of pharmacology learning was provided across semesters' three to six of the UG nursing program.

There were 178 UG nursing student respondents to the online student questionnaire, representing 33% of the eligible student population. Findings demonstrated overall satisfaction with the pharmacology content provided (90% of respondents) and level of integration of pharmacology curriculum within the program (73% of respondents). On an ascending scale of 0-10, clinical placement experiences were valued highest ($M = 7.52; SD = 2.32$), followed by self-tuition opportunities ($M = 6.48; SD = 2.01$). The areas of theoretical lessons ($M = 5.83; SD = 2.04$) and practical lessons in the laboratory ($M = 5.98; SD = 2.46$) were ranked lowest. Kruskal-Wallis one-way ANOVA showed statistically significant differences according to clinical placement $\chi^2 (3, N=159) = 44.39, p < 0.001$ and self-tuition $\chi^2 (3, N=160) = 9.46, p = 0.024$ teaching approaches utilised to support students' pharmacology learning on clinical placement. Participants' self-rated readiness to deliver safe care in pharmacology whilst on clinical placement ranked highly across all cohorts of study ($M = 6.81, SD = 1.92$). Participants' mean values increased, with semester three participants' recording the lowest mean value ($M = 6.15, SD = 2.17$) and semester six participants' recording the highest mean value ($M = 7.41, SD = 1.82$). This was confirmed by Kruskal-Wallis one-way ANOVA results by semester group which showed a statistically significant difference, $\chi^2 (3, N=161) = 11.21, p = 0.011$. This was consistent with findings from semester six students' (n=40) when asked about their perceived preparedness for clinical practice upon graduation ($M = 6.64, SD = 1.88$). Side effects (56% of respondents) and contraindications (55% of respondents) were reported areas of difficulty. Timing of clinical placement in relation to pharmacology content delivery did not influence pharmacology learning or attitudes towards preparedness for clinical placement.

Conclusion: The study supports the premise that horizontal and vertical integration of pharmacology subject matter and pharmacology related concepts across core units of study throughout the curriculum is supportive to students' pharmacology learning whilst attending clinical placement. The student experience has shown an increasing value placed on pharmacology practice during clinical placement. Findings have shown that if an integrated

pharmacology curriculum is delivered, it can prepare UG nursing students for pharmacology learning on clinical placement. A conceptual framework is presented to highlight areas for consideration in pharmacology curriculum structure, including pharmacology knowledge acquisition, application of pharmacology learning and pharmacology decision making in a clinical placement context. This adds to current knowledge in the area of integrated pharmacology content in UG nursing curriculum and readiness for clinical placement from the student perspective, which may be of further interest to those coordinating placement experiences and clinical facilitation of UG nursing students. There is scope for additional research into ways of improving the student experience whilst attending clinical placement to advance their pharmacology knowledge and support ongoing learning in pharmacology.

Table of Contents

Declaration.....	i
Acknowledgements.....	ii
Abstract.....	iii
List of Figures	x
List of Tables.....	xi
List of Abbreviations.....	xiii
Glossary of Terms.....	xiv
Chapter One - Introduction	16
1.1 Background and Context to Study.....	17
1.1.1 Pharmacology in nursing.	17
1.1.2 Pharmacology knowledge and patient safety.....	18
1.1.3 Pharmacology content delivery in undergraduate nursing programs.....	20
1.1.4 UG nursing students' learning whilst attending clinical placement.	23
1.2 Aim	25
1.3 Research Questions	25
1.4 Objectives.....	26
1.5 Scope of the Study	26
1.6 Significance and Rationale	27
1.7 Outline of Thesis	28
Chapter Two - Literature Review	30
2.1 Introduction.....	30
2.2 Literature Review Search Strategy Method.....	30
2.2.1 Aim and design of literature review.....	30
2.2.2 Search methods.....	31
2.2.3 Identification and screening.....	32
2.2.4 Inclusion and exclusion criteria.....	33
2.3 Literature Review Results.....	34
2.3.1 Search outcome.....	34
2.3.2 Quality appraisal and data evaluation.....	36
2.3.3. Key publications attained.....	37
2.3.4. Synthesis of findings.....	40
2.4 Analysis of Key Publications.....	41
2.4.1 Integrated pharmacology curricula in UG nursing programs.....	41
2.4.2 Pharmacology knowledge and preparedness of the UG nursing student in a clinical context.....	48

2.5 Discussion of Key Publications.....	70
2.6 Conclusions From the Literature Review.....	72
Chapter Three - Methods	74
3.1 Introduction.....	74
3.2 Methodological Approach.....	74
3.3 Setting	75
3.4 Study Design	77
3.5 Phase One: Verified Curriculum	79
3.5.1 Document mapping.....	79
3.5.2 Unit Coordinator verification.....	79
3.5.3 Pharmacology curriculum content review (PCCR).....	80
3.5.4 Data collection and analysis.	81
3.6 Phase Two: Online Student Questionnaire.....	81
3.6.1 Development and validation of instrument	82
3.6.2 Sampling, recruitment and inclusion/exclusion criteria.....	84
3.6.3 Data collection and analysis.	85
3.7 Objectivity	88
3.8 Reliability and Validity (of Quantitative Research Component)	89
3.9 Trustworthiness (of Qualitative Research Component)	89
3.10 Ethical Considerations.....	90
3.11 Data Storage, Access and Disposal	92
Chapter Four - Results.....	94
4.1 Introduction.....	94
4.2 Phase One Results: Verified Curriculum	94
4.2.1 Document mapping.....	94
4.2.2 Unit coordinator verification.	97
4.2.3 Pharmacology curriculum content review (PCCR).....	104
4.2.4 Phase one summary.....	107
4.3 Phase Two Results: Online Student Questionnaire.....	110
4.3.1 Participant characteristics.....	110
4.3.2 Online student questionnaire findings.....	116
4.3.3 Phase two summary.	132
4.4 Summary	133
Chapter Five - Discussion	135
5.1 Introduction.....	135
5.2 Pharmacology Within an Integrated UG Nursing Curriculum.....	136

5.3 Student Expectations and Perceptions of an Integrated Pharmacology Curriculum	142
5.4 Student Readiness for Pharmacology Practice During Clinical Placement	145
5.5 A Conceptual Framework for Pharmacology Curricula in UG Nursing	152
5.6 Strengths and Limitations	157
5.7 Recommendations	159
5.7.1 Recommendations for educational practice.	159
5.7.2 Further research recommendations.	161
5.8 Conclusion.	163
References.....	165
Appendix One - JBI Standardised Critical Appraisal Tools	184
Appendix Two - Critical Assessment Using QARI (Qualitative Assessment Tool) Rankings for Included Studies	186
Appendix Three - Critical Assessment Using MASTARI (Descriptive Case Studies) Rankings for Included Studies	188
Appendix Four - Program Stream and Unit Structure in the BSc Nursing Curriculum.....	191
Appendix Five - Document Mapping and Integration Review Key Search Terms.....	192
Appendix Six - Verification of Document Mapping: Tool for Unit Coordinators	194
Appendix Seven - Existing Tools Modified and Adapted With Author Permission for Online Student Questionnaire	198
Appendix Eight - Online Student Questionnaire Expert Panel Review Checklist	208
Appendix Nine - Mapping of Online Student Questionnaire With Study Objectives and Research Questions.....	214
Appendix Ten - Online Student Questionnaire: Information Sheet and Qualtrics™ Survey Tool	215
Appendix Eleven - Researcher Candidacy Approval	223
Appendix Twelve - Curtin University Human Research Ethics Committee Approval.....	224
Appendix Thirteen - Phase Two Results Kolmogorov-Smirnov Normality Testing	225

List of Figures

<i>Figure 1.</i> Literature search strategy: PRISMA flow diagram.....	35
<i>Figure 2.</i> Structure of BSc (Nursing) curriculum at the study site.....	76
<i>Figure 3.</i> Study design: Two phases of the study.....	78
<i>Figure 4.</i> Semester three integration of pharmacology curriculum.....	105
<i>Figure 5.</i> Semester four integration of pharmacology curriculum.....	106
<i>Figure 6.</i> Semester five integration of pharmacology curriculum.....	107
<i>Figure 7.</i> Semester six integration of pharmacology curriculum.....	107
<i>Figure 8.</i> Verified curriculum diagram	109
<i>Figure 9.</i> Participant recruitment for online student questionnaire.....	111
<i>Figure 10.</i> Stages of UG nursing student awareness of their learning in pharmacology.....	149
<i>Figure 11.</i> A Conceptual framework for pharmacology curricula in UG nursing programs.....	156

List of Tables

Table 1. Key Publications Included in the Integrative Review.....	39
Table 2. Key Publications Exploring Integrated Pharmacology in UG Nursing Programs	42
Table 3. Key Publications Exploring Pharmacology Knowledge and Preparedness: Opinions of Clinicians	50
Table 4. Key Publications Exploring Pharmacology Knowledge and Preparedness: Opinions of Nursing Lecturers	56
Table 5. Key Publications Exploring Pharmacology Knowledge and Preparedness: Opinions of Nursing Students	64
Table 6. Sample Size Estimation for Online Student Questionnaire	86
Table 7. NVivo™ Document Mapping of UG Nursing Curriculum Results ...	95
Table 8. Unit Coordinator Verification of Document Mapping	98
Table 9. Characteristics of Online Student Questionnaire Participants.....	113
Table 10. Enrolment Characteristics of Online Student Questionnaire Participants	115
Table 11. Responses Related to Expectations of Integrated Pharmacology Content (Qu 13, 15, 16 Online Student Questionnaire)	117
Table 12. Self-Rating of Education Approaches to Learn Pharmacology (Qu 25 Online Student Questionnaire).....	118
Table 13. Level of Study and Perceived Current Level of Pharmacology Knowledge	118
Table 14. Level of Study and Satisfaction With Pharmacology Content Provided.....	119
Table 15. Level of Study and Mean Values for Self-Rating of Pharmacology Education Approaches.....	120
Table 16. Kruskal-Wallis One-Way ANOVA Level of Study and Self-Rated Education in Pharmacology	121
Table 17. Preparedness for Clinical Placement Relative to Integrated Pharmacology Curriculum Delivery (Qu 14, 18-23 Online Student Questionnaire)	123

Table 18. <i>Preparedness for Pharmacology Related Tasks When on Clinical Placement (Qu 24 Online Student Questionnaire)</i>	125
Table 19. <i>Reported Readiness in Pharmacology When on Clinical Placement (Qu26-27 Online Student Questionnaire)</i>	126
Table 20. <i>Level of Study and Self-Rated Readiness to Deliver Safe Medicine Care</i>	127
Table 21. <i>Kruskal-Wallis One-Way ANOVA Level of Study and Reported Readiness to Deliver Safe Medicine Care</i>	127
Table 22. <i>Level of Study and Opportunity to Further Develop Pharmacology Knowledge When on Recent Clinical Placement</i>	129
Table 23. <i>Level of Study and Value of Previous Pharmacology Experiences When on Recent Clinical Placement</i>	130
Table 24. <i>Level of Study and How Pharmacology Experiences on Recent Clinical Placement Met Expectations</i>	131
Table 25. <i>Timing of Clinical Placement and Self-Rated Preparedness for Clinical Practice in Pharmacology</i>	131
Table 26. <i>Kruskal-Wallis One-Way ANOVA Timing of Clinical Placement and Semester Six Participants' Self-Rated Preparedness for Clinical Practice in Pharmacology</i>	132

List of Abbreviations

- ACSQH: Australian Commission on Safety and Quality in Healthcare
AHPRA: Australian Health Practitioner Regulation Agency
ANMAC: Australian Nursing and Midwifery Accreditation Council
ANMC: Australian Nursing and Midwifery Council
ANOVA: One way analysis of variance
AQF: Australian Qualifications Framework
BSc: Bachelor of Science (Nursing)
CALD: Culturally and Linguistically Diverse
GEM: Graduate Entry Masters nursing students
IPFY: Interprofessional First Year
IQR: Interquartile range
JBI: Joanna Briggs Institute
LMS: Learning Management System
NHMRC: National Health and Medical Research Council
NMBA: Nursing and Midwifery Board of Australia
NSQHS: National Safety and Quality Health Service Standards
PBL: Problem based learning
PCA: Patient Care Assistant
PCCR: Pharmacology curriculum content review
RN: Registered Nurse
SD: Standard Deviation
UC: Unit Coordinator
UG: Undergraduate
VCD: Verified curriculum diagram

Glossary of Terms

The following terms are of relevance to this study:

Bioscience: The study of anatomy, physiology, immunology, biochemistry which relate to pathophysiology and pharmacology concepts linked to specific disease processes within undergraduate (UG) nursing curricula.

Clinical placement: Where UG nursing students' attend a practical experience across various clinical settings in line with their current level of study, as part of their UG Nursing program.

Competence: “The combination of skills, knowledge, attitudes, values and abilities underpinning effective and/or superior performance in a profession (from the National Competency Standards for the Registered Nurse)” (Australian Nursing and Midwifery Accreditation Council, 2012, p. 20).

Integrated pharmacology curriculum: Refers to pharmacology content intentionally addressed within several units of study within the UG nursing program (as opposed to discrete units of study in pharmacology). Includes pharmacology subject matter and pharmacology related concepts.

Pharmacology: Defined as “the study of the preparation, properties, uses and actions of drugs” (Harris, Nagy, & Vardaxis, 2014, p. 1032). The study of pharmacology usually relates to the therapeutic use of medicines, rather than recreational use.

Pharmacology curriculum content review: Conducted by the researcher, this consisted of a review of pharmacology and the extent of integration of the pharmacology subject matter and related concepts delivered across core units of study within the existing UG nursing curriculum.

Registered Nurse (RN): A qualified nurse who has undergone studies in an accredited program and is registered with the Australian Health Practitioner Regulation Agency (AHPRA) to practice in Australia.

Unit Coordinator (UC): Academic staff member/lecturer involved in the design, management and delivery of core units of study within the Bachelor of Science (Nursing) curriculum at the study site.

Undergraduate (UG) Nursing Student: Student enrolled in the undergraduate nursing curriculum bachelor degree stream at the study site.

Chapter One - Introduction

In the clinical setting, the Registered Nurses' (RN) responsibilities include the effective administration and management of medications (Ndosi & Newell, 2009; Sulosaari, Kajander, Hupli, Huupponen, & Leino-Kilpi, 2012). Key components of the nursing role include sound knowledge in pharmacology and the safe administration of medication, to reduce the risk of errors and maintain patient safety (Aitken, Manias, & Dunning, 2006; Manias & Bullock, 2002a). The Australian Commission on Safety and Quality in Healthcare (ACSQH) developed eight National Safety and Quality Health Service (NSQHS) Standards to improve quality in healthcare and provide a nationally consistent statement which underpins clinical practice. NSQHS standard four is centered around medication safety (Australian Commission on Safety and Quality in Healthcare, 2017). As a result, pharmacology is a key area of study in undergraduate (UG) nursing curricula, in order to prepare students for their clinical roles upon graduation (Cleary-Holdforth & Leufer, 2013; Krautscheid, Orton, Chorpenning, & Ryerson, 2011; Latimer, Hewitt, Stanbrough, & McAndrew, 2017).

Worldwide, significant changes have occurred in pre-registration nursing education over the past fifty years. It has seen the move from hospital based apprenticeship training to education in the tertiary setting and degree programs (Parkes, 1984). In the university setting, the delivery of pharmacology content within UG nursing curricula may take one of two forms, discrete units in pharmacology or through an integrated approach where pharmacology content is addressed within several units of study (Lim & Honey, 2006). A thorough understanding of the relationship between pathophysiology and pharmacology (which may be referred to in nursing education as "the biosciences") is integral for beginning health practitioners, and fosters the development of critical thinking and pharmacological reasoning skills (Banning, 2003). Pharmacology within UG nursing curricula delivers information to support safe medicine care. Clinical placements undertaken by nursing students throughout their UG nursing programs represent significant opportunities for consolidation of the science knowledge

(including pharmacology content) taught at university, through supervised practice and implementation of key skills in a clinical placement setting (Birks, Ralph, Cant, Chun Tie, & Hillman, 2017).

1.1 Background and Context to Study

The Australian Health Practitioner Regulation Agency (AHPRA) 2014/2015 annual report indicates that 637,218 health practitioners across fourteen professions (including nursing) are registered to practice in Australia. Data also indicate that more than 141,951 individuals are undertaking an approved clinical training program to become Health Practitioners in Australia.

Statistics from the Australian Institute of Health and Welfare indicate there are approximately 235,000 employed RN working in Australia (Australian Institute of Health and Welfare, 2014). Registrations with AHPRA indicate that RN and Midwives represent approximately fifty percent of the entire health workforce in Australia (AHPRA, 2015). Given this large proportion of nurses within the health workforce, it is evident how nurses play such a significant role in the safe administration of medications in a clinical context.

1.1.1 Pharmacology in nursing.

Pharmacology is a key area of learning across many health disciplines, including the medical, pharmacy and nursing professions (Lloyd et al., 2013). The Nursing and Midwifery Board of Australia (NMBA) and AHPRA requirements for registration mandate that a RN must successfully complete an approved program of study to be permitted to obtain, supply and administer scheduled medicines (Nursing and Midwifery Board of Australia, 2010). The Australian Nursing and Midwifery Accreditation Council (ANMAC) require that pre-registration nursing degree programs offer no less than 800 hours of professional placement experience for each student, to support their competence in the workplace required for registration (Australian Nursing and Midwifery Accreditation Council, 2012). Tertiary education providers are required by ANMAC to ensure a nursing curriculum appraises “competence in pharmacokinetics, pharmacodynamics and the quality use of medicines” (Australian Nursing and Midwifery Accreditation Council, 2012, p. 14).

Pharmacology is one aspect of nursing care and nurses provide care in complex environments within multidisciplinary teams. Graduate RN are expected to be medication competent when they commence work after completing their degree. Ives, Hodge, Bullock, and Marriott (1996) examined the actual and self-rated pharmacology knowledge of first year graduate nurses through a survey and calculations test. The study indicated that the newly registered nurses surveyed held inadequate pharmacology knowledge (Ives et al., 1996). More recent studies undertaken by Ndosi and Newell (2009) and Simonsen, Dæhlin, Johansson, and Farup (2014) have also published similar findings. Concern remains in contemporary literature, where Lim and Honey (2017) surveyed graduate nurses from one hospital site in New Zealand, finding that although graduates recognised the importance of pharmacology knowledge in the clinical setting, they also realise the need to improve their own depth of understanding of pharmacology and medication management to apply in clinical practice.

1.1.2 Pharmacology knowledge and patient safety.

Several studies have noted that the pharmacology knowledge of nurses (Boggs, Brown-Molnar, & Delapp, 1988; Ives et al., 1996; Sodha, McLaughlin, Williams, & Dhillon, 2002) and students (Bourbonnais & Caswell, 2014; Clancy, McVicar, & Bird, 2000; Courtenay, 1991; Latimer et al., 2017; Latter, Rycroft-Malone, Yerrell, & Shaw, 2000) is insufficient to meet clinical needs. A lack of pharmacology knowledge and skills in medication calculation are known to contribute to medication errors in the clinical setting (Choo, Hutchinson, & Bucknall, 2010; Dilles, Vander Stichele, Van Bortel, & Elseviers, 2011; Krautscheid et al., 2011; Vaismoradi, Jordan, Turunen, & Bondas, 2014). Of all hospital admissions in Australia, two to three percent of these are considered to be due to medication related errors (Roughead, Semple, & Rosenfeld, 2016). Medication errors in a clinical context may contribute to significant patient harm and cost to the health system and are known to involve medication prescribing, dispensing and administration phases (Whitehair, Provost, & Hurley, 2014) which can involve

the drug, route, dose, patient, time and medication omission (Latimer, Chaboyer, & Hall, 2011; Roughead et al., 2016). It is also important to be aware of other factors that may influence medication errors. These include team structure, environment, organisational culture and individual patient, student and staff factors, which demonstrates the complex nature of pharmacology nursing practice (Levett-Jones & Reid-Searl, 2018).

Students and nurses have insufficiencies in their medication competence across areas such as calculation skills (Grandell-Niemi, Hupli, Leino-Kilpi, & Puukka, 2005; McMullan, Jones, & Lea, 2010; Simonsen et al., 2014), pharmacology knowledge (Ashurst, 1993; Brady, Malone, & Fleming, 2009; Grandell-Niemi et al., 2005; Simonsen et al., 2014; Vaismoradi et al., 2014), patient medication education skills (Banning, 2004; Latter, Rycroft-Malone, Yerrell, & Shaw, 2001), and medication administration (Choo et al., 2010; Manias, 2009; Vaismoradi et al., 2014). Ongoing difficulty in the application of science and pharmacology knowledge beyond graduation means that nurses still struggle to effectively use theory to support their clinical reasoning (Clancy et al., 2000; Logan & Angel, 2011; McVicar, Andrew, & Kemble, 2014). A lack of confidence in applying this knowledge may have patient safety implications within the clinical setting (McVicar, Clancy, & Mayes, 2010).

When examining medication competence in students, previous studies have indicated that calculation error is just one factor that may contribute to medication errors (Latimer et al., 2017; Wright, 2010). Wright (2007) and Latimer et al. (2017) identified that UG nursing students require more than just mathematical proficiency to develop the pharmacology knowledge and skills associated with safe medication administration in a clinical environment. Conceptual skills and clinical reasoning were required for accuracy in drug calculations and medication management in the clinical setting. Latimer et al. (2017) published suggestions made by nursing academics in Australia to improve first year UG nursing students' awareness of medication errors and possible prevention strategies. These included scaffolding medication management learning in the curriculum to build

student confidence and providing opportunities for case based learning and simulated practice. The authors highlighted that knowledge, recognition and awareness of the factors associated with medication errors were important aspects for the prevention of medication errors in practice (Latimer et al., 2017). Learning on clinical placement provides an opportunity for students to bridge the gap between theory and clinical practice to promote quality patient care (Prowse & Heath, 2005).

1.1.3 Pharmacology content delivery in undergraduate nursing programs.

Changes in the nursing profession have seen the emergence of nurses as autonomous practitioners within an interdisciplinary healthcare team, with the nursing role requiring the ability to apply scientific knowledge to clinical practice (Casey, 1996; Clancy et al., 2000; McVicar et al., 2014). As such, these increased expectations require nursing education to be built on strong scientific foundations (Birks et al., 2017). As already noted, there are two main methods for teaching pharmacology in university nursing curricula, either traditional methods with discrete (or standalone) units of study in pharmacology, or approaches where pharmacology theory and content are integrated (or embedded) across a curriculum. With the use of either approach the emphasis needs to remain on the principles, concepts and application of pharmacological therapy, rather than simply educating students' about individual medications in isolation (Lim & Honey, 2006).

A sound basis in bioscience knowledge supports many areas of nursing practice, including pharmacology learning (Betty & Kyriacos, 2016; Fell, Dobbins, & Dee, 2016). A requisite of nursing curricula to provide sufficient education on the biosciences which supports pharmacology knowledge acquisition and application in a clinical context is well established (Andersen & Moralejo, 2016; Betty & Kyriacos, 2016; Birks, Ralph, Cant, Hillman, & Chun Tie, 2015; Clancy et al., 2000; Davis, 2010; Jordan, Davies, & Green, 1999; Molesworth & Lewitt, 2016). The need to use teaching strategies that enhance student nurse learning and the application of bioscience and

pharmacology knowledge in clinical practice has been widely reported (Davies, Murphy, & Jordan, 2000; Molesworth & Lewitt, 2016; Smales, 2010). Enabling bioscience learning presents a challenge. This has previously been referred to in the literature as the 'bioscience problem' (Jordan et al., 1999; McVicar et al., 2014) and is recognised worldwide by authors such as Friedel and Treagust (2005) in New Zealand, Craft, Hudson, Plenderleith, Wirihana, and Gordon (2013) in Australia and Andrew, McVicar, Zanganeh, and Henderson (2015) in the United Kingdom. The integration of bioscience subjects in curricula poses a challenge for lecturers (Andersen & Moralejo, 2016; Birks et al., 2015). Nursing researchers have published results showing some concerns around the difficulty in teaching complex bioscience concepts (Courtenay, 1991; Jordan et al., 1999), varying levels of student comprehension (Clancy et al., 2000; Clarke, 1995; Craft et al., 2013; Davis, 2010; Jordan et al., 1999), disproportionate allocation of hours of teaching subjects in curricula across various tertiary institutions (Davis, 2010; Taylor, Ashelford, Fell, & Goacher, 2015; Trnobrański, 1993) and the application of concepts taught to the nursing role (Banning, 2003; Clarke, 1995; Courtenay, 1991; Davies et al., 2000; Jordan et al., 1999; Manias & Bullock, 2002b; McVicar et al., 2010; Taylor et al., 2015). Additionally, nursing lecturers (including clinical instructors and preceptors) with insufficient bioscience knowledge may further add to students' inadequate understanding of the relationship between bioscience, pharmacology and clinical practice (Friedel & Treagust, 2005; McVicar et al., 2014). The challenge for nursing educators is to ensure that concepts taught are relevant and applicable to clinical practice (Fell et al., 2016; Molesworth & Lewitt, 2016) and to demonstrate unequivocal connections that link pharmacology to bioscience, and bioscience to nursing practice to expand students' knowledge and confidence (Christensen, Craft, Wirihana, & Gordon, 2015; Craft, Christensen, Bakon, & Wirihana, 2017).

In existing literature there has been significant debate around whether pharmacology is best taught as standalone or integrated subjects in UG nursing curricula (Latter, Yerrell, Rycroft-Malone, & Shaw, 2000; Manias & Bullock, 2002b; Robinson, 1987; Zellner, Boerst, & Semling, 2003). Several

nursing academics have also argued that prominence of social and behavioural sciences in UG nursing curricula has resulted in a lack of emphasis on the subjects which incorporate and support pharmacology learning (Clarke, 1995; Jordan et al., 1999; Larcombe & Dick, 2003; Trnobrański, 1993; Wynne, Brand, & Smith, 1997). This deliberation has continued for decades, where concerns around depth of content provided in nursing programs and the bioscience and pharmacology knowledge needed by nurses extends back over 40 years (Jordan et al., 1999; Manias, 2009). Literature supports the use of integrated pharmacology curricula in UG nursing programs (Bullock & Manias, 2002; Latter, Yerrell, et al., 2000; Morrison-Griffiths, Snowden, & Pirmohamed, 2002). Integrated pharmacology curriculum models are utilised in some UG nursing programs in Australia, New Zealand, the United States, the United Kingdom and Finland (Bullock & Manias, 2002; Foster, Collins, Dong, Nteff, & Pinkney, 2017; Lim & Honey, 2006; Meechan, Mason, & Catling, 2011; Sulosaari et al., 2014). However there is the potential for pharmacology content to be less visible in an integrated model than when it is provided as a separate program or discrete units of study. Whilst there are inconsistencies in the time spent in teaching pharmacology between tertiary institutions worldwide (Banning, 2003; Davis, 2010; Lloyd et al., 2013), it is recognised that UG nursing curricula design must include methods of teaching pharmacology that promote effective student learning (Manias, 2009; Zellner et al., 2003). Modern teaching methods in nursing education often integrate concepts across curricula and academics are still exploring the issue of pharmacology learning in nursing education (Lanz & Davis, 2017; Latimer et al., 2017; Lim & Honey, 2017). Debate continues around the best methods for teaching pharmacology to UG nursing students, which include blended learning, face-to-face delivery, case-based scenarios, simulation learning methods, e-learning, web technologies and flipped classroom strategies (Alton, 2016; Bata-Jones & Avery, 2004; Geist, Larimore, Rawiszer, & Al Sager, 2015; Hanson, 2016; Latimer et al., 2017; Saleem, Tabassum, & Asif, 2014). Emphasis on integrated learning experiences supports the UG nursing students to develop knowledge, skills and expertise in pharmacology that can

be transferred from theory into the clinical practice setting (Lim & Honey, 2017).

The integration of pharmacology content within nursing curricula enhances the student's ability to link theory to practice and reduces the likelihood of students focusing on separate 'silos' of knowledge, through the development of a pharmacology curricula thread (Barkhouse-Mackeen & Murphy, 2013; Lim & Honey, 2006). Tse and Lo (2008) also support this view, reporting that UG nursing students studying a web-based pharmacology course felt learning pathophysiology and pharmacology in an integrated manner better facilitated their understanding of content delivered, rather than just memorisation. The students surveyed also indicated this approach developed their critical thinking and problem solving ability. Banning (2003) identified in a United Kingdom context the need to examine how integrated pharmacology content could be best applied in an UG nursing curricula model, to develop students' critical thinking, clinical reasoning skills and improve confidence in medications management and translate this for use in the clinical setting.

1.1.4 UG nursing students' learning whilst attending clinical placement.

Clinical placement can be a daunting time for UG nursing students and adequate support and preparedness for clinical placement is vital to assist learning (Levett-Jones, Pitt, Courtney-Pratt, Harbrow, & Rossiter, 2015). Several studies examined the impact of the clinical placement experience on an UG nursing students learning in a broader sense (Chan, 2002; Nolan, 1998; Papp, Markkanen, & Von Bonsdorff, 2003). Midgley (2006) identified in a mixed methods study that UG nursing students' prefer a clinical placement learning environment that provides innovative teaching strategies with 'hands on' learning opportunities, to allow for personalisation of learning and opportunities to practice tasks in a real clinical environment. Fell et al. (2016) conducted a mixed methods study of final year UG nursing students in the United Kingdom which identified several factors that influenced the application of knowledge when on clinical placement. These included their

clinical mentor's knowledge, attitudes, level of support and enthusiasm for teaching in helping students cement their learning within the clinical placement context. Participants also indicated that they often had limited time to discuss important concepts during the course of their clinical placement such as pharmacology practice (Fell et al., 2016). Similarly, Molesworth and Lewitt (2016) conducted focus groups interviews with UG nursing students in Scotland which suggested that although students recognised the value of learning opportunities when on clinical placement, they felt these learning opportunities were limited and were under-emphasised when compared to other competing clinical activities. Participants articulated the need for structured and integrated approaches to learning both on clinical placement and in the tertiary setting. They also recognised the importance of theory to support knowledge acquisition. The study highlighted student opinions which valued the opportunity to incorporate practical examples into classroom teaching and the chance to share their clinical experiences with their peers during and after clinical placement (Molesworth & Lewitt, 2016).

Multifactorial reasons attempt to explain the difficulty UG nursing students' have in applying their pharmacology learning to clinical practice. Courtenay (1991) surveyed 140 third-year UG nursing students who indicated they found pharmacology learning difficult and felt pharmacology curriculum taught was not at the level required for clinical practice. Limited knowledge and confidence among nurse educators and clinical facilitators hinders the ability to help students apply knowledge whilst on clinical placement (Fell et al., 2016; Friedel & Treagust, 2005; Logan & Angel, 2011; McVicar et al., 2010). Pharmacology taught at university in UG nursing curriculum need to prepare students for safe and competent practice whilst undertaking their clinical placements, as well as in preparation for registration (Cleary-Holdforth & Leufer, 2013; Latimer et al., 2017; Lim & Honey, 2006; Lim & Honey, 2017). The UG nursing students' pharmacology learning can be enhanced whilst attending clinical placement, which provides the opportunity to integrate the theoretical pharmacology concepts taught at university through supported practice in a real life clinical setting.

Regardless of the mode of delivery, pharmacology knowledge is essential to the nursing role. It is clear that a scientifically grounded understanding of pharmacology supports the safe and effective use of medicines in a clinical context. However, the lack of pharmacology knowledge identified in students and nurses is of concern. Pharmacology learning in the tertiary setting needs to be supported by clinical placement learning experiences. Gaining a clearer understanding of how integrated pharmacology curricula relates to UG nursing student readiness for pharmacology practice when attending clinical placement would be of benefit.

1.2 Aim

The aim of this study was to determine the effectiveness of an integrated pharmacology curriculum in meeting student's expectations for their pharmacology learning on clinical placement.

1.3 Research Questions

The following research questions were proposed for this study:

1. How is the UG nursing curriculum structured in relation to integrated pharmacology content?
2. What are the students' expectations of the integrated pharmacology content provided in the UG nursing curriculum?
3. How prepared for clinical placement do students' feel as a result of completing units of study with integrated pharmacology curriculum?
4. Does a student's perceived readiness for clinical placement vary according to their level of study within the UG nursing program?

1.4 Objectives

The objectives of this study were as follows:

1. Map and analyse the pharmacology content delivered in the integrated pharmacology units within the various streams of the UG nursing curriculum. (Relates to research question 1)
2. Verify the pharmacology content provided in the integrated model, to confirm if/how pharmacology learning is scaffolded in the integrated model throughout the UG nursing curriculum. (Relates to research question 1)
3. Identify the students' expectations of pharmacology content provided within the integrated curriculum units. (Relates to research question 2)
4. Identify the students' perceptions of their own knowledge in relation to pharmacology content provided. (Relates to research question 3)
5. Describe the students' perceived readiness for clinical placement in relation to the pharmacology content provided across each student cohort. (Relates to research question 4)
6. Compare results obtained between student cohorts in relation to their perceived readiness for clinical placement. (Relates to research question 4)

1.5 Scope of the Study

This study has been designed to examine the students' perceptions of the pharmacology content provided in an integrated curriculum model and their resulting readiness for clinical placement. The study explored:

- What are the students' own perceptions of their pharmacology knowledge as a result of their studies in an integrated curriculum model?
- How prepared for clinical placement do they feel as a result of their integrated curriculum studies in pharmacology?
- Does this perception vary according to their level of study across the curriculum?

It is recognised that this study focused on students *perceptions* of their pharmacology knowledge, which may or may not be an accurate indicator of their *actual* pharmacology knowledge. The impact of lecturers, clinical facilitators, preceptors or other clinical mentors is not explicitly explored in this study, nor is the comparison between students' readiness for clinical placement according to curriculum delivery methods (integrated versus discrete pharmacology content delivery) or pharmacology curriculum design approaches. The study does not focus on strategies for providing an ideal clinical placement learning environment for UG nursing students. It does focus on pharmacology learning within an integrated curriculum and the students' perceived readiness for clinical placement. The literature review for this study will specifically explore the pharmacology learning needs of UG nursing students in relation to clinical placement.

1.6 Significance and Rationale

The value of pharmacology understanding within the nursing clinical role has been well established. The importance of supporting the competency required for registration is also acknowledged, but what is not known in the current literature is how to best deliver pharmacology learning within UG nursing curriculum. This study provides insight into the UG nursing students' own perceptions of their readiness for clinical placement as a result of their ongoing studies in pharmacology, within a program that adopted an integrated pharmacology curriculum model. It also provides awareness of students' perceptions of their pharmacology learning experiences in relation to their preparedness for clinical placement, and how this may be influenced by factors such as their level of study within the program and timing of clinical placement in relation to their pharmacology learning within this curriculum model.

1.7 Outline of Thesis

The Introduction (Chapter One) outlines the background and context, aim, research questions, objectives, scope, significance and rationale for this study. The literature outlining accreditation requirements for UG nursing programs, pharmacology learning needs of the student and methods for delivery of pharmacology content has been presented to demonstrate the importance of pharmacology learning to the student. With this understanding, the need for better insight into the students' perspective on their readiness for clinical placement as a result of their pharmacology studies across various levels of an UG nursing program will be of value.

Chapter Two develops the background information presented in Chapter One and outlines the specific literature relevant to this study. Research studies exploring the use of integrated pharmacology in UG nursing curriculum are presented across an international perspective, and relative to the pharmacology curriculum model used at the study site. The published opinions of clinicians, lecturers and nursing students in relation to the pharmacology knowledge required of the UG nursing student is explored, along with the need for ongoing evaluation of pharmacology curricula design to support students whilst on clinical placement.

The methodological considerations for this study are described in Chapter Three, in two sections. First, document mapping, subsequent Unit Coordinator (UC) verification and pharmacology curriculum content review (PCCR) were undertaken to generate a verified curriculum diagram in phase one of the study. Concurrently, phase two of the study was conducted using quantitative methods, which incorporated the development, validation and administration of an online questionnaire exploring students' perceptions of how effectively the integrated pharmacology content met clinical placement needs.

Chapter Four presents the results and findings of the data collected in the two phases of this study. Phase one demonstrates that an integrated pharmacology curriculum is used at the study site, and shows how this content is integrated across the curriculum. Phase two outlines students' views of studying within an integrated curriculum model, and describes the factors that influence the students' perceived readiness for clinical placement as a result of their pharmacology studies.

Chapter Five discusses the findings, strengths and limitations of the study, and explores implications of the findings for curriculum delivery and pharmacology teaching and learning. The researcher presents a framework to describe the effective use of integrated pharmacology curriculum. Recommendations for future research are made.

Chapter Two - Literature Review

2.1 Introduction

Chapter Two describes the literature pertinent to this study, and presents an integrative review that included research collected from qualitative and quantitative data. The purpose of the review was to provide insight into whether integrated pharmacology nursing curriculum adequately prepared UG nursing students for clinical placement. Firstly, the literature search strategy is outlined, followed by the method employed, results and analysis of the literature, forming an integrative review related to the study topic. Within this, research exploring the integrated and other methods of pharmacology curriculum delivery employed in UG nursing programs are presented. With a focus on the delivery of integrated pharmacology curriculum, the chapter then outlines the perceptions of clinicians, nursing lecturers and nursing students regarding the pharmacology knowledge of UG nursing students.

2.2 Literature Review Search Strategy Method

2.2.1 Aim and design of literature review.

The main aim of this study was to obtain a clearer understanding of the relationship between integrated pharmacology content delivery in UG nursing curriculum and the UG nursing students' perceived readiness for clinical placement. An initial literature review was undertaken to inform the topic for this study. A systematic review of the study topic was not possible in this instance, as defined inclusion criteria could not be applied to the eligible studies due to a lack of uniformity in the study designs in terms of the study sample size, nature of participants, study objectives, type of intervention, duration of the intervention, and types of data (Shuldhham, 2008). As a result, the review of the literature was broadened to an integrative review, to provide an examination of key research pertaining to the aim of this study, to gain insight into UG nursing student perceptions of integrated pharmacology curricula and their readiness for clinical placement.

The integrative review method summarised past literature relevant to the research topic, to provide a clearer understanding for the researcher and ultimately the reader. The inclusion of experimental and non-experimental research provided a broad understanding of the study topic, and required the use of appraisal strategies throughout the integrative review process to maintain rigor, prevent bias and develop accurate conclusions (Whittemore & Knafl, 2005). To maintain focus and boundaries for the review, the researcher set inclusion and exclusion criteria that reflected the study aims and objectives, conducted a well-defined literature search guided by PIO (Population, Intervention, Outcome), applied a data evaluation rating system to publications identified and then presented the analysis of information obtained in an integrative manner (Whittemore & Knafl, 2005). The integrative review method allowed the researcher to explore the findings of published literature across the area of integrated pharmacology curricula and analyse these in the context of UG nursing curriculum and student readiness for clinical placement from the perspective of educators, clinicians and UG nursing students.

2.2.2 Search methods.

The integrative review methodology outlined by Whittemore and Knafl (2005) was used to guide the selection of previous nursing research undertaken on the topic without imposing any limitations based on research methods, as studies within the field used different methods and comprised a range of variables. The review was based on a search of CINAHL, MEDLINE/ProQuest, MEDLINE/Ovid, PubMed, SCOPUS, Web of Science and Wiley databases to research integrated pharmacology education in UG nursing curricula, preparation for practice and the theory-practice gap. Google Scholar and Trove thesis repository searches were also undertaken. This included quantitative, qualitative and mixed methods studies on the topic that were date limited, English language full text publications with specific inclusion and exclusion criteria.

2.2.3 Identification and screening.

To direct the integrative review search, a written search protocol was developed which expressed the research problem as a PIO statement:

- **P** (Population): UG nursing students'
- **I** (Intervention): Integrated or embedded pharmacology nursing curriculum delivered
- **O** (Outcome): Students' readiness for clinical placement.

PIO: To determine whether integrated pharmacology nursing curriculum adequately prepares UG nursing students for clinical placement.

This PIO statement was utilised by the researcher to guide search terms as part of the literature search strategy (Godshall, 2010). To identify eligible studies, a thorough electronic literature search was conducted on electronic databases to identify publications on the study topic written in English between 2001 and 2018. This timeframe was selected due to the relatively recent use of integrated pharmacology curricula in nursing education. Health and Medicine specific search filters were applied. Databases to capture publications relating to integrated pharmacology curriculum in UG nursing programs were chosen. An initial search using the terms *integrated pharmacology* and *nursing* was too broad. A further Boolean search was undertaken including the term *AND* and *OR*. Truncation of search terms such as **Pharmacol** and **Curricul** was also utilised. The search was specific to UG nursing students, and used other key words of similar meaning or variations in spelling, such as integrated (or embedded or threaded) pharmacology or bioscience curriculum, nursing curriculum design (or curricula), undergraduate nursing curriculum, nursing education. The original literature search was undertaken in December 2014, then a final search undertaken in 2018 prior to thesis submission.

The search strategy deployed and keywords utilised were as follows:

- S1: Integrated pharmacology OR embedded pharmacology OR threaded pharmacology OR bioscience OR pharmacology knowledge OR pharmacological knowledge OR pharmacology skills AND
- S2: Undergraduate nursing curriculum OR nursing curricula OR curriculum design OR nursing education OR Education, nursing OR Pre-registration nursing curriculum
- S3: Student nurse OR nursing student OR nurse student OR undergraduate nurse OR pre-registration nurse OR pre-registration nursing student
- S4: experience OR readiness OR perceptions
- S5: Clinical placement OR clinical practicum OR clinical practice OR placement learning

2.2.4 Inclusion and exclusion criteria.

Inclusion and exclusion criteria were determined and applied to the search strategy. Inclusion criteria for the search were:

- peer reviewed articles discussing integrated pharmacology curricula from a clinician, lecturer or UG nursing student perspective
- articles examining integrated pharmacology curriculum teaching strategies
- empirical research articles published in peer reviewed journals exploring integrated pharmacology curriculum

Concurrently the researcher also searched for articles relating to student perceptions of their clinical placement experiences. Bibliographies of publications that provided a review of existing literature were also reviewed for other significant studies on the topic. Articles included those referring to baccalaureate, associate and diploma nursing programs. Peer reviewed articles relevant to education and training in the clinical setting focusing on the above criteria were also included. Some empirical studies exploring other factors besides teaching methods that related to pharmacology learning in

the UG nursing student (such as strategies for medication education) were also included in this review.

This literature review did not set out to identify or evaluate the effectiveness of teaching methods in pharmacology content delivery. Criteria for exclusion were:

- pertaining to medical, allied health and pharmacy curricula design
- not specific to UG nursing curricula and pharmacology learning
- sample was not UG nursing students
- conference proceedings and editorials

2.3 Literature Review Results

2.3.1 Search outcome.

Figure 1 details the database search process deployed based on a PRISMA flow diagram (Moher, Liberati, Tetzlaff, Altman, & The PRISMA group, 2009). The initial literature search was undertaken independently by the researcher, and combined the S1-S5 specified search terms and keywords previously outlined. After the removal of duplicates, relevant abstracts were retrieved and reviewed to determine if articles were of relevance to the study. If the abstract did not provide sufficient information, or there was no abstract provided, the full paper was obtained and reviewed. Relevant publications were all attained in full and saved electronically using Endnote, Version X7 as an electronic citation management tool. Additional records were also identified through the review of bibliography/reference lists from those articles identified as relevant to the field. Discussion regarding the inclusion and exclusion of publications was undertaken with study supervisors. Ultimately, fourteen publications were evaluated.

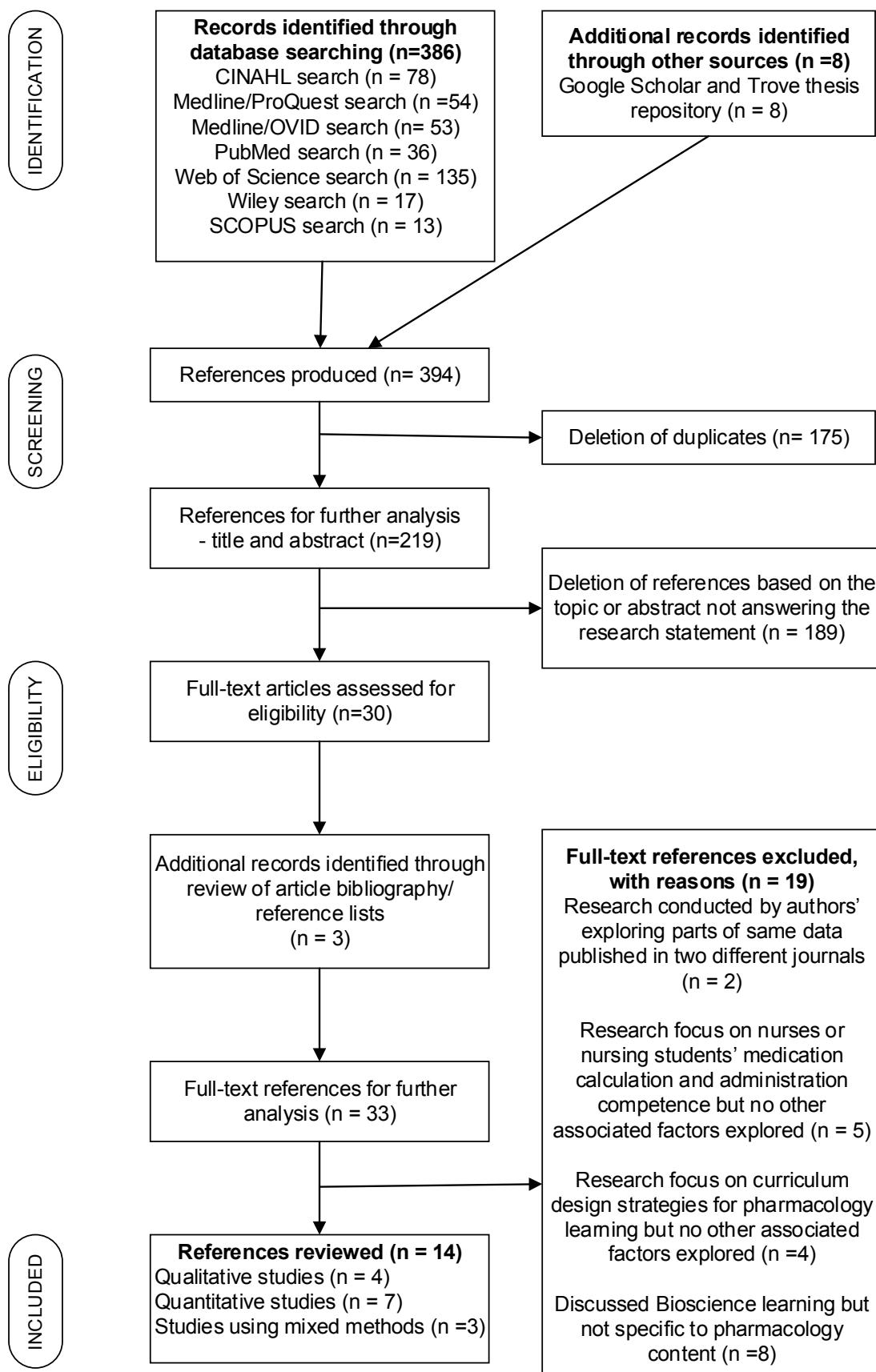


Figure 1. Literature search strategy: PRISMA flow diagram. Adapted from “PRISMA 2009 flow diagram,” by D. Moher, A. Liberati, J. Tetzlaff, and D.G. Altman and The PRISMA Group, 2009. *PLOS Medicine*, 6(7), p. 3. Copyright 2009 by PRISMA. Reprinted with permission.

2.3.2 Quality appraisal and data evaluation.

Discussion was undertaken with the two research supervisors throughout the integrative review process regarding the inclusion and exclusion of articles, categorising and data abstraction in the integrative review of the literature. The methodological quality of the fourteen publications that met the inclusion criteria were evaluated by the researcher and one of the research supervisors, independent of one another, using appropriate critical appraisal tools attained from the Joanna Briggs Institute (JBI) (The Joanna Briggs Institute, 2014). The researcher and supervisor then discussed these appraisals and reached consensus. Appendix One illustrates the standardised critical appraisal tools used to determine the quality of evidence; the JBI Qualitative Assessment and Review (QARI) data extraction form for interpretive and critical research (The Joanna Briggs Institute) to assess Honey and Lim (2008), King (2004), Manias and Bullock (2002a) and Manias and Bullock (2002b) and the Meta Analysis of Statistics Assessment Review Instrument (JBI-MASARI) for descriptive/case series studies (The Joanna Briggs Institute) was used to assess Dilles et al. (2011), Foster et al. (2017), Grandell-Niemi et al. (2005), Meechan et al. (2011), Strayer and Beitz (2010), Sulosaari et al. (2014), Zellner et al. (2003). Three studies were mixed method, Bullock and Manias (2002), Latter et al. (2001) and Morrison-Griffiths et al. (2002) so the qualitative and quantitative data reported were analysed using the appropriate JBI QARI and/or MASARI tool.

When using JBI critical appraisal tools, there are ten questions for qualitative case studies and nine questions for descriptive/case series (The Joanna Briggs Institute, 2014). An additional question for ethical considerations was added to the MASARI to ensure studies met the National Health and Medical Research Council (NHMRC) guidelines for the ethical conduct of research. The researcher and study supervisors agreed prior to the critical appraisal which were essential and non-essential criteria. Some questions were scored as not applicable, which then reduced a study's eligible total score. It was agreed that a minimum score of within two points of the eligible total score was accepted for the qualitative studies (see Appendix Two) and

the quantitative pre and post-test studies or for trials with a randomised or pseudorandomised sample (see Appendix Three). For the mixed method studies, achieving the minimum scores for both quantitative and qualitative studies were required to include the study's relevant qualitative or quantitative data in the integrative review (see Appendices Two and Three). In the case where articles did not report on the qualitative or quantitative aspects of their study, only data pertaining to the areas that met scoring criteria were analysed and reported in the literature review (Bullock & Manias, 2002; Latter et al., 2001). Once ranked, any studies that did not meet all essential criteria or the minimum required score were excluded from the integrative review. As a result, one study reported as mixed methods (Morrison-Griffiths et al., 2002) and one quantitative study (Zellner et al., 2003) were excluded from the review. Twelve studies were included in this review. Methodological weaknesses of the descriptive case studies included: no statement reporting the attainment of appropriate ethical approval (Morrison-Griffiths et al., 2002; Zellner et al., 2003), confounding factors not clearly identified (Morrison-Griffiths et al., 2002), inappropriate statistical analysis used (Morrison-Griffiths et al., 2002) and outcomes not measured reliably (Morrison-Griffiths et al., 2002). The methodological weaknesses of the excluded study that utilised qualitative methods were: no explanation of ethical approval obtained, and incongruence between the research methodology and research objectives, methods used for data collection, representation and analysis of data and the interpretation of results (Morrison-Griffiths et al., 2002).

2.3.3. Key publications attained.

The significant publications are listed in Table 1. Information detailing the country and sample size, research question, study design, method of data collection, analysis and critical findings for each paper are provided in Tables 2 - 5 within the categories and subcategories to follow. No direct comparison between integrated and discrete curriculum were found. All twelve papers included in this integrative review of the literature met the minimum score and essential criteria set by the reviewers to confirm scientific rigor. The

twelve key publications were drawn from six countries: Australia (3), Belgium (1), Finland (2), New Zealand (1), United Kingdom (3) and the United States (2). The study designs included qualitative ($n = 4$), mixed methods ($n = 2$) and quantitative ($n = 6$) approaches. The qualitative study designs used structured and semi-structured interview methods of data collection. Of the quantitative study designs, the majority utilised surveys that contained Likert rating scale questions to attain data for analysis. The twelve key publications explored respondent opinions regarding UG nursing pharmacology learning from UG nursing students ($n=5$) (Dilles et al., 2011; Foster et al., 2017; Honey & Lim, 2008; Meechan et al., 2011; Strayer & Beitz, 2010), RN ($n = 2$) (King, 2004; Manias & Bullock, 2002a), nursing lecturers ($n = 3$) (Bullock & Manias, 2002; Latter et al., 2001; Sulosaari et al., 2014), UG nursing students and lecturers ($n = 1$) (Manias & Bullock, 2002b) and UG nursing students and RN ($n = 1$) (Grandell-Niemi et al., 2005) using various methods. Three publications utilised self-assessment questionnaires in addition to test results in pharmacology to compare data (Dilles et al., 2011; Grandell-Niemi et al., 2005; Meechan et al., 2011). One publication compared the pharmacology test scores of two subgroups of UG nursing students, examining their usual blended curriculum with new integrated pharmacology curriculum delivery methods (Meechan et al., 2011). Several papers focused on sites for delivery of integrated pharmacology curriculum, which increased the complexity of comparing findings across different educational environments. The researcher also noted that the publications listed in Table 1 best aligned with the aims and objectives for this study, although no publications were found to specifically examine the PIO, UG nursing students' perspective of their integrated pharmacology learning in relation to their perceived preparedness for clinical placement.

Table 1.*Key Publications Included in the Integrative Review*

Author(s)	Year	Publication title
Bullock and Manias	2002	The educational preparation of undergraduate nursing students in pharmacology: A survey of lecturers' perceptions and experiences.
Dilles, Vander Stichele, Van Bortel and Elseviers	2011	Nursing students' pharmacological knowledge and calculation skills. Ready for practice?
Foster, Collins, Dong, Nteff and Pinkney	2017	Teaching clinical pharmacology to undergraduate nursing students: Barriers and strategies.
Grandell-Niemi, Hupli, Leino-Kilpi and Puukka	2005	Finnish nurses' and nursing students' pharmacological skills.
Honey and Lim	2008	Application of pharmacology knowledge in medication management by final year undergraduate nursing students.
King	2004	Nurses perceptions of their pharmacological education needs.
Latter, Rycroft-Malone, Yerrell and Shaw	2001	Nurses' educational preparation for a medication education role: findings from a national survey.
Manias and Bullock	2002a	The educational preparation of undergraduate nursing students in pharmacology: clinical nurses' perceptions and experiences of graduate nurses' medication knowledge.
Manias and Bullock	2002b	The educational preparation of undergraduate nursing students in pharmacology: perceptions and experiences of lecturers and students.
Meechan, Mason and Catling	2011	The impact of an integrated pharmacology and medicines management curriculum for undergraduate adult nursing students on the acquisition of applied drug/pharmacology knowledge.
Strayer and Beitz	2010	Factors influencing pharmacology knowledge acquisition in traditional versus non-traditional baccalaureate nursing students.
Sulosaari, Huupponen, Torniainen, Hupli, Puukka and Leino-Kilpi	2014	Medication education in nursing programmes in Finland: Findings from a national survey.

2.3.4. Synthesis of findings.

In undertaking the integrative review process, the researcher extracted the data of factors related to UG nursing students' studying within an integrated curricula model independently. When undertaking an integrative review, Whittemore and Knafl (2005) advocate that data is categorised and analysed, then synthesised further into main themes about the research problem. Data were extracted from the twelve key publications according to criteria relevant to this study which involved phases of data reduction, data display, data comparison, conclusion drawing and verification.

In the data reduction phase, key publications pertinent to this study were grouped into two main outcome categories to facilitate analysis, which aligned to the research questions:

1. Research surrounding integrated pharmacology curricula in UG nursing programs
2. Pharmacology knowledge and preparedness in a clinical context, with subcategories of publications exploring pharmacology learning needs from the perspectives of:
 - a) clinicians
 - b) nursing lecturers and
 - b) UG nursing students

Relevant data grouped within each of these outcome categories and subcategories were then compiled by the researcher. Information from each primary source were ordered and compared according to relevance within that outcome category or subcategory to the research aims and objectives for this study. Data were examined across the primary sources for patterns and relationships. Data displays are provided in a tabular format within each outcome category and subcategory of the integrative review to follow, which acted as a starting point for comparing and interpreting the information obtained. Whittemore and Knafl (2005) support the use of data displays and critical analysis as key components of data comparison that assist the researcher to identify precise and relevant themes in relation to the research

topic. Some overlaps in the literature in relation to the outcome categories were noted by the researcher in the key publications.

2.4 Analysis of Key Publications

The following sections examine and compare the twelve key publications listed in Table 1 in relation to the study topic according to the outcome categories and subcategories identified. Where possible the themes identified within the qualitative and quantitative papers were pooled (The Joanna Briggs Institute, 2014).

2.4.1 Integrated pharmacology curricula in UG nursing programs.

The background literature to this study has indicated the use of integrated pharmacology curricula in UG nursing programs. Following critical appraisal, three key publications outlined in Table 2 explicitly discussed key aspects in the delivery of integrated pharmacology curricula in UG nursing programs (Foster et al., 2017; Meechan et al., 2011; Strayer & Beitz, 2010). All three publications examined in this outcome category utilised quantitative methods and convenience samples of UG nursing students enrolled at their study sites, either in the United States (Foster et al., 2017; Strayer & Beitz, 2010) or the United Kingdom (Meechan et al., 2011). All studies were undertaken in the past decade. One publication specifically compared two integrated curriculum methods of pharmacology content delivery in an UG nursing student context (Meechan et al., 2011). Two publications examined influencing factors and barriers to pharmacology learning within the integrated curricula model (Foster et al., 2017; Strayer & Beitz, 2010).

Table 2. *Key Publications Exploring Integrated Pharmacology in UG Nursing Programs*

Author, year of publication and title	Country and sample size	Research question	Design, method of data collection and method of data analysis	Synopsis of critical findings relevant to pharmacology learning and readiness for clinical placement of the UG nursing student
Foster, Collins, Dong, Nteff and Pinkney (2017) Teaching clinical pharmacology to undergraduate nursing students: Barriers and strategies	United States Convenience sample of 3 cohorts of UG nursing students ($n = 55$) from 1 university site	To discuss perceived barriers and strategies for teaching clinical pharmacology to UG nursing students and compare findings to student evaluation responses.	Quantitative design Descriptive, Comparative cross-sectional design examined data from nursing faculty ($n = 5$) and student evaluations from past 5 years to compare perceived barriers and strategies. Authors then developed an online questionnaire to assess UG nursing student responses around these identified barriers and strategies using Likert scale questions. Analysis of online student survey undertaken with t-tests and one way analyses of variance against barriers and teaching strategies (previously identified in the faculty consultation).	Four barriers to learning pharmacology identified by faculty were: content saturation, course placement, English as a 2 nd language and teaching resources. Four strategies identified were: lectures, teaching by drug class, reviewing pathophysiology and use of case studies. Faculty agreed the threading of pharmacology content throughout curriculum increased student knowledge in medications and their management. UG nursing student responses to the online survey indicated teaching resources were less of a barrier than content saturation. Respondents were more likely to agree that teaching by drug class was a more effective teaching strategy than case studies. Students who had English as a 2 nd language were more likely to report student characteristics as a barrier to learning pharmacology than those whose primary language was English. They were also more likely to see lectures as an effective teaching strategy for pharmacology. Students with previous clinical experience were more likely than others to see

Author, year of publication and title	Country and sample size	Research question	Design, method of data collection and method of data analysis	Synopsis of critical findings relevant to pharmacology learning and readiness for clinical placement of the UG nursing student
Meechan, Mason & Catling (2011) The impact of an integrated pharmacology and medicines management curriculum for undergraduate adult nursing students on the acquisition of applied drug/pharmacology knowledge.	United Kingdom Compared 2 groups of UG nursing students from one site – randomly assigned N=120 students to control group (usual blended curriculum) or intervention group (new integrated pharmacology curriculum). Convenience sample.	To investigate the efficacy of a 14 month integrated pharmacology and medicines management curriculum for UG nursing students on the acquisition of applied drug/pharmacology knowledge	Quantitative – comparative design Collected data using 69 item short answer questionnaire Pharmacology Assessment Tool (PAT) relating to a patient scenario (vignette). Students also asked to self-rate their knowledge using Self-Assessment rating Score (SARS) four point Likert scale. Results of SARS compared with group mean scores for the PAT. Statistical Package for Social Sciences (SPSS®) used to analyse data.	reviewing pathophysiology as beneficial to helping them to learn pharmacology. United States context – examined teaching at one site only, limits generalisability. Small convenience sample. Did not specifically examine UG nursing student perceptions of their readiness for clinical placement. Students in the intervention group demonstrated superior pharmacokinetic knowledge and were more able to apply drug knowledge to patient vignettes than the control group. Students in the control group self-rated their pharmacology knowledge higher than the intervention group. UK context – sound data collection methods and analysis undertaken. Data obtained from one site. Longitudinal data would be useful. Did not specifically examine UG nursing student perceptions of their readiness for clinical placement.

Author, year of publication and title	Country and sample size	Research question	Design, method of data collection and method of data analysis	Synopsis of critical findings relevant to pharmacology learning and readiness for clinical placement of the UG nursing student
Strayer and Beitz (2010) Factors influencing pharmacology knowledge acquisition in traditional versus non-traditional baccalaureate nursing students.	United States UG nursing students enrolled at study site (n = 100)	Analysed the nature and strength of the relationship between the selected independent academic and non-academic variables and final pharmacology course averages in UG nursing students.	Quantitative design Comparative descriptive design using Kolb's learning style inventory. Statistical Package for Social Sciences (SPSS®) used to analyse the data.	Findings suggested that non-academic factors such as family responsibilities significantly affect academic success. Sound data collection and analysis used. Good sample size. Limited generalisability as only assessed one group of students from one site. Looked at curriculum content outcomes, but did not specifically examine UG nursing student perceptions of their readiness for clinical placement.

In a comparative descriptive study in the United States, Strayer and Beitz (2010) assessed the strength of the relationship between several independent academic and non-academic variables and the impact these may have on the pharmacology marks of UG nursing students enrolled in an UG nursing program containing pharmacology. Their findings indicated that several non-academic (personal) factors such as family responsibilities played a role in a student's academic success in acquiring pharmacology knowledge. The study highlighted that the non-traditional group of students (which was composed of part-time enrolled, older, mature age, entry level students) had statistically significant inverse correlations with their pharmacology marks. This suggested that non-academic responsibilities are significantly linked to low academic performance in pharmacology (Strayer & Beitz, 2010). The researchers recognised the role non-academic variables may have played in student learning, and suggested further study exploring the environmental factors that may impact on pharmacology learning success and further investigation of potential strategies to minimise their impact on academic success of UG nursing students (Strayer & Beitz, 2010).

Foster et al. (2017) conducted a comparative descriptive study (also in the United States) exploring potential barriers to teaching clinical pharmacology within UG nursing curriculum. The study site utilised an integrated approach to teaching pharmacology content alongside its existing pharmacology course. Perceived barriers to teaching pharmacology identified through faculty consultation included content saturation within the course, the placement of pharmacology learning, English as a second language among students enrolled and teaching resources used. Faculty members also identified four key teaching strategies to help overcome these barriers which included pharmacology lectures, teaching by drug class, reviewing pathophysiology to aid pharmacology knowledge acquisition, and using case studies to promote critical thinking and clinical decision making. Student opinions of these barriers and strategies were examined through administration of an online student questionnaire, with differences found according to students' English language proficiency and prior experience in healthcare. Responses to the online student survey indicated that teaching

resources were viewed as less of a barrier than pharmacology content saturation within the course. This finding may reflect that students felt overwhelmed by the amount of content provided in the integrated approach, reporting the pharmacology content provided was substantial. Students surveyed were also more likely to agree that learning by drug class was more effective than the use of case studies, which is somewhat contradictory to the structure of integrated pharmacology curricula which prevents 'silo' learning. Students with English as a second language acknowledged that individual student characteristics had an influence on their pharmacology learning. Respondents with English as a second language were also found to be more likely to view lectures as an effective teaching strategy (Foster et al., 2017). Another key finding of the study showed that UG students with prior healthcare experience were more likely than others to recognise that reviewing and linking pathophysiology helped them to learn pharmacology. Faculty members also supported the threading of pharmacology concepts throughout the curriculum to better enhance students' pharmacology knowledge and application in practice. These study findings support the need for well-structured and scaffolded, relevant pharmacology content in UG nursing curricula. Awareness of the potential barriers to pharmacology learning and strategies for teaching pharmacology may guide nursing educators in the development of effective integrated pharmacology curricula.

The efficacy of integrated pharmacology curriculum and medication management from a student perspective was examined in the United Kingdom context in a comparative design study conducted by Meechan et al. (2011). The authors compared two groups of UG nursing students. The first (control) group were exposed to their usual curriculum containing pharmacology, which included periods of clinical placement supported by pharmacology lectures, a workbook and clinical placement assessment learning outcomes. The second (intervention) group undertook a new integrated pharmacology and medicines management curriculum. Students' knowledge was assessed using their responses to a short answer questionnaire about a clinical scenario, an online test exploring principles of pharmacokinetics and a self-assessment rating score using a four point

Likert scale. The study results indicated that students who were exposed to the new integrated approach to pharmacology curriculum delivery demonstrated a higher level of pharmacokinetic knowledge and were able to more successfully apply drug knowledge to the clinical scenario provided than the control group (Meechan et al., 2011). The findings of this study indicated that the introduction of key pharmacology concepts early in UG nursing curriculum and their continued alignment throughout curriculum can improve the UG nursing students' application of pharmacology knowledge to patient conditions. This approach is likely to improve students' pharmacology knowledge prior to graduation and will help to promote effective medication management into the clinical environment (Meechan et al., 2011).

Category summary.

In summary, this outcome category captures published data exploring factors related to the use of integrated pharmacology curricula in UG nursing programs. There was an identified use of integrated pharmacology curricula models in UG nursing programs. There is insufficient published data exploring integrative pharmacology curriculum use in UG nursing programs to allow for direct comparisons and sufficient analysis. The key publications discussed here from the United Kingdom and United States are supportive of the delivery of pharmacology concepts within this integrated curricula model. However, only one of these publications specifically compared integrated curriculum methods of pharmacology content delivery in an UG nursing student context (Meechan et al., 2011). This limits conclusions that may be drawn from this integrative review within this category. None of the studies were particularly rigorous, large multi-centre, student focused studies, and as such current published literature indicated pharmacology curricula are built on scant evidence. All publications did however highlight the need for accountability and consistency in pharmacology teaching across UG nursing programs. The mapping and demonstration of where pharmacology content was delivered within an integrated model supports awareness of pharmacology content within curricula.

2.4.2 Pharmacology knowledge and preparedness of the UG nursing student in a clinical context.

Ten key publications examined the association between pharmacology knowledge and ability of UG nursing students' in a clinical context. Literature in the area of pharmacology in UG nursing curricula focused on the perceptions and preparedness in pharmacology knowledge from the point of view of clinicians, which included new graduates, RN and nurse managers (Grandell-Niemi et al., 2005; King, 2004; Manias & Bullock, 2002a); nursing academics (Bullock & Manias, 2002; Latter et al., 2001; Manias & Bullock, 2002b; Sulosaari et al., 2014) and nursing students (Dilles et al., 2011; Grandell-Niemi et al., 2005; Honey & Lim, 2008; Manias & Bullock, 2002b; Meechan et al., 2011). The researcher noted that considerable attention was placed on the preparation of nurses for prescribing rights and the medication education role, with less emphasis on research supporting the UG nursing student gaining a sound basis of pharmacology knowledge to underpin their clinical placement experiences and subsequent clinical learning opportunities (Latter, Yerrell, et al., 2000; Manias & Bullock, 2002a).

Opinions of clinicians.

The ability of trained nurses to meet their responsibilities in relation to their level of pharmacology knowledge and medication administration has been assessed by several authors over the past decade and is not a new issue within nursing education (Manias & Bullock, 2002a; Meechan et al., 2011). There have been some concerns identified previously over the lack of bioscience teaching, in particular pharmacology, which occurs in nursing curricula since the move towards tertiary education for nurses (Andersen & Moralejo, 2016; Birks et al., 2015; Clancy et al., 2000; Davis, 2010; Jordan et al., 1999; Molesworth & Lewitt, 2016). There is limited research exploring the perceptions and experiences of clinical nurses' regarding UG nursing students' pharmacology needs. Table 3 outlines the three studies that explored the opinions of clinicians regarding the preparedness of UG nursing students based on their pharmacology knowledge (Grandell-Niemi et al., 2005; King, 2004; Manias & Bullock, 2002a). Two studies utilised qualitative methods which incorporated focus group discussion and semi-structured

interviews to identify common themes (King, 2004; Manias & Bullock, 2002a). One study used a quantitative evaluative approach to elicit data (Grandell-Niemi et al., 2005).

Table 3. *Key Publications Exploring Pharmacology Knowledge and Preparedness: Opinions of Clinicians*

Author, year of publication and title	Country and sample size	Research question	Design, method of data collection and method of data analysis	Synopsis of critical findings relevant to pharmacology learning and readiness for clinical placement of the UG nursing student
Grandell-Niemi, Hupli, Leino-Kilpi & Puukka (2005) Finnish nurses' and nursing students' pharmacological skills.	Finland UG nursing students (n = 282) RN (n = 364) from 7 hospital sites and 5 polytechnics providing nursing education across Finland	To investigate self-rated and actual pharmacological skills of RN and graduating nursing students in Finland, to determine how pharmacological skills are related to background factors; to identify differences between nurses and students and to examine how the Medication Calculation Skills Test works	Quantitative design Evaluative study design using the Medication Calculation Skills Test (with self-rating questionnaire) to collect data for study. SAS for Windows 8.2 software used to analyse data.	Nurses and students have some deficiencies in their pharmacological skills. The Nurses displayed better pharmacological skills than UG nursing students according to both self-rating and actual performance on the MCS test. Good sample sizes obtained. Didn't determine how pharmacology skills are related to background factors. Finland context – did not specifically examine curricula structure or delivery methods used across each sites that may have impacted on results. Did not specifically examine UG nursing student perceptions of their readiness for clinical placement.
King (2004) Nurses perceptions of their pharmacological education needs.	United Kingdom Purposive sample of RN (n = 10) from 1 site	To explore nurses' pharmacology education needs by identifying nursing roles that require pharmacology knowledge, and nurses' preparation for practice from preregistration pharmacology education.	Qualitative design Semi structured interview were transcribed and categorised to identify common themes and categories using the constant comparison method.	Findings highlighted limited understanding in pharmacology, dissatisfaction with the teaching of pharmacology and resulting anxiety upon qualifying. Nursing roles identified to need pharmacology knowledge including drug administration, patient assessment, nurse prescribing, and patient medication education.

Author, year of publication and title	Country and sample size	Research question	Design, method of data collection and method of data analysis	Synopsis of critical findings relevant to pharmacology learning and readiness for clinical placement of the UG nursing student
Manias and Bullock (2002a) The educational preparation of undergraduate nursing students in pharmacology: clinical nurses' perceptions and experiences of graduate nurses' medication knowledge	Australia Interviewed clinical nurses ($n = 38$) from 2 metropolitan and 2 regional hospitals in Victoria.	Clinical nurses' opinions regarding their perceptions and experiences of graduates pharmacology knowledge and whether this prepares them for practice as a newly graduated nurse.	Qualitative design Focus groups interviewing method used. 6 focus group discussions conducted. Framework method of data analysis – common themes identified	United Kingdom context - Small sample size, involving only 1 site. Did not specifically examine UG nursing student perceptions of their readiness for clinical placement. 4 main themes identified: overall lack of depth of pharmacology knowledge in graduates, unstructured approach to their ongoing learning needs, pharmacology knowledge perceived to be important to practice, improvements for nursing education needs UG nursing students to take greater responsibility in monitoring and administering medications and the need for more structured learning experiences.

findings. Did not specifically examine UG nursing student perceptions of their readiness for clinical placement.

In exploring the clinicians' viewpoint, Manias and Bullock (2002a) identified in an Australian context that four key themes impacted the UG nursing students' preparation in pharmacology. These themes were: UG nursing students' pharmacology knowledge base, continuing education in pharmacology, perceived areas of importance for clinical practice and improvements required in UG pharmacology education. Findings of their study indicated that graduate RN were perceived overall to lack depth in their knowledge of pharmacology concepts. Gaps in their knowledge were identified relating to medication family groups, ability to read medication order charts and comprehension of common pharmacology terminology. The clinical nurses also identified that this deficit in pharmacology knowledge was not just confined to UG nursing students and new graduates, as they acknowledged that all nurses experienced difficulty applying pharmacology knowledge in clinical practice. It was also reported that newly qualified RN experienced an unstructured approach to their ongoing pharmacology education upon graduation, which meant that knowledge deficits were unlikely to be easily resolved in the clinical practice setting. However it was identified that the new graduates saw the relevance of their pharmacology learning to clinical practice, and suggested the need to consider the delivery of structured pharmacology learning experiences in the clinical environment (Manias & Bullock, 2002a).

Using a qualitative approach in the United Kingdom, King (2004) similarly explored RN perceptions of their own pharmacology educational needs in a clinical context. Findings reflected those of Manias and Bullock (2002a), suggesting that nurses often identified themselves as having a limited understanding of pharmacology and were correspondingly dissatisfied with the teaching they received through their UG pharmacology studies, which resulted in anxiety upon qualifying. The study also supported the findings of Manias and Bullock (2002a) where pharmacology knowledge and competence pertaining to medication administration, patient assessment, nurse prescribing and patient education regarding medicines were valued. King (2004) concluded nurses recognised that pharmacology knowledge is important for practice, and that improvements to pharmacology teaching may

further enhance nurses' confidence in their pharmacology related duties in the clinical environment.

Grandell-Niemi et al. (2005) investigated the self-rated and actual pharmacological skills of qualified RN compared to UG nursing students in Finland across seven hospital sites as a quantitative study. Participants completed a Medication Calculation Skills Test which tested pharmacology and mathematical knowledge. These test results were compared to respondents self-rated responses about their pharmacology and mathematical skills. The study indicated that whilst the qualified RN demonstrated better pharmacological skills than UG nursing students according to their results in the medication calculation skills test and their self-rated knowledge, they still showed some deficits in their pharmacological skills. Across both qualified RN and UG nursing students, knowledge of dosage forms, routes of administration, notes for prescription and information on medicine packages were best known, followed by terminology and common pharmacology abbreviations. Both groups self-rated their knowledge of pharmacokinetics and pharmacodynamics lowest. Findings further support the need for ongoing knowledge development and skill reinforcement to assist pharmacology learning in a clinical context.

Subcategory summary.

This subcategory captured the opinions of clinicians regarding students' and nurses' pharmacology knowledge and preparedness in a clinical context. The key publications consistently identified concerns that clinicians hold regarding the pharmacology knowledge of nurses from an UG level and following registration. Findings supported the need to address pharmacology knowledge and preparedness of the UG nursing student throughout their continuum of pharmacology learning, to better support their pharmacology role in a clinical context upon graduation.

Opinions of nursing lecturers.

Four studies exploring the opinions of nurse lecturers around UG nursing students' preparedness in pharmacology are outlined in Table 4 (Bullock & Manias, 2002; Latter et al., 2001; Manias & Bullock, 2002b; Sulosaari et al., 2014). A variety of data collection methods including questionnaire (Bullock & Manias, 2002; Latter et al., 2001; Sulosaari et al., 2014) and focus group discussions (Manias & Bullock, 2002b) were used in these studies to explore the opinions of nursing lecturers regarding UG nursing students' pharmacology learning.

Table 4. Key Publications Exploring Pharmacology Knowledge and Preparedness: Opinions of Nursing Lecturers

Author, year of publication and title	Country and sample size	Research question	Design, method of data collection and method of data analysis	Synopsis of critical findings relevant to pharmacology learning and readiness for clinical placement of the UG nursing student
Bullock & Manias (2002) The educational preparation of undergraduate nursing students in pharmacology: A survey of lecturers' perceptions and experiences.	Australia Purposive sample of University lecturers ($n = 23$) across 12 of the 13 university campuses in Victoria involved in UG nursing education.	This study was conducted as part of a larger project in Victoria (looking at UG nursing student, clinical nurses and lecturer perceptions). Focused on information sought from academic staff only about the delivery of pharmacology education to undergraduate nursing students.	Mixed methods (quantitative and qualitative) design for questionnaire (modified from NAME survey instrument used in Latter et al. study in the UK) Open-ended question responses were subjected to content analysis where words, phrases and sentences were grouped into categories. Statistical Package for Social Sciences (SPSS®) used to analyse the data.	Great variation between institutions in the number of hours devoted to pharmacology and when offered. A number of respondents indicated dissatisfaction with the preparation of graduates and their knowledge base in pharmacology. Recommend review of curriculum. Australian context – restricted to one geographical state with low response rate of 34%. Small sample size for quantitative component design. Comprehensive analysis of curriculum content not conducted. Does not specifically explore UG nursing student readiness for clinical placement.

Author, year of publication and title	Country and sample size	Research question	Design, method of data collection and method of data analysis	Synopsis of critical findings relevant to pharmacology learning and readiness for clinical placement of the UG nursing student
Latter, Rycroft-Malone, Yerrell & Shaw (2001) Nurses' educational preparation for a medication education role: findings from a national survey.	United Kingdom A postal questionnaire was distributed to identified individuals within 51 education institutions in England (n = 204)	To provide a national overview of curriculum design and delivery factors related to pharmacology knowledge and communication and education skills within pre- and post-registration programmes.	Mixed methods design Two Part questionnaire developed using 5 point Likert scales and open ended questions Statistical Package for Social Sciences (SPSS®) used to analyse quantitative data and content analysis conducted for qualitative data.	Confirmed majority use integrated curricula in teaching pharmacology content; respondents were dissatisfied with insufficient curricular time devoted to pharmacology; the importance of lecturers' ability to apply theory to practice; a lack of clarity concerning pharmacology learning outcomes applied to medication education; and respondents' perceptions that opportunities for integrating pharmacology knowledge, patient education and communication skills were available within practice settings. United Kingdom context - wide representation across the country in national survey. Sound methods used. Did not specifically examine perceptions of UG nursing students' in relation to readiness for clinical placement.

Author, year of publication and title	Country and sample size	Research question	Design, method of data collection and method of data analysis	Synopsis of critical findings relevant to pharmacology learning and readiness for clinical placement of the UG nursing student
Manias & Bullock (2002b) The educational preparation of undergraduate nursing students in pharmacology: perceptions and experiences of lecturers and students.	Australia 14 focus group interviews at 10 university settings (regional and metropolitan) in Victoria – academic staff (n=7); UG nursing students (n=7).	To describe strategies used to teach pharmacology (lecturers), strategies used to learn pharmacology (students). To explore perceptions of relationship between pharmacology and clinical practice and describe desired attributes of a pharmacology program.	Qualitative design Focus group interviewing method used. Framework method of data analysis – common themes identified	Four common themes identified: Teaching considerations, Learning considerations, Relationship between knowledge and clinical practice, Features of an ideal program in pharmacology. Identified conflict between teachers and students over value placed on a separate subject versus integrated pharmacology program. Still much scope for educational initiatives to improve students' knowledge concerned with pharmacology and medication management. Australian context – sound data collection methods and analysis undertaken. Limited generalisability due to qualitative design and small sample size. Did not specifically examine UG nursing student perceptions of their readiness for clinical placement.

Author, year of publication and title	Country and sample size	Research question	Design, method of data collection and method of data analysis	Synopsis of critical findings relevant to pharmacology learning and readiness for clinical placement of the UG nursing student
Sulosaari et al (2014) Medication education in nursing programmes in Finland: Findings from a national survey.	Finland Sampled program managers (n = 22) and teachers involved in medication education (n = 136) across Finland	Describes current medication education in Finland by exploring curriculum content, teaching and evaluation methods.	Quantitative design Two electronic surveys conducted using Likert scales - one targeted programme managers responsible for curriculum; other targeted teachers involved with medication education. Statistical Package for Social Sciences (SPSS®) used to analyse the data.	Identified that whilst teaching is comprehensive, amount of medication education varied between schools, with under emphasis on theoretical basis of medication care. Wide sample population across all nursing schools in Finland – good representation and generalisability. Did not specifically relate to perceptions of UG nursing student readiness for clinical placement as a result of their pharmacology studies.

Latter et al. (2001) conducted a national survey involving lecturers across 51 education institutions across the United Kingdom. The study explored the preparation provided to nurses for their role in patient education regarding medications, through use of a postal survey. This formed part of a larger national survey funded by the English National Board for Nursing, Midwifery and Health Visiting, utilising the Nursing and Medication Education (NAME) postal questionnaire as the data collection tool. Although of relevance, this study was set in the context of the nurse prescribers, rather than that of the UG nursing student. The study also confirmed that the majority of education providers delivered an integrated curricula approach when teaching pharmacology. In relation to medication education, there was a perceived lack of clarity regarding learning outcomes in pharmacology. The majority of lecturers surveyed also indicated their dissatisfaction with the time devoted to pharmacology teaching in the curricula and identified that factors such as the lecturers' ability to demonstrate the application of theory to practice was crucial to successful learning outcomes. The study also reflected lecturers views that clinical placements offered much needed opportunities for UG nursing students to integrate their pharmacology knowledge, communication skills and patient education (Latter et al., 2001). Whilst academics reported that pharmacology content lacked attention within UG nursing curricula, the need of this content was recognised (Manias & Bullock, 2002b).

The national study of Sulosaari et al. (2014) explored the medication education provided in UG nursing programs across Finland through a cross sectional survey design using two questionnaires targeting program managers and nursing lecturers. The data obtained confirmed that although comprehensive teaching in pharmacology was provided across institutions, the actual amount of medication education varied between schools and tended to underemphasise pharmacology theory. The study also highlighted challenges in clearly identifying where pharmacology content sat within the integrated pharmacology curriculum models employed, and suggested collaboration between educational institutions to share their understandings of the pharmacology content emphasised in curricula. As a result, the study identified lecturer concerns and the need to further develop medication

education using contemporary and evidence based methods. Ongoing collaboration between tertiary nursing education providers and clinical placement providers is emphasised to ensure UG nursing students are well equipped for their medication administration roles within the clinical environment (Sulosaari et al., 2014).

A qualitative study design undertaken by Bullock and Manias (2002) in Australia examined the expectations and perceptions of lecturers about teaching and learning pharmacology in undergraduate nursing programs across thirteen university campuses across the state of Victoria. The results indicated some dissatisfaction amongst lecturers in the pharmacological knowledge base of graduates. The study echoed the findings of Latter et al. (2001) and predated Sulosaari et al. (2014) findings by identifying inconsistencies in the time spent teaching pharmacology between institutions and location of pharmacology content within integrated curricula. This study was based on six focus groups, each comprising of between four and twelve participants. It formed part of larger study by the researchers which also explored perceptions and experiences of clinicians, lecturers and students (Manias & Bullock, 2002a, 2002b). The study findings supported current literature in the need to improve undergraduate nursing students' knowledge of pharmacology and medication management. The authors recommended further review of the integration of pharmacology curricula within UG nursing programs, to ensure sufficient linkage between theory and practical pharmacology content to reflect the learning needs of UG nursing students in a clinical context (Bullock & Manias, 2002).

Manias and Bullock (2002b) also described both the lecturer and student perceptions of strategies used to teach and learn pharmacology. Qualitative focus group interviews of 43 students and 16 lecturers concurrently across ten university settings (regional and metropolitan) were conducted in Australia. The interviews identified four common themes in pharmacology education, being teaching considerations; learning considerations; the relationship between pharmacology knowledge and clinical practice; and features of an 'ideal' program in pharmacology. Within these themes, some

conflicting views between lecturers were identified in relation to the balance of pharmacology content needed within curricula. However the majority of lecturers valued the place of integrated pharmacology curricula within UG nursing programs to address pharmacology content throughout entire UG nursing programs and support links to clinical placement learning. The authors concluded there is still ongoing scope to explore effective teaching strategies to improve pharmacology knowledge in UG nursing students (Manias & Bullock, 2002b).

Subcategory summary.

This subcategory captured the opinions of nursing lecturers regarding student pharmacology knowledge and preparedness in a clinical context. The key publications outlined concerns regarding the time allocated to teaching pharmacology, the ability to map the level of integration of pharmacology content within curricula and the ability of UG nursing students to link their pharmacology learning to medication processes within the clinical environment. The commonality across these studies highlighted the need for comprehensive, relevant and well integrated pharmacology content for UG nursing students that can be applied in a clinical context.

Opinions of nursing students.

In examining the literature on the topic, current research concerning the students' own perceptions of their readiness for clinical placement as a result of their pharmacology studies is lacking. Research in the area of UG nursing students' pharmacology learning itself is scarce, and the particular needs of UG nursing students in nurturing their understanding of pharmacology concepts, and their ability to apply pharmacology knowledge in clinical practice were infrequently explored in the literature.

Table 5 outlines the five studies exploring the UG nursing students' perspective of their pharmacology learning, although these were not specific to integrated pharmacology curricula nor students' corresponding perceptions of their pharmacological learning needs during clinical placement

(Dilles et al., 2011; Grandell-Niemi et al., 2005; Honey & Lim, 2008; Manias & Bullock, 2002b; Meechan et al., 2011). A variety of quantitative (Dilles et al., 2011; Grandell-Niemi et al., 2005; Meechan et al., 2011) and qualitative (Honey & Lim, 2008; Manias & Bullock, 2002b) methods were employed across these studies.

Table 5. *Key Publications Exploring Pharmacology Knowledge and Preparedness: Opinions of Nursing Students*

Author, year of publication and title	Country and sample size	Research question	Design, method of data collection and method of data analysis	Synopsis of critical findings relevant to pharmacology learning and readiness for clinical placement of the UG nursing student
Dilles, Vander Stichele, Van Bortel & Elseviers (2011) Nursing students' pharmacological knowledge and calculation skills. Ready for practice?	Belgium Evaluated responses from 29 UG nursing schools in Belgium, to examine pharmacology curricula delivered. UG nursing students (n=613) responded.	To evaluate graduating students' pharmacological knowledge and calculation skills and describe their self-rated readiness to safe medication care in practice. Additionally, describes some characteristics of pharmacology in nurse education in Flanders, Belgium.	Quantitative design Cross sectional survey of UG nursing students enrolled across 29 schools in Belgium. Schools asked to provide information about the pharmacology aspects delivered in curriculum, then tested graduating students in their school using the Medication Knowledge and Calculations test, and to assess students' self-rated readiness to safe medication care. SPSS® used to analyse data.	Just before graduation, nursing students' pharmacological knowledge and calculation skills are limited. Apart from the test results, students did not perceive themselves able to deliver safe medication care in practice. Confirmed use of integrated pharmacology curricula across some sites, with variations in time spent teaching pharmacology. European context – Belgium, good data collection methods and sample size. Did not specifically examine UG nursing student perceptions of their readiness for clinical placement.

Author, year of publication and title	Country and sample size	Research question	Design, method of data collection and method of data analysis	Synopsis of critical findings relevant to pharmacology learning and readiness for clinical placement of the UG nursing student
Grandell-Niemi, Hupli, Leino-Kilpi & Puukka (2005) Finnish nurses' and nursing students' pharmacological skills.	Finland UG nursing students (n = 282) RN (n = 364) from 7 hospital sites and 5 polytechnics providing nursing education across Finland	To investigate self-rated and actual pharmacological skills of RN and graduating nursing students in Finland, to determine how pharmacological skills are related to background factors; to identify differences between nurses and students and to examine how the Medication Calculation Skills Test works	Quantitative design Evaluative study design using the Medication Calculation Skills Test (with self- rating questionnaire) to collect data for study. SAS for Windows 8.2 software used to analyse data.	Nurses and students had some deficiencies in their pharmacological skills. Nurses had better pharmacological skills than UG nursing students according to both self-rating and actual performance on the MCS test. Good sample sizes obtained. Didn't determine how pharmacology skills are related to background factors. Finland context – did not specifically examine curricula structure or delivery methods used across each sites that may have impacted on results. Did not specifically examine UG nursing student perceptions of their readiness for clinical placement.
Honey and Lim (2008) Application of pharmacology knowledge in medication management by final year undergraduate nursing students.	New Zealand Class of UG nursing students (n = 54) at 1 university site that uses an integrated approach to pharmacology education (response rate 90%)	To explore final year undergraduate nursing student's perception of clinical practice situations where they applied, or were not able to apply, their pharmacology knowledge in medication management.	Qualitative descriptive study. Survey contained 2 open ended questions. Content analysis undertaken to identify categories and themes.	Lack of opportunities and preceptor direction in the clinical context are still barriers to fuller integration and consolidation of pharmacology knowledge. Students' perception of lack of pharmacology knowledge and the need for more knowledge as it applies to medication management remains an area for concern. New Zealand context – One class at one university site surveyed, limited

Author, year of publication and title	Country and sample size	Research question	Design, method of data collection and method of data analysis	Synopsis of critical findings relevant to pharmacology learning and readiness for clinical placement of the UG nursing student
Manias & Bullock (2002b) The educational preparation of undergraduate nursing students in pharmacology: perceptions and experiences of lecturers and students.	Australia 14 focus group interviews at 10 university settings (regional and metropolitan) in Victoria – academic staff (n=7); UG nursing students (n=7).	To describe strategies used to teach pharmacology (lecturers), strategies used to learn pharmacology (students). To explore perceptions of relationship between pharmacology and clinical practice and describe desired attributes of a pharmacology program.	Qualitative design Focus group interviewing method used. Framework method of data analysis – common themes identified	generalisability of results, but good sample size for qualitative methods used. Sound data collection methods and analysis. Four common themes identified: Teaching considerations, Learning considerations, Relationship between knowledge and clinical practice, Features of an ideal program in pharmacology. Identified conflict between teachers and students over value placed on a separate subject versus integrated pharmacology program. Still much scope for educational initiatives to improve students' knowledge concerned with pharmacology and medication management. Australian context – sound data collection methods and analysis undertaken. Limited generalisability due to qualitative design and small sample size. Did not specifically examine UG nursing student perceptions of their readiness for clinical placement.

Author, year of publication and title	Country and sample size	Research question	Design, method of data collection and method of data analysis	Synopsis of critical findings relevant to pharmacology learning and readiness for clinical placement of the UG nursing student
Meechan, Mason & Catling (2011) The impact of an integrated pharmacology and medicines management curriculum for undergraduate adult nursing students on the acquisition of applied drug/pharmacology knowledge.	United Kingdom Compared two groups of UG nursing students from one site – randomly assigned N=120 students to control group (usual curriculum) or intervention group (new integrated pharmacology curriculum). Convenience sample.	To investigate the efficacy of a 14 month integrated pharmacology and medicines management curriculum for UG nursing students on the acquisition of applied drug/pharmacology knowledge	Quantitative – comparative design Collected data using 69 item short answer questionnaire Pharmacology Assessment Tool (PAT) relating to a patient scenario (vignette). Students also asked to self-rate their knowledge using Self-Assessment rating Score (SARS) four point Likert scale. Results of SARS compared with group mean scores for the PAT. Statistical Package for Social Sciences (SPSS®) used to analyse data.	Students in the intervention group demonstrated superior pharmacokinetic knowledge and were more able to apply drug knowledge to patient vignettes than the control group. Students in the control group self-rated their pharmacology knowledge higher than the intervention group. UK context – sound data collection methods and analysis undertaken. Data obtained from one site. Longitudinal data would be useful. Did not specifically examine UG nursing student perceptions of their readiness for clinical placement.

Manias and Bullock (2002b) identified some conflicting opinions between UG nursing students and lecturers interviewed. These included the value placed on standalone versus integrated pharmacology curriculum delivery, and the balance of pharmacology teaching within curriculum. Although both lecturers and students recognised that pharmacology principles should be addressed throughout the entire curriculum, students felt that pharmacology was best taught as a standalone subject. Some lecturers also recognised the benefits of teaching pharmacology as a separate subject, although the majority agreed that pharmacology content is best integrated within nursing subjects to support the application of knowledge within a clinical context. UG nursing students interviewed expressed difficulty in linking theory to practice, due to a perceived lack of congruence between the pharmacology content provided in the university setting and the actual use of medications whilst in the clinical setting. The students' data identified the need to understand the theory behind the pharmacology, rather than just using ritualistic and automated clinical practices that are not underpinned by theoretical evidence. The study demonstrated consensus between UG nursing students and lecturers regarding the importance of developing and maintaining connections between pharmacology theory and clinical practice (Manias & Bullock, 2002b).

Meechan et al. (2011) utilised a self-assessment rating score as part of their study into UG nursing students' performance in either their usual pharmacology curriculum (control group) or a new integrated pharmacology curriculum (intervention group). Interestingly, the researchers found that students in the control group self-rated their pharmacology knowledge higher than those students undertaking the new integrated pharmacology curriculum, although their test results indicated that the new integrated curriculum students performed better and demonstrated a higher knowledge compared to the other control curriculum group (Meechan et al., 2011). This supports previous findings of Manias and Bullock (2002b) which suggested UG nursing students self-rate their pharmacology knowledge higher than what is demonstrated through more objective assessment.

Grandell-Niemi et al. (2005) found that UG nursing students enjoyed studying pharmacology, but did not find it easy. On the whole, students did not perform well on the pharmacology test administered, which highlighted their inadequate pharmacology knowledge. Similar results are reported in other studies (Dilles et al., 2011; Grandell-Niemi et al., 2005; Manias & Bullock, 2002b; Meechan et al., 2011). Grandell-Niemi et al. (2005) found that UG nursing students self-rated abilities in pharmacology correlated significantly with their actual skill level in pharmacology according to the test scores achieved. The evaluation of graduating nursing student's pharmacological knowledge and medication calculation skills have also been examined in Belgium using a Medication Knowledge and Calculation test and self-rated readiness for safe medication care tool by Dilles et al. (2011). Results from the self-rated readiness tool indicated that students did not perceive themselves to be able to safely administer medication in the clinical setting, although the study did not explore what factors may have contributed to this, nor how prepared for clinical placement the students felt. The student responses and test scores raised concerns about graduating nursing students' pharmacology knowledge being sufficient to support medication safety. The authors recommended being aware of newly graduated nurses' potential limitations in their pharmacology knowledge and its application to prevent patient harm in a clinical context (Dilles et al., 2011). However the study undertaken by Bullock and Manias (2002) previously explored in this review has highlighted that nursing lecturers contradicted the view that the majority of students' pharmacology learning occurred whilst attending clinical placement. Lecturers' supported the stance that clinical placements were not the only opportunity for students to integrate pharmacology theory with practice or gain medication knowledge (Bullock & Manias, 2002) .

Honey and Lim (2008) conducted a qualitative descriptive study in New Zealand, identifying that 85% of final semester UG nursing students surveyed acknowledged using their pharmacology learning whilst on clinical placement. An integrated pharmacology curriculum was delivered at the study site, and the study surveyed final semester UG nursing students as part of their program evaluation following their final clinical placement. The

study also identified that UG nursing students' reported a lack of confidence when utilising their pharmacological knowledge. Two factors identified by the UG nursing students surveyed that contributed to this were academic preparation and a lack of confidence in the retention and application of their pharmacology knowledge. A key finding indicated that a lack of opportunity to practice pharmacology, along with preceptor guidance and direction whilst on clinical placement were perceived barriers to integrating and consolidating their pharmacology learning. The findings supported previous studies identifying perceived difficulty in the subject (Grandell-Niemi et al., 2005; King, 2004; Manias & Bullock, 2002b) and limited time in class devoted to pharmacology teaching (King, 2004; Latter et al., 2001; Manias & Bullock, 2002a, 2002b), and the necessity for improved links between classroom theory and students' clinical placement experiences (Honey & Lim, 2008).

Subcategory summary.

This subcategory captured the opinions of nursing students of their pharmacology knowledge and preparedness in a clinical context. Although various quantitative and qualitative methods were used, the key publications highlighted overall concerns that UG nursing students' have of their own pharmacology learning and their ability to apply pharmacology knowledge to the clinical environment. Strategies to address the students' identified lack of knowledge, confidence, integration of their pharmacology learning and application within a clinical context are needed in UG nursing curricula.

2.5 Discussion of Key Publications

This review grouped and evaluated studies investigating integrated pharmacology in nursing curricula from the point of view of clinicians, lecturers and nursing students. It has highlighted factors that may impact on UG nursing students' pharmacology learning and their perceptions of readiness in pharmacology that are needed in a clinical context. Review findings show a scarcity of research related specifically to integrated pharmacology curricula in UG nursing programs across national and international literature. Previous research has concentrated on the biological

sciences in a general context, but have not explicitly examined the pharmacology learning of the UG nursing student in great detail (Foster et al., 2017; Sulosaari et al., 2014). Further research focusing on UG nursing student learning of pharmacology within an integrated curricula model is needed. Analysis of the key publications illustrate the lack of empirical data to understand the pharmacology learning experiences of UG nursing students in relation to clinical placement. Of the reviewed articles, the use of qualitative methods to examine perceptions of students, clinicians and lecturers has limited the generalisability of findings due to sample size and the limited scope of small geographical context areas. The studies that employed mixed methods or quantitative approaches with larger sample sizes aided transferability and generalisability of the research results in this area, and provide valuable insights into the UG nursing students' perspective of their pharmacology learning. Combining findings from these methodologies in this integrative review has highlighted how they complement one another in providing a composed overview of published literature pertinent to the study topic.

Broad themes were used in this integrative review, although it is possible that there are studies that were not captured under these themes. As publications employing differing methodologies were combined under the chosen categories and subcategories, it gave a broader perspective on UG nursing students' pharmacology learning needs from several viewpoints. Whilst frameworks are established in curricula design to ensure pharmacology learning needs are met for registration, it is important for lecturers to explore the students' perspective of their pharmacology learning in preparing them for clinical placement whilst progressing through their studies. Exploring this perspective is as high a priority as examining the students' acquisition of knowledge to support clinical competency and practice, since the foundations for students' pharmacology learning are established during their time at university and when on clinical placement. An understanding of the student perspective will assist educators and clinicians to support students for continued, lifelong learning in pharmacology as they progress through their careers as RN.

This integrative review of the literature has explored the opinions of lecturers and clinical staff in their perception of new graduates' pharmacology knowledge. The student perspective has been viewed from an international context, where the vast majority of studies examined the topic in relation to medication competence, rather than the students' perceived readiness for clinical placement in an Australian context (Manias & Bullock, 2002a, 2002b). This limits the conclusions that can be made of the UG nursing student perspective of their readiness for clinical placement. Despite this focus, the findings supported the importance of exploring UG nursing students' readiness for clinical placement with respect to their pharmacology learning. This review has highlighted the critical importance of exploring the current research-gap in the literature of the students' perspective of their learning in relation to integrated pharmacology curriculum, and the relationship between their pharmacology knowledge and perceived readiness for clinical placement. Key papers by Bullock and Manias (2002), Dilles et al. (2011) and Meechan et al. (2011) were of considerable value, as they ranked highly on MASTARI critical appraisal and used validated tools which could be replicated.

2.6 Conclusions From the Literature Review

In relation to the aim and objectives of this study, this integrative review has intended to evaluate the evidence concerning integrated pharmacology content within undergraduate nursing curricula. The review has been unable to determine conclusively whether integrated pharmacology curriculum adequately prepared UG nursing students for clinical placement. Within its acknowledged limitations, the integrative review has illustrated the paucity and lack of focus in the literature on UG nursing students' perceptions of their readiness for clinical placement as a result of their pharmacology studies within an integrated curricula model.

The effectiveness of integrated pharmacology curricula has not been well established in existing literature. At present, few studies have specifically explored the pharmacology education needs of UG nursing students in

preparation for clinical placement. Previous studies have surveyed the perceptions' of UG nursing students, graduates, clinicians and lecturers in relation to pharmacology or bioscience learning, and found that insufficient time may be allocated to pharmacology learning within curricula. However these studies have not investigated the UG nursing students' perceived readiness for clinical placement as a result of their pharmacology studies in an integrated curriculum model.

The integrated approach to pharmacology content delivery requires further evaluation in relation to the preparedness of nursing students for clinical placement throughout their studies. Also lacking is the UG students' own perceptions of their readiness for clinical placement in relation to their existing pharmacology knowledge. Future research and practice is needed to focus attention on the UG nursing student experiences in pharmacology whilst on clinical placement, to support their attainment of the pharmacology knowledge needed for graduation, registration and ultimately safe clinical practice. As such, the existing published literature does not explicitly answer the research question posed by this study, to assess the effectiveness of an integrated pharmacology curriculum in meeting student expectations for their pharmacology learning on clinical placement.

Chapter Three - Methods

3.1 Introduction

This chapter details the methods employed in this study to achieve the research aims and objectives. First, the methodological approach is explained, including the study design and the development of instruments for use in the study, along with the sequence of each phase of data collection employed. The chapter includes explanation of the sample, setting, inclusion/exclusion criteria and the methods undertaken for data analysis. Finally, the approach utilised to ensure the study was ethically founded is addressed.

3.2 Methodological Approach

Research paradigms are belief systems or theories that help guide researchers making decisions about how to undertake research (Sansnee, 2011). Depending on the qualitative, quantitative or mixed methods nature of the research, common paradigms relevant in nursing research include critical social theory, constructivist, interpretive, positivist, postpositivist, and pragmatism (Weaver & Olson, 2006).

The positivist paradigm encompasses the understanding that objectivity is the basis of truth and is commonly associated with quantitative research designs (Polit & Beck, 2014). This is where data is collected through objective means to examine 'cause and effect' relationships, such as through surveys and quantitative analysis (Polit & Beck, 2014). Positivism was relevant to this study in examining the nursing students' perceptions of their readiness for clinical placement as a result of their studies in pharmacology within the integrated curriculum model. The literature review demonstrated that previously undertaken qualitative studies (Bullock & Manias, 2002; Honey & Lim, 2008; King, 2004; Manias & Bullock, 2002a, 2002b) have examined opinions using smaller sample sizes. What is not evident in the literature is studies involving larger cohorts to establish student opinions and perceptions of integrated pharmacology curriculum.

Pragmatism as a research paradigm advocates the use of mixed methods in research to emphasise the truth of what works behind the research questions being investigated (Teddlie and Tashakkori, 2009). Pragmatism is often utilised in mixed methods research as “it rejects the either-or choice from the constructivism-positivism debate” and “embraces superordinate ideas ... from both sides of the paradigm debate in interaction with the research question and real-world circumstances (Teddlie & Tashakkori, 2009, p. 73).

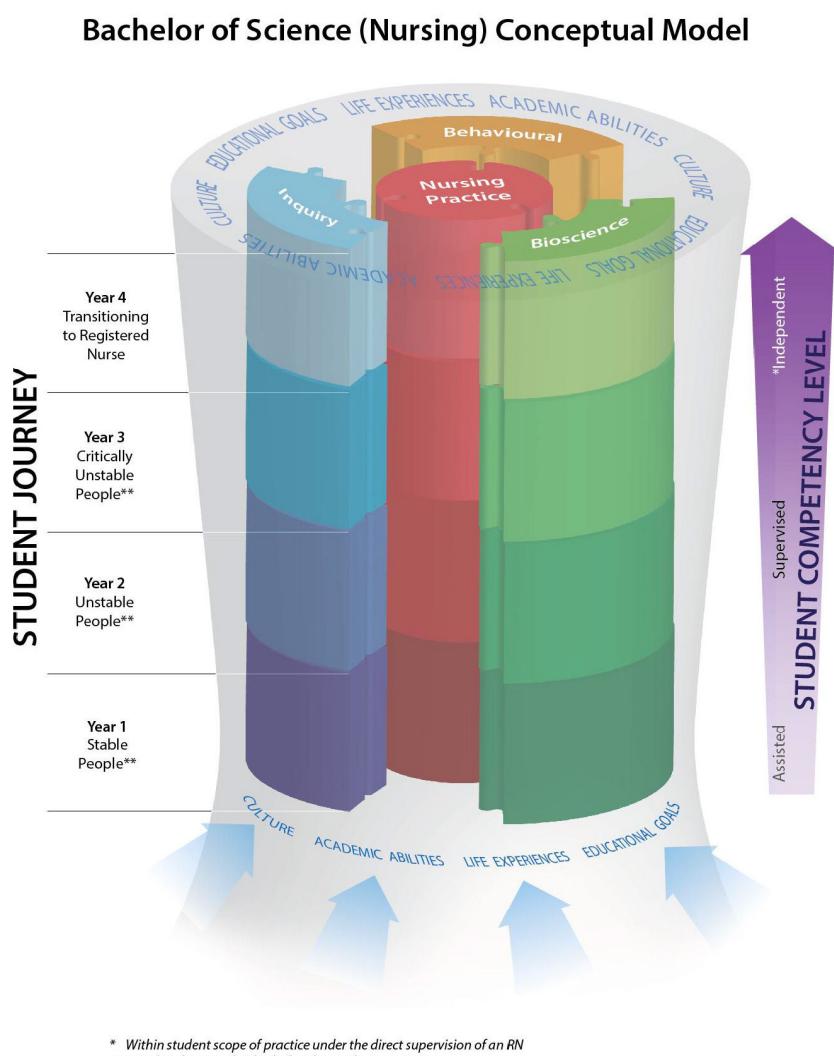
Pragmatism was relevant to this study in examining the structure of the integrated pharmacology curriculum at the study site (a qualitative approach) alongside student expectations of pharmacology content provided, perceptions of their own knowledge in relation to pharmacology content provided and their corresponding perceived readiness for clinical placement (a quantitative approach).

Through evaluation of qualitative and quantitative methods and instruments (Bullock & Manias, 2002; Dilles et al., 2011; Meechan et al., 2011) used in previous studies related to this research topic and included in the review of the literature, it was apparent that a mixed methods design with an emphasis on the quantitative component of data collected would achieve the study aims and objectives. Mixed methods research often utilise specific notation where capitalisation indicates the priority given to one research orientation (quantitative or qualitative) over another (e.g., Quan, Qual, QUAN, QUAL). A plus sign (+) is used to indicate simultaneously designed studies, as opposed to the use of an arrow (→) for sequential data collection (Teddlie and Tashakkori, 2009). In applying this notation, the methodological approach for this study is represented as a Qual+QUAN study, using a concurrent mixed methods approach with emphasis on the quantitative component of data collection.

3.3 Setting

The study site is Curtin University, a tertiary education facility providing UG nursing curriculum to students in Perth, Western Australia. It holds accreditation to deliver the Bachelor of Science (BSc) Nursing program as

per The Australian Nursing and Midwifery Accreditation Council (ANMAC) accreditation requirements until mid-2020. This curriculum reviewed at the time of this study used an integrated approach to curriculum design. It was organised as a matrix across four broad themes of study and four stages of the student journey clustered on a semester structure and developing patient acuity. Figure 2 displays the structure of the UG nursing curriculum at the study site across four main streams of study; Behavioural, bioscience, inquiry and nursing practice. This framework illustrates the horizontal and vertical integration of the UG nursing curriculum.



*Figure 2. Structure of BSc (Nursing) curriculum at the study site. Reprinted from *Curtin University, School of Nursing Midwifery and Paramedicine*, 2015. Copyright 2015 by Curtin University. Reprinted with permission.*

Four applied bioscience units and seven nursing practice stream core units were delivered in the UG nursing curriculum. Some of these units were also undertaken by Undergraduate Midwifery, RN conversion and Graduate Entry Masters (GEM) students during the course of their studies. Some faculty taught units are undertaken in the Interprofessional First Year (IPFY) of study by UG Health Science students enrolled across nursing, medicine, occupational therapy, paramedicine, pharmacy, physiotherapy, psychology and social work degrees. Each calendar year of the study, the UG nursing program were delivered in Western Australia at the Bentley, Albany and Geraldton campus sites. For an UG nursing student enrolled in full-time study, the BSc UG nursing curriculum is delivered across seven semesters, over a three and a half year period. Clinical placement learning opportunities are provided within the nursing practice stream core units of study throughout the curriculum.

3.4 Study Design

The study involved two phases, as shown in Figure 3:

1. Phase One - Verified curriculum: This involved document mapping, subsequent Unit Coordinator (UC) verification and pharmacology curriculum content review (PCCR) of the data obtained, to demonstrate the pharmacology delivered within the UG nursing curriculum at the study site. Curriculum documents (unit outlines and syllabus learning outcomes) were reviewed to map where pharmacology subject matter and pharmacology related concepts were scaffolded in core units of study within the UG nursing program. An information sheet completed by respective UC confirmed the accuracy of findings of the document mapping and PCCR. This process was undertaken to provide a verified curriculum diagram for integrated pharmacology content and structure.
2. Phase Two - Online student questionnaire: The questionnaire was adapted, modified and consolidated using existing published measurement tools with the authors' permission, then validated by an expert panel of six researchers. The online student questionnaire was

delivered to UG nursing students' enrolled across four semesters of enrolment at the study site following relevant Ethics committee approval. The questionnaire explored students' perceptions of how effectively integrated pharmacology content met clinical placement needs.

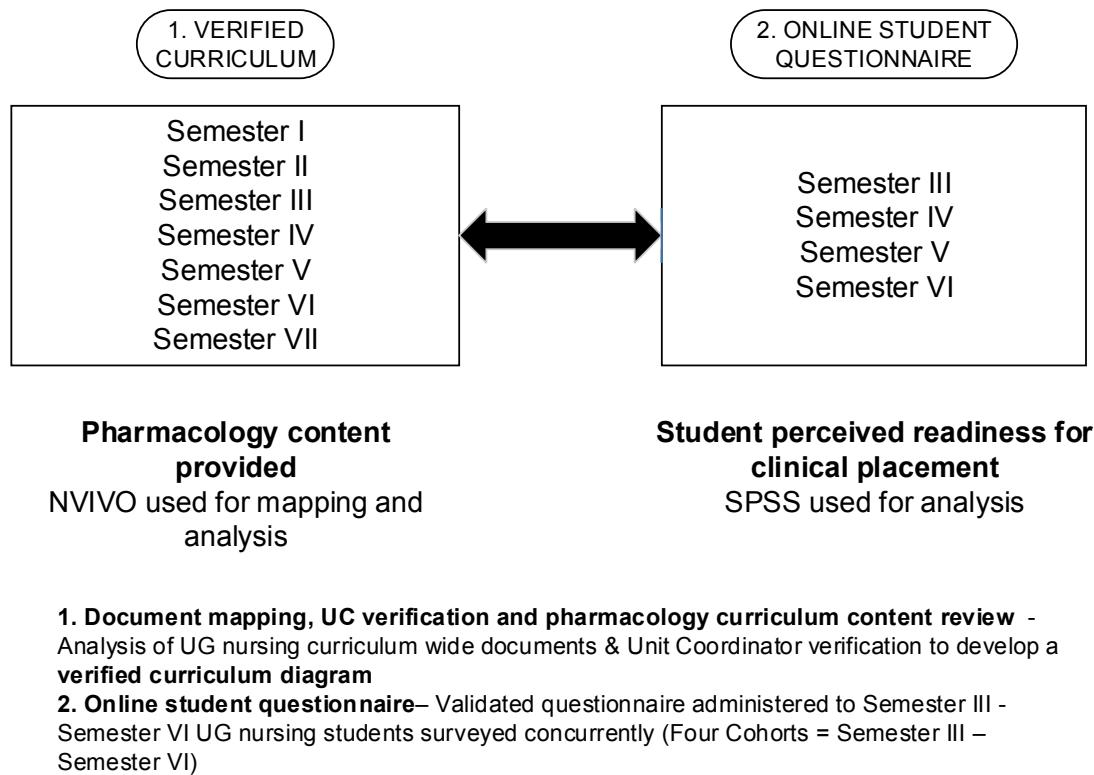


Figure 3. Study design: Two phases of the study.

A quantitative, non-experimental, cross-sectional, descriptive study was undertaken using the validated questionnaire. The quantitative questionnaire was administered online using the University Learning Management System (LMS), Blackboard™ Learn software, Version 9.1 Copyright © 2015 Blackboard Inc. (Blackboard, 2015). The descriptive nature of the study allowed the researcher to see the current situation, which was useful when reviewing curriculum design and structure, and could inform any possible areas of future change or improvement (Büttner, 2015). Data collection for each phase of the study (verified curriculum and online student questionnaire) were undertaken concurrently from April to June, 2015.

3.5 Phase One: Verified Curriculum

The verified curriculum for pharmacology included document mapping, subsequent UC verification and PCCR across the UG nursing curriculum. This allowed the researcher to develop a diagram to demonstrate where pharmacology subject matter and pharmacology related concepts sit and assess the level of vertical and horizontal integration of content provided.

3.5.1 Document mapping.

Appendix Four illustrates the 27 core units of study delivered across the UG nursing curriculum. All UG nursing students' enrolled must successfully complete these core units in order to be awarded the UG nursing degree. The document mapping was undertaken across all (27) core units. Unit outlines and syllabus outcomes were examined. A thesaurus of common terminology relating to pharmacology were identified by the researcher and applied in the search. Appendix Five outlines the thesaurus search terms used in this process, which when identified in the documents, were grouped and classified into either main themes (pharmacology subject matter) or subthemes (pharmacology related concepts).

3.5.2 Unit Coordinator verification.

All lecturers who held the role of UC for the 27 core units in the UG nursing curriculum were invited to participate in the document verification process for phase one of the study. There were no exclusion criteria within this group of participants. Some of the lecturers were the UC for more than one unit of study in the UG nursing curriculum provided. The UC verification was to confirm the document mapping obtained by the researcher accurately reflected the pharmacology subject matter or pharmacology related concepts delivered across each unit of study. The researcher sent the results of the document mapping for each core unit to the respective UC, along with an accompanying verification tool to complete. Appendix Six outlines the tool developed by the researcher, which was reviewed by study supervisors prior to use. The verification tool was provided to the UC, to determine if the findings of the document mapping were an accurate reflection of each core

unit's pharmacology subject matter and/or pharmacology related concepts. This also gave the UC the opportunity to provide feedback and further comment regarding the pharmacology identified in their respective unit(s) with the researcher.

Findings for each core unit of study obtained in the document mapping were sent via email to each UC. This allowed them to review the data obtained and respond in their own time. The use of participant validation (UC as participants) or peer review/debrief were useful methods to independently confirm the results obtained in the study (Plichta & Kelvin, 2013). This verification process safeguarded against researcher bias and improved the study rigor.

The researcher recorded and verified the information obtained from the UC, to develop the diagram, indicating where pharmacology learning was integrated and scaffolded throughout the curriculum. Further clarification with the UC was sought by the researcher where required. This process verified if the document mapping conducted was sound, and if it accurately reflected where pharmacology subject matter and pharmacology related concepts were integrated in the UG nursing curriculum.

3.5.3 Pharmacology curriculum content review (PCCR).

The PCCR consisted of a further review of the unit outlines and syllabus outcomes undertaken by the researcher. This examined the main themes (pharmacology subject matter) and sub themes (pharmacology related concepts) identified in the UG nursing curriculum through the document mapping process. It allowed the researcher to further identify the nature of the integrated pharmacology subject matter and/or pharmacology related concepts, and examine how these were addressed and linked horizontally and vertically within the UG nursing program.

3.5.4 Data collection and analysis.

Collation and examination of unit outlines and syllabus learning outcomes in relation to pharmacology and pharmacotherapeutic content was undertaken across all core units delivered in the UG nursing curriculum at the study site. Unit outlines and syllabus learning outcomes for core units offered in semesters one through seven of the UG nursing curriculum were analysed. NVivo™ 10 for Windows qualitative data analysis software was utilised to support the document mapping of the pharmacology delivered and analysis of curriculum documents across the UG nursing curriculum (NVivo, 2012). NVivo™ 10 for Windows software was chosen as a document management tool to add rigor to the study and allowed for the coding and identification of themes and subthemes in the curriculum documents mapped and analysed (NVivo, 2012). This allowed the researcher to identify any gaps or overlaps in pharmacology subject matter and pharmacology related concepts provided within the core units of study, and verified where pharmacology was provided in the integrated curriculum model.

A Thank you message was sent to UC for their involvement in the study at the conclusion of the data collection. Invitations were also sent to the UC group involved to view a presentation held by the researcher, which shared the raw data results of the verified curriculum and online student questionnaire conducted.

3.6 Phase Two: Online Student Questionnaire

The online student questionnaire surveyed UG nursing students enrolled in the BSc Nursing degree at the study site across four semesters of study using a quantitative approach. This enabled the researcher to collect data regarding students' perceptions of their studies within an integrated pharmacology curriculum model and assess how effectively this met their pharmacology learning on clinical placement.

3.6.1 Development and validation of instrument.

Existing tools used in three key expert publications eliciting the students' perception of pharmacology knowledge were deemed relevant to the aims and objectives of this study. Published measurement tools that were adapted, modified and consolidated for the online student questionnaire were:

- The Nursing and Pharmacology Education (NPE) Questionnaire for Undergraduate Nursing programs (Bullock & Manias, 2002)
- The Self-Assessment Rating Score (SARS) (Meechan et al., 2011) and
- The Medication Knowledge and Calculation test Self-rated Readiness to Safe Medication Care (Dilles et al., 2011).

Approval was requested and granted from each of these authors to adapt and utilise their existing research tools for this study (Appendix Seven). A copy of the final tool was provided to the original authors prior to use. The student questionnaire was also validated by an expert panel of six researchers prior to use, using a tool modified by the researcher to meet the study needs, as illustrated in Appendix Eight. The expert panel included the two study supervisors, two quantitative researchers from within the Faculty of Health Sciences, one qualitative researcher from within Faculty of Health Sciences, and one external site panel member who is an expert in the field of study (integrated pharmacology). This validated the student questionnaire for face validity, content validity and internal consistency prior to data gathering (Plichta & Kelvin, 2013). All feedback was returned to the researcher by the 20th March 2015, and suggested amendments and revisions were made to the questionnaire based on feedback provided. These included minor typographical errors, syntax and some minor amendments to sentence structure. Additional explanatory information was also added to the questionnaire information sheet. The revised student questionnaire was then re-appraised and tested by the researcher and study supervisors, where no additional suggestions for amendments were made. A trial online questionnaire was developed and completed via the researcher and two study supervisors prior to use, to identify and eliminate any potential errors in

formatting of the online questionnaire prior to data collection. Responses obtained in this testing process were discarded and not included in data collection.

The online student questionnaire was mapped to ensure it met the study objectives and research questions, as outlined in Appendix Nine. The online student questionnaire used to obtain data for this phase of the study is attached as Appendix Ten. The final online student questionnaire administered for the study consisted of 27 questions taking approximately 15-20 minutes for participants to complete. It was kept short for ease of completion and online modality chosen for ease of participant use and familiarity. Online surveying is increasingly used in the tertiary setting to attain student feedback and unit/program evaluations. Advantages include being environmentally friendly, fast, cost effective and bypassing some of the time intensive requirements of paper based data collection, including data entry and administration (Duffy, 2002). Online surveying also avoids the need to administer surveys during valuable class time, and provides flexibility for students to complete surveys at a time convenient to their needs. However in general, online surveys are less likely to obtain higher response rates than paper based or face-to-face methods, so additional practices to promote and boost response rates are often employed (Dommeyer, Baum, Hanna, & Chapman, 2004; Nulty, 2008). The study site regularly utilises online surveying to gain feedback and unit evaluations from enrolled students. The researcher did not force responses to questions. Questions 1-12 collected data from participants regarding demographics and enrolment characteristics. This allowed the researcher to explore the extent to which any biographical variables may have contributed to participant responses. Questions 13-27 utilised dichotomous (yes/no) questions, four point Likert scales and ten or eleven point visual analogue scales to assess students' perceptions about their pharmacology learning experiences and readiness for clinical placement.

3.6.2 Sampling, recruitment and inclusion/exclusion criteria.

A non-probability purposive sample was used to recruit participants for the online student questionnaire. This ensured the sampled group was representative of the population of UG nursing students enrolled at the study site. Dommeyer et al. (2004) advocates that online student questionnaires should include several elements; assuring students that their responses will be de-identified and that their final results will not be adversely affected by their feedback, providing students access via an online link and with a notification confirming survey completion, and allowing at least a fortnight for students to respond, typically towards the end of semester. Keeping questionnaires brief, providing frequent reminders and incentives/rewards, involving academics, and extending the duration a survey is available for completion are some additional strategies often employed to maximize response rates from students (Nulty, 2008). Aside from providing incentives/rewards for completion of the online questionnaire and extending the survey duration, the strategies suggested above were undertaken by the researcher during this phase of the study.

For data gathering purposes, participants were surveyed during Weeks 8-15 of semester one 2015 of the academic calendar. All UG nursing students enrolled in the relevant core stream integrated pharmacology units (semesters three to six students) were invited to complete the student questionnaire. There had not been any significant changes in curriculum during the time of students progressing through their studies that impacted results or warranted conducting a longitudinal study in this case. Graduate Entry Masters (GEM), UG Midwifery and Enrolled Nurse (EN) to RN conversion students were excluded from the study, as they did not complete all integrated pharmacology units of study within their program curriculum. Geraldton & Albany campus students were also excluded from the study cohort, as these campuses were in the process of phasing out their UG nursing program at the time of questionnaire implementation, and as a result were not offering all units of study. Nursing students undertaking units of study through external enrolment were also excluded from the study, as not

all core units of study are available externally, including the nursing practice stream units and some of the bioscience and inquiry stream units.

3.6.3 Data collection and analysis.

The student questionnaire was administered in an online format using Qualtrics™ research platform, Version April, 2015 Copyright © 2015 Qualtrics™ via the University LMS, Blackboard™ Learn, Version 9.1 Copyright © 2015 Blackboard Inc. (Blackboard, 2015) This platform was familiar to participants and regularly utilised to deliver online student surveys. A copy of the information sheet was provided online to all potential study participants. The information sheet was also distributed in hard copy form at lecture and tutorial sessions, online via LMS Blackboard™ (Blackboard, 2015), via email and other opportunities where the UG nursing students were gathered together (in class).

A sample estimate was made by the researcher based on the following considerations to approximate the response rate required to accurately reflect the views obtained as representative of UG nursing students.

Required response rates for online surveys are calculated taking into account several factors, such as total number of potential respondents and if a subset of respondents are indeed the target group for that population (Dommeyer et al., 2004). Online survey response rates of around 33% are often considered to meet the required representative sample for largely homogenous groups, in this case undergraduate nursing students undertaking pharmacology studies and practice (Nulty, 2008). Student online surveys conducted at the study site as part of normal unit evaluation processes consider response rates greater than 30% as acceptable. Online survey is a method regularly employed with these potential participants, so issues due to unfamiliarity with web-based formats were minimised. The researcher also recognised an adequate spread of responses across the cohorts of study from semester three to semester six was needed to provide accurate representation of student opinion (Nulty, 2008). Expectations around sample size return rates are listed in Table 6. An expected online survey response rate of 30% was

considered acceptable to reflect the views of the participant group. Applying a 5% margin of error and 95% confident level, a sample size of at least 161 participants was determined for this study (Plichta & Kelvin, 2013).

Table 6.

Sample Size Estimation for Online Student Questionnaire

UG nursing students'	536
Margin of error	5%
Confidence level	95%
Minimum sample size required*	161 participants

Note. *based on 30% response rate

Regular reminders and follow up by the researcher were made to maximise response rates from the student cohort through the University LMS Blackboard™ (Blackboard, 2015) over the study period, with approval from the School of Nursing, Midwifery and Paramedicine, and the University Office of Strategy and Planning. Dates were as indicated below:

- Survey opened: 28/04/2015
- Announcement 1: 28/04/2015
- Announcement 2: 18/05/2015
- Announcement 3: 05/06/2015
- Survey closed: 15/06/2015. A Thank you message was sent to students for their involvement in the study at the conclusion of the data collection via Blackboard™ (Blackboard, 2015).

The data obtained were analysed and the results compared between the student cohorts using the IBM Statistical Package for the Social Sciences (SPSS®), release version 24.0. A confidence interval of 95% was used for all tests, with p-values less than 0.05 considered significant. Descriptive statistics, including mean (M), standard deviation (SD), ranges and frequencies were calculated for items in the questionnaire. Comparisons were also made within questions to elicit response difference between semester/cohort of study (using responses to question eight of the online student questionnaire indicating students' current bioscience unit of study)

and timing of clinical placement (using responses to question seventeen of the online student questionnaire indicating if pharmacology learning was undertaken prior to, parallel or after clinical placement) in relation to the UG nursing students' pharmacology learning and readiness for clinical placement.

Initial statistical analyses were undertaken of the participant responses against biographical data, participants' semester of study and timing of clinical placement in relation to pharmacology content delivery using Chi-square tests. Results with a p value less than 0.05 were considered statistically significant and recomputed in SPSS®. Confidence level was set at 95%. Data were presented using measures of central tendency and variability such as mean (M) and standard deviation (SD) where normally distributed, and median and interquartile range (IQR) where not normally distributed. Data were assessed for normal distribution through an examination of the skewness and kurtosis, histograms, probability plots and normality tests including Kolmogorov-Smirnov test, and were re-assessed where necessary. Non-parametric statistical methods were chosen as most variables were not normally distributed. Where cell sizes fell below statistical requirements for non-parametric tests, groups were re-classified to dichotomous variables. Tests applied to the data included Pearson's chi-square test for independence and Kruskal-Wallis one-way ANOVA.

Through comparison of data across the different cohorts' level of study (bioscience unit of study) the researcher was able to explore if any relationships existed between student responses and their level of study in the curriculum. Cross tabulation was required to compare two or more categorical variables (i.e. response to Likert scale questions and semester of study, or timing of clinical placement in relation to pharmacology content delivery). Bar charts were useful to display categorical data, and normality tests were applied to review the symmetry and degree of skewness. Chi-square tests were used in examining two independent variables and when the participants in the study were an independent random sample. The UG nursing cohorts level of study were compared using Pearson's chi-square

test for independence to determine any significant differences between groups (Plichta & Kelvin, 2013). Kruskal-Wallis one-way ANOVA were used as non-parametric tests to compare the distribution between participant responses where data were obtained using the 10 and 11 point visual analogue scales (Plichta & Kelvin, 2013).

3.7 Objectivity

The researcher is a RN who completed a Bachelor of Science (Nursing) at Curtin University, Western Australia in 1996. The researcher holds 22 years' experience in clinical nursing environments including postoperative surgical wards, high dependency and Intensive care areas, both in Australia and the United Kingdom. This is supported by experience as a Nurse Educator and Lecturer, in settings ranging from clinical teaching and mentorship of existing staff, new graduates and UG nursing students in the clinical setting and the tertiary teaching environment. As a direct consequence of this experience, the teaching of pharmacology content to UG nursing students to support their experiences whilst on clinical placement is of great interest.

At the time this study was undertaken, the researcher was employed as a lecturer in the UG nursing program at the study site. The researcher holds personal experience in the delivery of integrated pharmacology curriculum. To avoid imposing biases and preconceptions on the data collection and analysis from staff and students participating, a reflective journal was kept by the researcher throughout this study. Research supervisors also served to monitor the risk of any biases being imposed by the researcher during the study. The researcher has also undertaken various conference presentation and professional development opportunities to support research preparation and improvement through peer review.

Objectivity refers to the prevention of bias in research (Polit & Beck, 2014). The researcher was able to accomplish this throughout the study duration by maintaining an accurate journal reflecting personal and professional opinions and responses to the research. This allowed for self-identification and

consideration of any attitudes and beliefs held during the study, and subsequently prevented these views influencing study processes that may have impacted the data collection, analysis and findings (Polit & Beck, 2014). The following is an example excerpt of a journal entry made by the researcher on 5th June 2015 during the data collection phase:

“I have to be extremely mindful of how my own knowledge and experiences in teaching in the integrated pharmacology curriculum, and awareness of this research being conducted does not pre-empt or influence the results obtained in the data gathered for the verified curriculum. I also need to be mindful of not biasing the data collection process for the online student questionnaire when undertaking my existing classroom teaching sessions, to ensure I do not over emphasise the link between pharmacology learning and the students’ reflections on their experiences whilst out on clinical placement.”

3.8 Reliability and Validity (of Quantitative Research Component)

Polit and Beck (2014) refer to reliability as the accuracy, consistency and repeatability of information attained in a study. Validity is the soundness of research designs and methods, often detailed as internal and external validity. The student questionnaire used in this study was validated for face validity, content validity and internal consistency prior to data gathering.

3.9 Trustworthiness (of Qualitative Research Component)

Trustworthiness in qualitative research includes credibility, transferability, dependability and confirmability. Research credibility is essential to any study, in allowing for a high degree of trust in the truth of the data collected (Polit & Beck, 2014). Data credibility was reached in this study through independent review of the data results and analyses undertaken. The researcher also made her contact details available for all participants (UC and UG nursing students) to allow for the provision of any additional information and clarification regarding the study.

Transferability is the degree to which research findings attained in a given study or project can be transferred to other groups or settings (Polit & Beck, 2014). The researcher notes that as data collection across phases one and two were restricted to only one study site, the relevance of findings to other universities or programs may be limited. The generalisability and limitations of findings is addressed in the discussion section of this thesis and related publications.

3.10 Ethical Considerations

Application to undertake this low risk research study was approved by Curtin University Human Research Ethics Committee (HREC) on the 7th October 2014 (Protocol approval SONM41 – 2014). Appendices Eleven and Twelve demonstrate attainment of candidacy and ethical approvals relevant to this study prior to data collection. Permission from the Head of School at the study site to conduct research involving staff and students was also sought by the researcher and granted. University staff and student research participation guidelines relevant to the study site were also addressed, with approval from the Market and Institutional Research team within the Office of Strategy and Planning.

Consideration of the National Statement on Ethical Conduct in Human Research (National Health and Medical Research Council, 2007) was made, with particular reference to dependent relationships, such as those involving staff and students in research. The fiduciary relationship and power imbalance between the researcher (as a lecturer in the school where the study was conducted) and participants (other UC and UG nursing students) was acknowledged and managed throughout the course of the study by the researcher. All participants (UC and UG nursing student) were invited to participate in the study and were assured their involvement in the survey was entirely voluntary, and they may withdraw at any time without adverse consequence. Whilst the UC participants were not anonymous due to the nature of phase one of the study, the researcher confirmed that data provided would remain confidential and staff privacy was respected and

maintained at all times. The online student questionnaire was anonymous, and participants were reassured their grades would not be adversely affected if they chose not to participate. As the researcher held the position of UC for one of the core units of study in the UG nursing curriculum at the study site, all initial participant recruitment was conducted via email for UC participants and online for UG nursing students. This avoided any actual or perceived coercion, direct verbal contact or promotion of the study from the researcher.

The study abided by NHMRC guidelines for low risk studies (National Health and Medical Research Council, 2007). Permissions were obtained online from staff and students to take part in the research. Consent was inferred through UC agreement to complete the UC verification process and return of the questionnaire to the researcher. Completion of the online student questionnaire by UG nursing students' implied consent to participate in the study. This was clearly identified to participants in the pre survey information.

Research conducted using online methods may pose added risks for privacy and confidentiality as data exists as an online record, and could potentially be accessed by others even when it is held by the researcher (Duffy, 2002). In this study, it is less of a concern as data gathered is not sensitive material. Participant privacy and confidentiality is of the utmost importance in research ethics (National Health and Medical Research Council, 2007). As such, data obtained for the online student questionnaire in phase two of the study were protected using an online password only known by the researcher. The data collected in the UC verification of the document mapping, PCCR, and online student questionnaire were also de-identified to maintain the privacy and confidentiality of participants. This was confirmed in writing with the participants. For the document mapping, PCCR and associated UC verification process, the researcher developed a master list so a numerical code was given to each UC who participated in the verification of the documents, thereby ensuring no names were recorded. Quantitative data collected in the online student questionnaire were not identifiable and demographic data were kept separate to the UG nursing student responses.

Data collection aimed to minimise disruption to the curriculum teaching/learning program.

The online student questionnaire was administered in accordance with University requirements. Students could choose not to participate. Participants' fears that they could be identified or their grades unduly influenced as a result of their participation/non-participation and responses needed to be considered. This potential issue was clearly addressed in the information sheet at the beginning of the online student questionnaire, to ensure participants were aware taking part in the study was optional and that there would not be any adverse consequence if they chose not to complete the questionnaire.

3.11 Data Storage, Access and Disposal

The ongoing storage and security of research records was undertaken in accordance with the Western Australian University Sector Disposal Authority (WAUSDA) guidelines. All data collected for this study have been stored according to guidelines under Section Two of the Australian Code for the Responsible Conduct of Research (National Health and Medical Research Council, 2007). For the verified curriculum, the master list of UC and associated de-identified UC verification documents are securely kept in a locked filing cabinet and electronically on a password encrypted USB drive, only accessible to the researcher. For the online student questionnaire, no names were provided by the participants, as the use of Qualtrics™ research platform allowed the researcher to gather de-identifiable data and securely store this electronically on a password protected Qualtrics™ site, in a locked filing cabinet and electronically on a password encrypted USB drive only accessible to the researcher. Study documents and raw data obtained will be kept in secure storage for a period of seven years from the date of last publication of this research, after which time the electronic data will be deleted and paper documents shredded. The contributions and cooperation all participants in this study are acknowledged whilst maintaining

confidentiality. Anonymity will be continually maintained when citing findings of the study in publications and presentations.

Chapter Four - Results

4.1 Introduction

This chapter presents the characteristics of the study sample for each phase, along with the findings. The findings of phase one are outlined i.e. the document mapping, subsequent UC verification and pharmacology curriculum content review (PCCR), which verified the pharmacology subject matter and pharmacology related concepts in the verified curriculum diagram. Results attained in phase two, the online student questionnaire are then provided. Biographical data and statistical tests are presented from the online student questionnaire. The data is organised to address the research questions for this study, and includes the comparisons of findings according to unit/semester of study and timing of clinical placement.

4.2 Phase One Results: Verified Curriculum

Phase one results address how the existing UG nursing curriculum at the study site was structured in relation to the integrated pharmacology content. This mapped and analysed integrated **pharmacology subject matter** and *pharmacology related concepts* provided within the UG nursing curriculum.

4.2.1 Document mapping.

For the purposes of this study *pharmacology* was defined as “the preparation, properties, uses, and actions of drugs” (Harris et al., 2014, p. 1381). Table 7 outlines the NVivo™ (NVivo, 2012) document mapping findings for key pharmacology terms across all 27 core units of study in the UG nursing curriculum. Fourteen units were found to include either **pharmacology subject matter** ($n = 8$) or *pharmacology related concepts* (such as *medico-legal, safety and quality or medication mathematics*) ($n = 6$).

Table 7.

NVivo™ Document Mapping of UG Nursing Curriculum Results

Year/Semester of study	Behavioural science stream	Inquiry stream	Bioscience stream	Nursing practice stream
IPFY I	NURS1003 Imagining Health in Social and Cultural Contexts#	CMHL1000 Foundations for Professional Health Practice#	HUMB1000 Human Structure and Function#	NURS1000 <i>Foundations of Nursing Practice</i>
	INDH1000 Indigenous Cultures and Health#; CMHL1003 Health and Health Behaviour#	CHML1001 Evidence Informed Health Practice#	HUMB1001 Integrated Systems Anatomy and Physiology#	NURS1002 <i>Fundamentals of Nursing Practice</i>
Year Two III	NURS2003 Behavioural Perspectives of Lifespan	<i>NURS2001</i> <i>Inquiry for Chronic Care</i>	GMED2000 Applied Bioscience for Chronic Conditions	NURS2002 <i>Integrated Nursing Practice</i>
	NURS2000 Behavioural Responses to Chronic Illness	<i>NURS2004</i> <i>Inquiry for Professional Practice</i>	GMED2001 Applied Bioscience for Acute Conditions	NURS2005 <i>Integrated Clinical Practice</i>
Year Three V	NURS3001 Behavioural Responses to Acute Illness	NURS3003 Inquiry for Evidence Based Practice	GMED3000 Applied Bioscience for Complex Conditions	CRIT3000 <i>Complex Nursing Practice 1</i>
	MENT3000 Behavioural Perspectives of Mental Wellbeing	NURS3002 Inquiry for Complex Care	GMED3001 Applied Bioscience for Critical Conditions	CRIT3001 <i>Complex Nursing Practice 2</i>
Year Four VII	Final semester option unit	<i>NURS4001</i> <i>Nursing and Midwifery Capstone</i>		NURS4002 <i>Transitional Nursing Practice</i>

Note. IPFY = Interprofessional first year. # = Health Science faculty IPFY units of study

Bold typeface = pharmacology subject matter delivered

Italicised typeface = pharmacology related medico-legal, safety and quality, and/or medication mathematics concepts delivered

Grey typeface = no pharmacology subject matter or pharmacology related medico-legal, safety and quality, and/or medication mathematics concepts delivered

Text matching using NVivo™ software did not reveal pharmacology subject matter or pharmacology related concepts within the Health Science faculty taught IPFY units of study offered during semesters one and two of the UG nursing curriculum, nor within the behavioural science stream units of study throughout the program.

Of the inquiry stream units, the semester three unit taught some pharmacology related concepts such as care planning and patient medication education through case-based learning. The semester four inquiry unit taught supporting pharmacology related medico-legal concepts. The semester seven nursing and midwifery capstone unit explored pharmacology related safety and quality aspects outlined in the National Safety and Quality Health Service (NSQHS) standards, including Standard 4: Medication Safety (Australian Commission on Safety and Quality in Healthcare, 2017). Final semester option units (Mental health, palliative care and wound care) offered content which complement the core curriculum units delivered but these were excluded from the review, as student enrolments in these units were elective.

All semester three to six bioscience stream units of study contained integrated pharmacology subject matter. All nursing practice units delivered in the UG nursing curriculum contained either integrated pharmacology subject matter or pharmacology related concepts. The semester one nursing practice unit introduced medication mathematics, but did not specifically explore the properties, uses, and actions of drugs. The semester two nursing practice unit explored medico-legal and applied pharmacology concepts, which supported UG nursing students' to complete their first clinical placement in an aged care facility. The semesters six and seven nursing practice units did not provide any new pharmacology subject matter, but assessed pharmacology related concepts via medication calculation and administration test(s) sat by students' prior to attending their clinical placements.

Whilst pharmacology related medico-legal, safety and quality and medication mathematics concepts were delivered throughout various UG nursing curriculum units from semesters one to seven of the program, the majority of pharmacology subject matter exploring the preparation, properties, uses and actions of drugs were found to be delivered in semesters three to six curriculum, within the bioscience and nursing practice stream units as summarised in Table 7. Case based learning strategies were utilised.

4.2.2 Unit coordinator verification.

Information obtained from the document mapping were reviewed and verified by each lecturer (UC) in the UG nursing program at the study site. This verification was undertaken to confirm the accuracy of the data obtained in the document mapping, and allowed the UC to provide any clarification required regarding integrated pharmacology subject matter for each unit of study within the UG nursing curriculum.

Participant characteristics.

All UC of the 27 core units in the UG nursing program agreed to participate in the UC verification process. Participant numbers were $n = 23$, as some lecturers held the position of UC for more than one unit of study within the UG nursing curriculum. The majority of UC were female ($n = 21$). Qualifications and experience in tertiary UG nursing education for the participants ranged from Postgraduate Certificate level study to PhD.

Findings.

Table 8 summarises the responses obtained from each UC during the verification process using the tool developed by the researcher (Appendix Six). This confirmed the accuracy of findings in the document mapping undertaken for each core unit of study in the UG nursing curriculum.

Table 8. Unit Coordinator Verification of Document Mapping

Unit of study	Pharmacology content taught Yes/No	UC confirms document mapping provided accurately represented pharmacology subject matter and related concepts provided within core units of study	Supporting detail provided by UC
Semester one			
CMHL1000 Foundations for Professional Health Practice [#]	No	Yes	N/A
NURS1003 Imaging Health in Social and Cultural Contexts [#]	No	Yes	N/A
HUMB1000 Human Structure and Function [#]	No	Yes	N/A
<i>NURS1000 Foundations of Nursing Practice</i>	Yes	Yes	Introduction to medications and medication mathematics for nurses.
Semester two			
CHML1001 Evidence Informed Health Practice [#]	No	Yes	N/A
INDH1000 Indigenous Cultures and Health [#]	No	Yes	N/A
CMHL1003 Health and Health Behaviour [#]	No	Yes	N/A

Unit of study	Pharmacology content taught Yes/No	UC confirms document mapping provided accurately represented pharmacology subject matter and related concepts provided within core units of study	Supporting detail provided by UC
HUMB1001 Integrated Systems Anatomy and Physiology [#]	No	Yes	N/A
NURS1002 Fundamentals of Nursing Practice	Yes	Yes	Pharmacology content is somewhat under-represented in curriculum documents, as content intertwined throughout the lectures/tutes is more detailed. Introduction to medications and medication mathematics for nurses includes definitions of basic pharmacology terms, legal issues for nurses and resources. Basic pharmacokinetics and pharmacodynamics, mostly in relation to the most commonly prescribed medications used to manage chronic conditions in the stable client.
<hr/> Semester three <hr/>			
NURS2003 Behavioural Perspectives of Lifespan	No	Yes	N/A
<i>NURS2001 Inquiry for Chronic Care</i>	Yes	Yes	Case based learning of nursing process includes some elements of care planning and documentation related to medication administration and patient education.
GMED2000 Applied Bioscience for Chronic Conditions	Yes	Yes	Introduction to pharmacology, pharmacokinetics and pharmacodynamics of medications used to treat chronic conditions

Unit of study	Pharmacology content taught Yes/No	UC confirms document mapping provided accurately represented pharmacology subject matter and related concepts provided within core units of study	Supporting detail provided by UC
			within module topics of diabetes, pain management, immune dysfunction and infection, altered healing and mobility, fluid and electrolytes, stress, depression and anxiety. Case based learning strategies utilised in all modules.
<hr/>			
NURS2002 Integrated Nursing Practice	Yes	Yes	Medication preparation, administration and recording, dosage calculations and legislative control for oral, topical and inhalation routes. Pain assessment and management, including complimentary therapy. Fluid balance maintenance, monitoring and documentation.
<hr/>			
Semester four			
NURS2000 Behavioural Responses to Chronic Illness	No	Yes	N/A
<i>NURS2004 Inquiry for Professional Practice</i>	Yes	Yes	Medico-legal contemporary issues in holistic nursing and healthcare. Includes discussion of nurses' role and legality in medication administration.
GMED2001 Applied Bioscience for Acute Conditions	Yes	Yes	Quality use of medicines, therapeutic clinical nursing management within acute care module topics of dementia and delirium,

Unit of study	Pharmacology content taught Yes/No	UC confirms document mapping provided accurately represented pharmacology subject matter and related concepts provided within core units of study	Supporting detail provided by UC
			neoplasia, urological, hepatobiliary, gastrointestinal, respiratory and cardiovascular systems. Case based content utilised in tutorials.
<hr/>			
NURS2005 Integrated Clinical Practice	Yes	Yes	Medication preparation, administration and recording, dosage calculations and medication infusion devices for parenteral and paediatric medication. Intravenous fluid replacement therapy, including the administration and use of blood products. Advanced pain management across the lifespan.
<hr/>			
Semester five			
NURS3001 Behavioural Responses to Acute Illness	No	Yes	N/A
NURS3003 Inquiry for Evidence Based Practice	No	Yes	N/A
GMED3000 Applied Bioscience for Complex Conditions	Yes	Yes	Pharmacokinetics and pharmacological management of mental illness, acute respiratory and cardiovascular failure and acid-base imbalances, including the use of psychotropic medications, sedatives and inotropes. Case examples used.

Unit of study	Pharmacology content taught Yes/No	UC confirms document mapping provided accurately represented pharmacology subject matter and related concepts provided within core units of study	Supporting detail provided by UC
CRIT3000 Complex Nursing Practice 1	Yes	Yes	Curriculum documents under-represent exactly what medications are taught. Specialised medication preparation, dosage calculation, administration and documentation in relation to advanced pain management (such as narcotics and Patient Controlled Analgesia) and inotropic medication are covered in the unit.
<hr/> Semester six <hr/>			
MENT3000 Behavioural Perspectives of Mental Wellbeing	No	Yes	N/A
NURS3002 Inquiry for Complex Care	No	Yes	N/A
GMED3001 Applied Bioscience for Critical Conditions	Yes	Yes	Pharmacology associated with critical instability: Head & Spinal injuries, Seizures and Epilepsy, Burns, Sepsis, ARDS, Acute and Chronic Renal Failure, Cerebrovascular Accidents, Major Trauma, Cardiac Arrhythmias and haematological dysfunction. Taught using case –based tutorial content.
CRIT3001 Complex Nursing Practice 2	Yes	Yes	Medication mathematics and dosage calculations. Only medication maths examined - principles are taught previously and examined in sem 6 prior to clinical placement.

Unit of study	Pharmacology content taught	UC confirms document mapping provided accurately represented pharmacology subject matter and related concepts provided within core units of study	Supporting detail provided by UC
Semester seven			
<i>NURS4001 Nursing and Midwifery Capstone</i>	Yes	Yes	Pharmacology related concepts taught around safety and quality including NSQHS Standard 4: Medication Safety, case scenarios about medication errors and CIMS/SAC reporting, but not pharmacology specific content in terms of classes of medications, uses or interactions. No new pharmacology content provided.
<i>NURS4002 Transitional Nursing Practice</i>	Yes	Yes	Medication mathematics and dosage calculations. No new pharmacology content provided. Medication test undertaken prior to attending final clinical placement.

Note. IPFY = Interprofessional first year. # = Health Science faculty IPFY units of study

Bold typeface = pharmacology subject matter delivered

Italicised typeface = pharmacology related medico-legal, safety and quality, and/or medication mathematics concepts delivered

Grey typeface = no pharmacology subject matter or pharmacology related medico-legal, safety and quality, and/or medication mathematics concepts delivered

Findings highlighted in Table 8 demonstrate how the UC confirmed that the document mapping undertaken accurately reflected the integrated nature of the pharmacology curriculum delivered at the study site. Additional comments provided by the UC were also added to the document mapping findings prior to undertaking the pharmacology curriculum content review.

4.2.3 Pharmacology curriculum content review (PCCR).

Using the initial document mapping findings and feedback received from UC, further PCCR undertaken by the researcher demonstrated the integration of pharmacology subject matter and pharmacology related concepts both horizontally and vertically within core units of study across the UG nursing curriculum.

Vertical integration of pharmacology subject matter is demonstrated within the bioscience and nursing practice stream units, as highlighted previously in Table 7, predominantly from semesters' three to six. The PCCR revealed that the pharmacology subject matter delivery (and medications introduced in the modules of study) accompanied disease specific subject matter explored within these core units. The pharmacology subject matter delivery also mirrored the curriculum structure delivery, where student learning and clinical placement opportunities increased in acuity as they progressed through the program; from stable people, to unstable people, followed by critically unstable people. For example, the semester three applied bioscience unit explored pharmacology subject matter in the context of chronic conditions, which lead into the semester four applied bioscience unit that explored pharmacology subject matter in acute conditions. Following this, semester five applied bioscience pharmacology subject matter increased in acuity pertinent to more complex conditions in critical care and mental health nursing contexts. This corresponding flow of pharmacology subject matter was echoed vertically within the nursing practice stream units. The pharmacology subject matter delivered also corresponded effectively with the UG nursing students' clinical placement opportunities as they progressed through their studies.

Horizontal integration of pharmacology subject matter and pharmacology related concepts were also confirmed within the UG nursing curriculum. This is evidenced by the exemplar in Figure 4, which illustrates the scaffolded and integrated pharmacology subject matter and pharmacology related concepts in the inquiry, bioscience and nursing practice streams units in semester three curriculum. These core units explored pharmacology learning in a chronic disease management context.

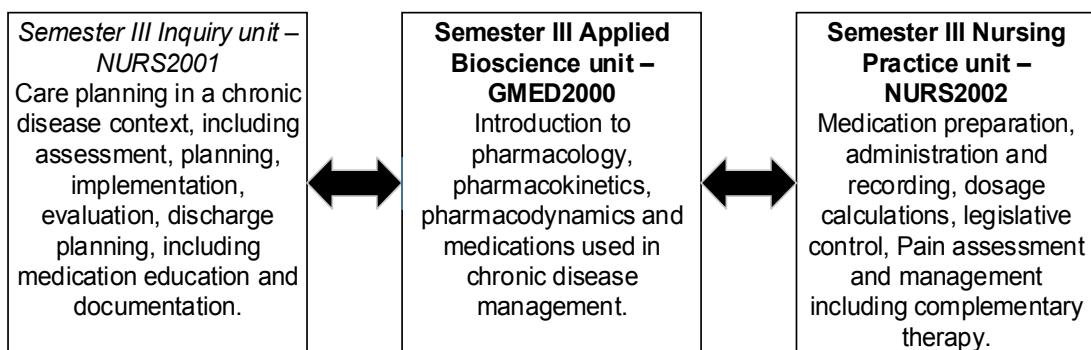


Figure 4. Semester three integration of pharmacology curriculum.

Closer analysis of this content outlined the link between units of study in addressing pharmacology subject matter and pharmacology related concepts within a disease specific integrated approach. One example illustrates how the applied bioscience unit examined the aetiology, pathophysiology, signs and symptoms, diagnosis, treatment and nursing management of Diabetes Mellitus as a chronic condition. Pharmacological intervention formed a key area of content delivery within this module of study in the unit. Case-based approaches were utilised to support the link between theory and practice. Concurrently, the nursing practice unit provided the opportunity for students' to build on this knowledge and practice insulin injection, hypoglycaemia management and related documentation in the laboratory setting, to support the students' clinical placement experiences. The inquiry unit also utilised a case-based approach to explore pharmacology related concepts relevant to nursing diagnoses and care planning for a patient with Diabetes Mellitus, including interventions, rationale and patient education. This was one clear example of horizontal integration and scaffolding of pharmacology subject

matter and pharmacology related concepts provided within the integrated curriculum, which was echoed throughout the UG nursing curriculum.

Similarly, Figures 5 demonstrates where semester four units of study in the inquiry, bioscience and nursing practice streams explored pharmacology subject matter and pharmacology related medico-legal concepts within an acute context.

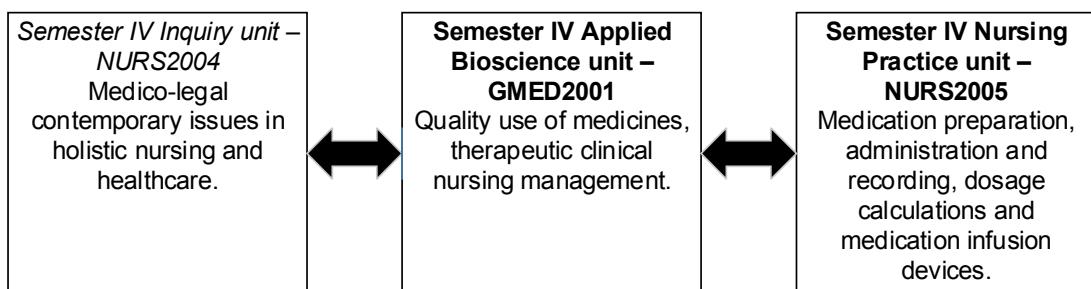


Figure 5. Semester four integration of pharmacology curriculum.

Further analysis of this curriculum also demonstrated links within a disease specific case-based learning approach. For example, the applied bioscience unit examined aetiology, pathophysiology, signs and symptoms, diagnosis, treatment and nursing management of Cholecystitis as an acute condition. Pharmacological intervention for pain control and infection prevention and management formed key areas of pharmacology content delivery within this module of study. The corresponding nursing practice unit supported student pharmacology learning in an acute clinical placement setting, and laboratory and classroom teaching explored the use of oral, intravenous, intramuscular and subcutaneous injections for the delivery of analgesia for advanced pain management and antibiotic therapy. The semester four inquiry stream unit utilised a case-based approach to explore pharmacology related medico-legal concepts in healthcare.

Disease specific cased-based approaches were used throughout curriculum to integrate the pharmacology subject matter and pharmacology related concepts delivered to support student learning whilst attending clinical placement. Figures 6 and 7 demonstrate how pharmacology integration

within the bioscience and nursing practice stream units in semesters five and six support student learning whilst attending clinical placement.

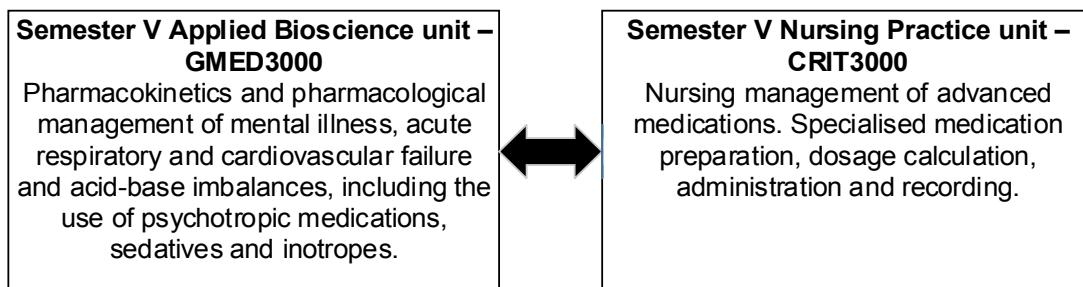


Figure 6. Semester five integration of pharmacology curriculum.

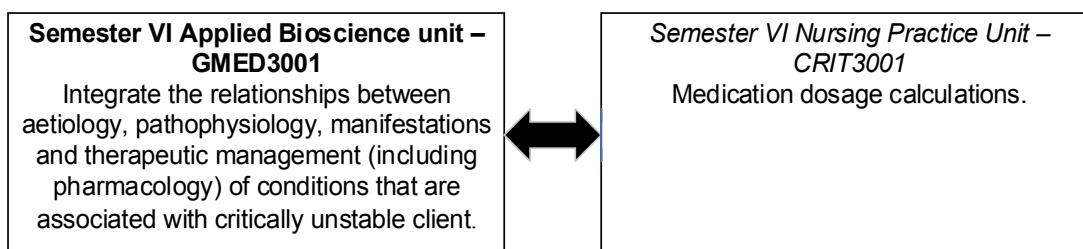


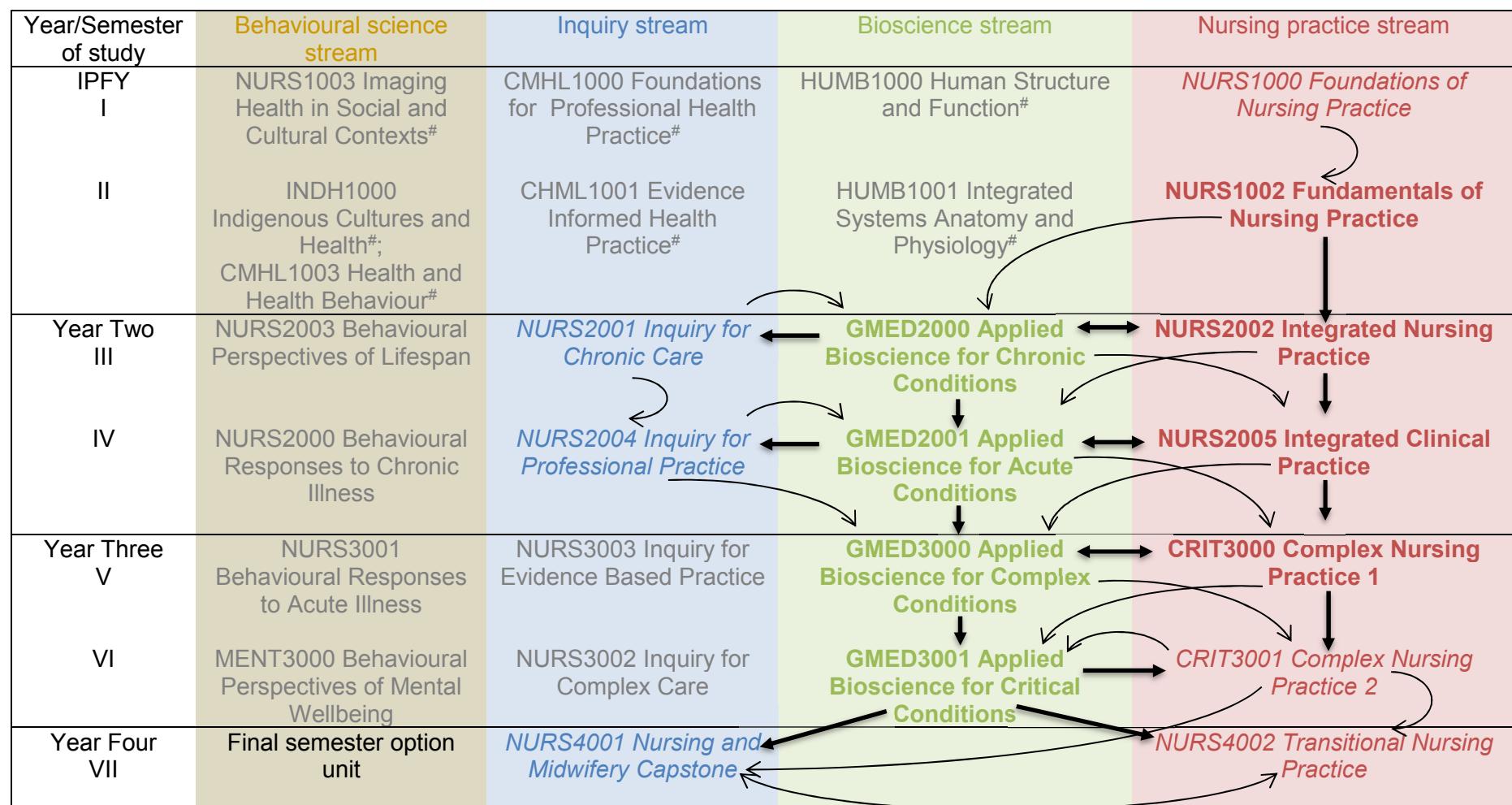
Figure 7. Semester six integration of pharmacology curriculum.

4.2.4 Phase one summary.

Phase one results are illustrated in Figure 8 as the verified curriculum diagram. The assimilation of pharmacology subject matter, medication mathematics and medico-legal, safety and quality pharmacology related concepts (includes NSQHS Standards, NMBA Code of Conduct, ICN Code of Ethics, CIMS/SAC reporting, potential impact of Human Factors, Swiss Cheese model, leadership and management) within various core units of study are demonstrated throughout the UG nursing curriculum.

Pharmacology subject matter was found to be predominantly provided within bioscience and nursing practice stream units. Pharmacology related concepts were addressed across the inquiry and nursing practice stream core units of study. The scaffolding of pharmacology learning both horizontally and vertically are illustrated throughout the program as UG nursing students' progressed through their studies. This further highlighted how the curriculum provided at the study site met expectations of an integrated curriculum structure. The strength of relationships between core

units of study in terms of pharmacology subject matter provided are emphasised in Figure 8 according to the use of looped arrows to show connections, with straight arrows indicating a stronger association between units according to the pharmacology subject matter provided. Phase one results have demonstrated the use of an integrated pharmacology curriculum model at the study site. The findings of phase one supported surveying UG nursing students enrolled in semesters' three to six within phase two for this study, as this is where the majority of pharmacology integration is evident from the review.



IPFY = Interprofessional first year. # = Health Science faculty IPFY units of study

Bold typeface = pharmacology subject matter delivered

Italicised typeface = pharmacology related medico-legal, safety and quality, and/or medication mathematics concepts delivered

Grey typeface = no pharmacology subject matter or pharmacology related medico-legal, safety and quality, and/or medication mathematics concepts delivered

Figure 8. Verified curriculum diagram

4.3 Phase Two Results: Online Student Questionnaire

The online student questionnaire addressed research questions two, three and four of this study. These research questions explored students' expectations of the integrated pharmacology content provided, how prepared for clinical placement students' felt as a result of completing units of study with integrated pharmacology curriculum and if a student's perceived readiness for clinical placement in relation to their pharmacology learning varied according to their level of study within the UG nursing program.

4.3.1 Participant characteristics.

Undergraduate nursing students constituted approximately 80% of all enrolments within the School of Nursing, Midwifery and Paramedicine at the study site. The study sample was derived from semester three to six UG nursing students, with a potential participant pool of 536. As shown in phase one results, this reflected where the majority of integrated pharmacology subject matter and pharmacology related concepts were delivered.

Figure 9 outlines the participant recruitment process utilised in phase two of this study, using an adapted CONSORT 2010 flow diagram (Schulz, Altman, & Moher, 2010). At the close of the online survey, 256 students had provided a response. Exclusion criteria were applied to the participants as outlined in the previous chapter, and responses from participants who did not answer questions beyond the demographic data were also excluded. As a result, 178 responses were available for analysis which met the predetermined minimum sample size requirement of 161. The margin of error was calculated at 6.01% based on a 95% confidence level. Even representation was achieved across each of the semester groups, accounting for approximately 33% of the eligible student population enrolled at the study site.

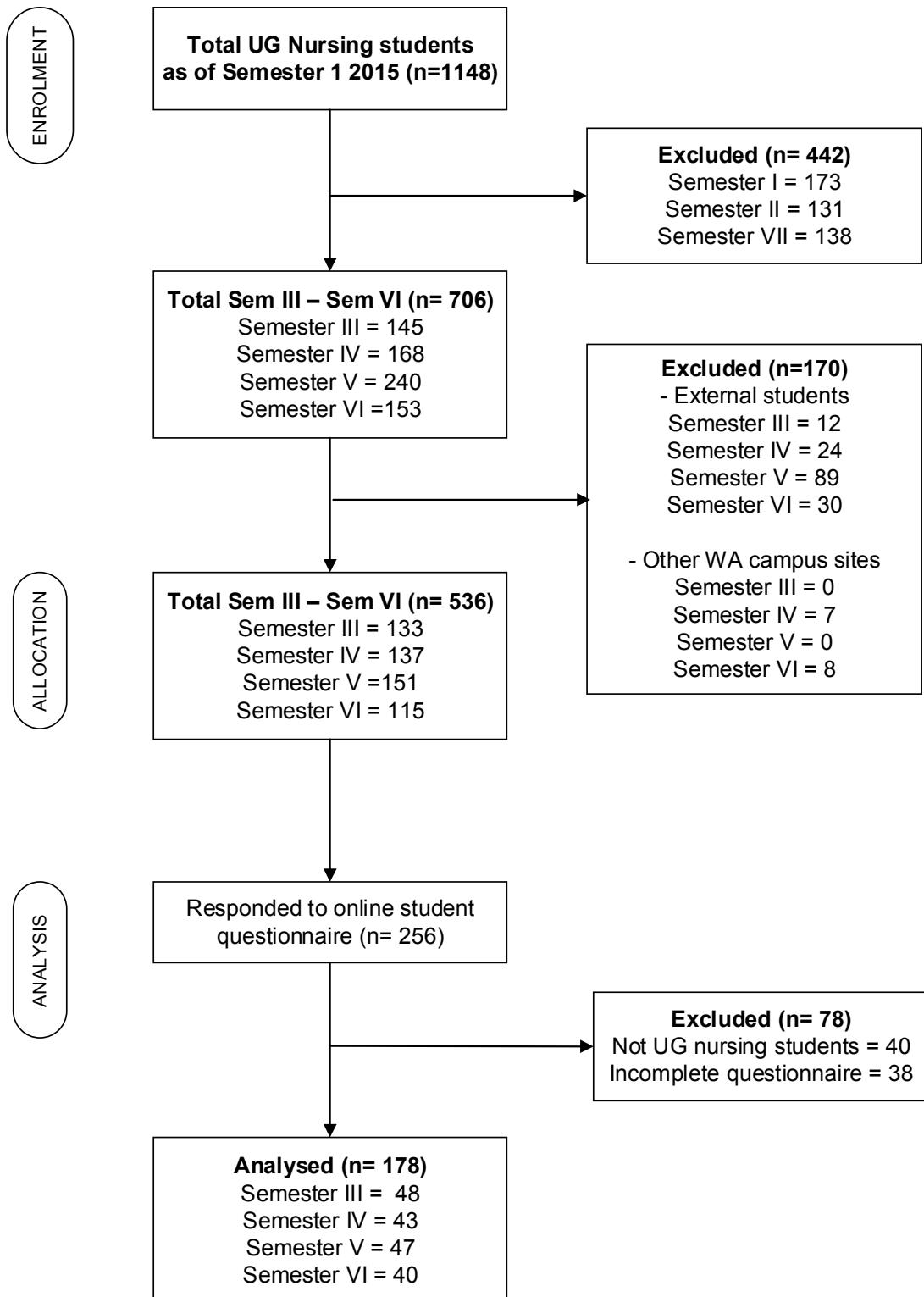


Figure 9. Participant recruitment for online student questionnaire.

Adapted from “CONSORT 2010 flow diagram,” by K. F. Schulz, D. G. Altman and D. Moher, 2010, *BMC Medicine*, 8(18), p. 5. Copyright 2010 by CONSORT. Reprinted with permission.

The characteristics of the online student questionnaire participants are outlined in Tables 9 and 10 to follow. Missing values are noted and represented in the results provided for the online student questionnaire data set. This occurred as the researcher did not force responses to questions, allowing participants to progress through the questionnaire to completion. This approach was valuable in allowing participants the choice of whether they want to respond to a particular question and still complete the survey. However, despite this design, some survey attrition was noted within the expected parameters and considered acceptable for an online survey (Nulty, 2008). Responses obtained to individual items within the online student questionnaire vary between 161 to 178.

In Table 9, it is clear that the majority (64%) of study participants were young (18 to 25 years) and entering the Bachelor of Science (Nursing) program as direct entry high school leavers. This is a typical representation in UG nursing program enrolments. The majority (94%) of participants enrolled were female, which follows the national and international statistics regarding the gender of nurses (World Health Organisation, 2017).

Table 9.*Characteristics of Online Student Questionnaire Participants*

Participant Characteristics (n = 178)	n (%)
Gender	
Female	168 (94)
Male	10 (6)
Age (range 18 - 55 years)	
18 - 25 years	114 (64)
26 - 35 years	41 (23)
36 - 45 years	15 (9)
45 + years	8 (4)
Primary language spoken	
English	115 (65)
Chinese	14 (8)
Asian other	25 (14)
Indo-Aryan	11 (6)
European	7 (4)
African	6 (3)
Highest education level completed	
School education	97 (54)
Certificate (AQF [#] Levels 1-4)	18 (10)
Diploma/Advanced Diploma (AQF Levels 5-6)	29 (16)
Bachelor Degree (AQF Level 7)	30 (17)
Postgraduate Degree (AQF Level 8)	4 (3)
Previous work experience in healthcare	
No	64 (36)
Yes	110 (62)
Missing values	4 (2)
If Yes < 1 year	17 (15)
1-3 years	64 (58)
3 + years	27 (25)
Missing values	2 (2)
If Yes Clinical paid	79 (72)
Non-Clinical paid	4 (3)
Volunteer	14 (13)
Missing values	13 (12)

Note. [#]AQF = Australian Qualifications Framework (Australian Qualifications Framework, 2013).

Two thirds of participants surveyed were of English speaking background. Of the one third of participants from Non-English speaking backgrounds, Chinese and other Asian languages were the most common. This reflects the international student enrolments in the course. Given that the largest percentage of study sample participants were school leavers, this was also reflected in the participants' level of education. Australian Qualifications Framework (AQF) levels and associated criteria specify of the relative depth and/or complexity of higher education programs, where AQF level 1 has the lowest complexity (Certificate one) and AQF level 10 the highest complexity (Doctoral degree) (Australian Qualifications Framework, 2013). Previous work experience in healthcare was reported by 62% of study participants. Of these, the majority indicated they held between one to three years' experience in paid clinical or non-clinical roles, or volunteer positions. The majority of paid positions included roles such as Assistant in Nursing, aged/home Carers or hospital based Patient Care Assistants.

Table 10 displays the enrolment characteristics of participants who completed the online student questionnaire. Even representation was apparent across each of the semester groups/cohorts from semesters' three to six within the applied bioscience units of study, which as reported in phase one results provided a significant component of integrated pharmacology learning. It was noted that 15% of participants were not completing their corresponding nursing practice unit of study. Possible reasons given for this included: failed prerequisite unit, part time enrolment, changed degrees or university part way through degree.

Table 10.*Enrolment Characteristics of Online Student Questionnaire Participants*

Participant Self-Reported Enrolment Characteristics (n = 178)	n (%)
Current semester of study	
Semester III	48 (27)
Semester IV	43 (24)
Semester V	47 (27)
Semester VI	40 (22)
Current applied bioscience unit of study	
GMED2000 (Semester III)	48 (27)
GMED2001 (Sem IV)	43 (24)
GMED 3000 (Sem V)	45 (25)
GMED3001 (Sem VI)	38 (22)
Missing values	4 (2)
Completing corresponding nursing practice unit of study	
Yes	148 (83)
No	27 (15)
Missing values	3 (2)
Last clinical placement unit of study	
NURS1002 Fundamentals of Nursing (Sem II)	20 (11)
NURS2002 Integrated Nursing Practice (Sem III)	54 (30)
NURS2005 Integrated Clinical Practice (Sem IV)	28 (16)
CRIT3000 Complex Nursing Practice 1 (Sem V)	43 (24)
CRIT3001 Complex Nursing Practice 2 (Sem VI)	30 (17)
Missing values	3 (2)
Timing of last clinical placement	
Previous semester	46 (26)
Current semester	129 (72)
Missing values	3 (2)
Timing of pharmacology content delivery	
Prior to clinical placement	69 (39)
Parallel to clinical placement	53 (30)
After clinical placement	48 (27)
Missing values	8 (4)

Ninety-eight percent of participants confirmed recent clinical placement experience in a clinical area relevant to their level of study in the curriculum. Due to the availability of clinical placements the timing of pharmacology content delivery occurs either prior to, parallel with or after clinical placement and this varies amongst students enrolled. The context of clinical placements

included Aged care, Community/Rehabilitation, Mental health, Medical, Surgical, Critical care, Operating theatres, Paediatrics/Maternity and other specialist placements. For semester six students, clinical placements included two weeks in one placement area and two weeks in another clinical area i.e. Mental health placement and Royal Flying Doctor Service (RFDS). Critical care placements included Emergency Department (ED), Intensive care (ICU), Coronary care (CCU), Oncology and Cardiothoracic surgical. Specialist placements included Palliative care, Practice nursing and remote/RFDS.

4.3.2 Online student questionnaire findings.

Expectations of integrated pharmacology curriculum.

Research question two explored student expectations of the integrated pharmacology content provided in the UG nursing curriculum at the study site, addressed through questions 13, 15, 16 and 25 of the online student questionnaire. These questions were in the context of their scope as a student RN. In keeping with the level of course progression, Table 11 illustrates that students' perceived their current level of pharmacology knowledge required development (72% of participants), although 26% of participants felt their current pharmacology knowledge was satisfactory. The majority of students' (90%) were satisfied to varying degrees with the pharmacology content provided in the integrated curriculum model. Of the participants, 73% reported feeling there was a good to excellent level of integration in the pharmacology curricula provided.

Table 11.

Responses Related to Expectations of Integrated Pharmacology Content (Qu 13, 15, 16 Online Student Questionnaire)

Participant Responses (n = 178)	n (%)
Perceived current level of pharmacology knowledge	
Satisfactory	47 (26)
Requires development	128 (72)
Not relevant to my practice	1 (1)
Missing values	2 (1)
Satisfaction with pharmacology content provided	
Very satisfied	14 (8)
Satisfied	82 (46)
Somewhat satisfied	64 (36)
Not satisfied	15 (8)
Missing values	3 (2)
Perceived integration of pharmacology content provided	
Excellent integration	11 (6)
Good integration	119 (67)
Poor integration	43 (24)
Not integrated	2 (1)
Missing values	3 (2)

Table 12 outlines participants' self-rating of their pharmacology education.

Average values were calculated on an eleven point scale, where zero represented no learning and ten represented considerable learning.

Participants indicated that all education approaches utilised at the study site (theoretical lessons, practical lessons in laboratory, clinical placement and self - tuition) were valued. When comparing these categories, education whilst on clinical placement was valued highest ($M = 7.52$, $SD = 2.32$), followed by self-tuition ($M = 6.48$, $SD = 2.01$).

Table 12.*Self-Rating of Education Approaches to Learn Pharmacology (Qu 25 Online Student Questionnaire)*

Participant Responses (Using 11 point scale [#]) (n = 178)	n (%)	M (SD)
On clinical placement	162 (91)	7.52 (2.32)
Missing values	16 (9)	
Self-tuition	163 (92)	6.48 (2.01)
Missing values	15 (8)	
Practical lessons in laboratory	163 (92)	5.98 (2.46)
Missing values	15 (8)	
Theoretical lessons	164 (92)	5.83 (2.04)
Missing values	14 (8)	

Note. [#]where 0 represents no learning to 10 representing considerable learning

Table 13 further illustrates how participants perceived their current level of pharmacology knowledge by semester group. Findings highlighted that across all levels of study, participants' consistently reported that their pharmacology knowledge 'required development'. No participants across semesters four, five or six indicated that their current level of pharmacology knowledge was irrelevant to practice.

Table 13.*Level of Study and Perceived Current Level of Pharmacology Knowledge*

<i>Level of Study</i>	Participant Responses (n = 172)		
	Satisfactory	Requires development	Not relevant to my practice
GMED2000 – Sem III (n = 47)	11	35	1
GMED2001 – Sem IV (n = 43)	7	36	0
GMED3000 – Sem V (n = 45)	11	34	0
GMED3001 – Sem VI (n = 37)	15	22	0

Table 14 further reports participants' level of satisfaction with the pharmacology content provided according to semester group. Findings from semester three to semester six students highlighted that the UG students' satisfaction moved from 'very satisfied' down to 'somewhat satisfied', although students' level of dissatisfaction did not increase.

Table 14.

Level of Study and Satisfaction With Pharmacology Content Provided

<i>Level of Study</i>	Participant Responses (n = 172)			
	Very satisfied	Satisfied	Somewhat satisfied	Not satisfied
GMED2000 – Sem III (n = 47)	9	27	10	1
GMED2001 – Sem IV (n = 43)	1	26	10	6
GMED3000 – Sem V (n = 45)	0	14	26	5
GMED3001 – Sem VI (n = 37)	3	15	17	2

In order to statistically compare results, these findings were re-categorised as 'satisfied' (including very satisfied, satisfied and somewhat satisfied responses) and 'not satisfied', and a Pearson's chi square test for independence was undertaken. Responses were compared to the UG nursing students' previous experience in healthcare $\chi^2 (1, N=171) = 0.008, p = 0.927$, which did not demonstrate statistical significance, indicating no association between participants' satisfaction with the pharmacology content provided and their previous healthcare experience. The re-categorised variables were also compared according to timing of clinical placement $\chi^2 (2, N=169) = 2.66, p = 0.265$ and students' level of study $\chi^2 (3, N=172) = 5.12, p = 0.163$, neither of which reached significance. Despite this re-categorisation it is worth noting that a number of the cells fell below the expected count of five, threatening the validity of the test statistics.

Further analyses were also undertaken according to participants' self-rating of their education in pharmacology across the areas of theoretical lessons, practical lessons, clinical placement and self-tuition. Table 15 shows descriptive statistics of mean values by semester group. Findings highlighted

that apart from the semester three students surveyed, across all other levels of study participants consistently reported clinical placement to be most valuable, followed by self-tuition opportunities. Semester six participants reported the highest mean values for pharmacology learning on clinical placement ($M = 8.75$, $SD = 1.16$) and self-tuition ($M = 7.08$, $SD = 1.50$). The semester three participants were the only group to value theoretical lessons highest ($M = 6.17$, $SD = 1.79$) and clinical placement learning lowest ($M = 5.56$, $SD = 2.41$). These results indicate the growing awareness of the importance of pharmacology learning on clinical placement.

Table 15.

Level of Study and Mean Values for Self-Rating of Pharmacology Education Approaches

<i>Level of Study</i>	<i>Participant Responses M (SD)</i>			
	<i>On clinical placement</i>	<i>Self-tuition</i>	<i>Practical lessons</i>	<i>Theoretical lessons</i>
GMED2000 – Sem III	5.56 (2.41)	5.80 (2.04)	5.71 (2.56)	6.17 (1.79)
GMED2001 – Sem IV	7.44 (2.33)	6.33 (2.26)	6.25 (2.52)	5.85 (2.25)
GMED3000 – Sem V	8.34 (1.76)	6.93 (1.80)	5.44 (2.60)	5.72 (2.28)
GMED3001 – Sem VI	8.75 (1.16)	7.08 (1.50)	6.64 (2.06)	5.70 (1.78)

Kolmogorov-Smirnov testing demonstrated non-normal distribution of data which guided subsequent statistical analysis. (For Kolmogorov-Smirnov results see Appendix Thirteen). Kruskal-Wallis one-way ANOVA results by semester group are reported in Table 16. Findings demonstrated no statistical significance for theoretical χ^2 (3, $N=161$) = 1.59, $p = 0.662$ or practical lessons χ^2 (3, $N=160$) = 5.75, $p = 0.125$. Statistically significant differences were found according to clinical placement χ^2 (3, $N=159$) = 44.39, $p < 0.001$ and self-tuition χ^2 (3, $N=160$) = 9.46, $p = 0.024$ teaching approaches utilised. These findings highlight the participants' perceived importance of clinical placement experiences and opportunities for self-tuition to support their pharmacology learning.

Table 16.***Kruskal-Wallis One-Way ANOVA Level of Study and Self-Rated Education in Pharmacology***

Level of Study	Participant Responses							
	Clinical placement		Self-tuition		Practical lessons		Theoretical lessons	
	N	Mean Rank	N	Mean Rank	N	Mean Rank	N	Mean Rank
GMED2000-Sem III	41	42.52	41	64.35	41	74.44	41	88.24
GMED2001-Sem IV	39	78.17	39	76.53	40	86.38	40	81.24
GMED3000-Sem V	43	96.93	43	89.85	43	70.78	43	77.80
GMED3001-Sem VI	36	104.44	37	91.72	36	92.49	37	76.43
Total	159		160		160		161	
Chi square	44.39		9.46		5.75		1.59	
Df	3		3		3		3	
Asymp. sig	<0.001*		0.024*		0.125		0.662	

*p <0.05

Preparedness for clinical placement.

The results to follow examine how prepared for clinical placement students' felt as a result of completing units of study containing integrated pharmacology curriculum. Data were collected from questions 14, 18-24, 26 and 27 of the online student questionnaire. These questions were in the scope of a student RN attending clinical placement under the direct supervision of a RN or clinical facilitator.

Table 17 echoed previous findings shown in Table 11, with 89% of participants' recognising the link between pharmacology learning and their experiences on clinical placement. Results showed that 88% of participants valued the opportunity for pharmacology learning whilst completing their last clinical placement. However the surveyed participants' indicated concerns around their ability to administer medicines within their scope of practice

when attending their last clinical placement (35% disagreement), and 47% of participants felt their class work in pharmacology learning did not meet their expectations for clinical placement. Despite this and although 72% of participants previously reported they 'required development' (Table 11), 60% of participants' felt they were prepared for the medication administration role when on clinical placement. Responses indicated that 90% of participants' valued the pharmacology learning opportunities afforded whilst on clinical placement. Of the participants, 87% also valued their previous experiences in pharmacology learning obtained whilst on clinical placement. Pharmacology learning experiences when on their most recent clinical placement were identified by 73% of participants to meet expectations and support pharmacology learning.

Table 17.*Preparedness for Clinical Placement Relative to Integrated Pharmacology Curriculum Delivery (Qu 14, 18-23 Online Student Questionnaire)*

Participant Responses (n = 178)	n (%)
Perceived relationship between pharmacology knowledge and clinical placement	
Yes	158 (89)
No	5 (3)
Unsure	13 (7)
Missing values	2 (1)
Value of pharmacology learning during last clinical placement	
Extremely valuable	18 (10)
Valuable	74 (42)
Somewhat valuable	64 (36)
Not valuable	15 (8)
Missing values	7 (4)
Class work in pharmacology met expectations for recent clinical placement	
Yes	87 (49)
No	84 (47)
Missing values	7 (4)
Preparedness to administer medicines within scope of practice when on recent clinical placement	
Strongly agree	18 (10)
Agree	89 (50)
Disagree	53 (30)
Strongly disagree	9 (5)
Missing values	9 (5)
Opportunity to further develop pharmacology knowledge when on recent clinical placement	
Strongly agree	85 (48)
Agree	74 (42)
Disagree	10 (5)
Strongly disagree	2 (1)
Missing values	7 (4)
Value of previous clinical experiences in pharmacology	
Extremely valuable	38 (21)
Valuable	73 (41)
Somewhat valuable	44 (25)
Not valuable	16 (9)
Missing values	7 (4)
Pharmacology experiences met expectations	
Strongly agree	27 (15)
Agree	102 (58)
Disagree	37 (21)
Strongly disagree	4 (2)
Missing values	8 (4)

Table 18 highlights the participants' reported preparedness for pharmacology related tasks when on clinical placement (question 24 of online student questionnaire). Of the participants, 57% indicated they were confident in their abilities to identify correct medication use when on clinical placement. Participants reported confidence in their abilities to undertaken medication calculations correctly (78% of participants). However, participants' reported difficulty identifying correct medication side effects (56%) and contraindications (55%). Confidence in managing their patients' condition according to prescribed pharmacology regimes was reported by 70% of participants. Surveyed participants also agreed they could interpret clinical observations and relate these to prescribed pharmacology regimes (65%), and were confident in their ability to provide patient education regarding medicines (70%).

Table 18.***Preparedness for Pharmacology Related Tasks When on Clinical Placement
(Qu 24 Online Student Questionnaire)***

Participant Responses Relating to Most Recent Clinical Placement (n = 178) n (%)	
Identify correct medicine use all of the time	
Strongly agree	13 (7)
Agree	88 (50)
Disagree	54 (30)
Strongly disagree	9 (5)
Missing values	14 (8)
Identify correct medicine side effects all of the time	
Strongly agree	5 (3)
Agree	59 (33)
Disagree	74 (41)
Strongly disagree	26 (15)
Missing values	14 (8)
Identify contraindicated medicines in patient treatment	
Strongly agree	7 (4)
Agree	58 (33)
Disagree	78 (44)
Strongly disagree	21 (11)
Missing values	14 (8)
Undertake medication calculations correctly all of the time	
Strongly agree	54 (30)
Agree	85 (48)
Disagree	19 (11)
Strongly disagree	6 (3)
Missing values	14 (8)
Manage patients' conditions according to prescribed pharmacology regimes	
Strongly agree	27 (15)
Agree	97 (55)
Disagree	31 (17)
Strongly disagree	9 (5)
Missing values	14 (8)
Interpret clinical observations and relate to prescribed pharmacology regimes	
Strongly agree	21 (12)
Agree	95 (53)
Disagree	39 (22)
Strongly disagree	9 (5)
Missing values	14 (8)
Patient education about medicines	
Strongly agree	30 (17)
Agree	95 (53)
Disagree	28 (16)
Strongly disagree	11 (6)
Missing values	14 (8)

Participants' self-reported readiness in pharmacology whilst on clinical placement (questions 26 and 27 of online student questionnaire) are reported in Table 19. Average values were calculated on a ten point scale, where one represented the lowest rating and ten the highest rating. Readiness to deliver safe medicine care was ranked highly, with a mean value of 6.81. A narrow standard deviation ($M = 6.81$, $SD = 1.92$) in relation to the delivery of safe medicine care was noted, indicating that this mean value was supported by a tight dispersion of values. This points to the majority of participants feeling at least ready to deliver safe medication care. Although slightly more conservative, findings obtained from semester six students' ($n=40$) when asked about their perceived preparedness for clinical practice upon graduation, followed this trend with a mean value of 6.64, again with a close dispersion of values around this result ($M = 6.64$, $SD = 1.88$). These findings demonstrate the majority of participants' perceived they were ready to deliver safe care in pharmacology whilst on clinical placement.

Table 19.

Reported Readiness in Pharmacology When on Clinical Placement (Qu26-27 Online Student Questionnaire)

Participant Responses (Using 10 point scale [#])	n (%)	M (SD)
Self-rated readiness to deliver safe medicine care ($n = 178$)	164 (92)	6.81 (1.92)
Missing values	14 (8)	
Semester VI students only ($n = 40$)		
Self-rated preparedness for clinical practice in pharmacology	36 (90)	6.64 (1.88)
Missing values	4 (10)	

Note. [#]where 1 represents lowest rating to 10 representing highest rating

Further analyses were also undertaken according to participants' self-rated readiness to deliver safe medicine care when on clinical placement. Table 20 shows descriptive statistics of the mean values by semester group. Participants mean values were higher amongst semester six participants compared to semester three participants, with semester six participants' recorded the highest mean value ($M = 7.41$, $SD = 1.82$), and semester three participants' the lowest mean value ($M = 6.15$, $SD = 2.17$).

Table 20.

Level of Study and Self-Rated Readiness to Deliver Safe Medicine Care

<i>Level of Study</i>	Participant Responses (n = 161)		
	N	M	SD
GMED2000 – Sem III	41	6.15	2.17
GMED2001 – Sem IV	40	6.65	1.46
GMED3000 – Sem V	43	7.12	2.04
GMED3001 – Sem VI	37	7.41	1.82

Kolmogorov-Smirnov testing demonstrated non-normal distribution of data which guided subsequent statistical analysis. (Appendix Thirteen displays Kolmogorov-Smirnov results). Table 21 reports Kruskal-Wallis one-way ANOVA results by semester group, which showed a statistically significant difference in self-reported readiness to deliver safe medicine care in participants' enrolled across the curriculum, $\chi^2 (3, N=161) = 11.21, p = 0.011$. This suggests a significant improvement in self-reported readiness to deliver safe medicine care in participants' enrolled across the curriculum from earlier to later semesters.

Table 21.

Kruskal-Wallis One-Way ANOVA Level of Study and Reported Readiness to Deliver Safe Medicine Care

<i>Level of Study</i>	Readiness to Deliver Safe Medicine Care	
	N	Mean Rank
GMED2000 – Sem III	41	66.51
GMED2001 – Sem IV	40	72.28
GMED3000 – Sem V	43	89.79
GMED3001 – Sem VI	37	96.27
Total	161	
Chi square	11.211	
Df	3	
Asymp. sig	0.011*	

*p < 0.05

Factors influencing readiness for clinical placement by level of study.

The results to follow further examine where participants' perceived readiness for clinical placement varied according to their level of study within the UG nursing program. Statistical analyses were also undertaken with timing of clinical placement in relation to pharmacology content delivery and participants' feelings of preparedness for clinical placement as a result of integrated pharmacology content delivery. However it was noted that a number of the cells fell below the expected count of five, which threatened the validity of test statistics. Data collected from questions 21-23, and 27 of the online student questionnaire were examined further according to participants' level of study within the program.

Participant responses to their opportunity to further develop pharmacology learning whilst on their recent clinical placement (question 21 of online student questionnaire) are broken down according to their level of study in the program in Table 22. In order to statistically compare the results, findings were re-categorised as 'agree' (including strongly agree and agree responses) and 'disagree' (including strongly disagree and disagree responses), and Pearson's chi square test for independence were undertaken, although despite this re-categorisation it is worth noting that a number of the cells fell below the expected count of five, threatening the validity of this test statistic. The re-categorised responses were compared to students' level of study χ^2 (3, N=167) = 10.85, p = 0.013. Acknowledging this, the data demonstrated that participants' valued clinical placement as pharmacology learning opportunities, with their level of disagreement declining from the semester three to the semester six participants.

Table 22.

Level of Study and Opportunity to Further Develop Pharmacology Knowledge When on Recent Clinical Placement

<i>Level of Study</i>	Participant Responses (n = 167)			
	Strongly agree	Agree	Disagree	Strongly disagree
GMED2000 – Sem III (n = 46)	14	26	6	0
GMED2001 – Sem IV (n = 41)	26	10	4	1
GMED3000 – Sem V (n = 43)	24	19	0	0
GMED3001 – Sem VI (n = 37)	20	17	0	0

Question 22 of the online student questionnaire asked participants to reflect on how they valued their previous experiences in pharmacology whilst attending their most recent clinical placement. Responses according to level of study within the program are shown in Table 23. Findings were re-categorised as 'valuable' (including extremely valuable, valuable and somewhat valuable responses) and 'not valuable' and a Pearson's chi square test for independence was undertaken, noting that despite this re-categorisation a number of the cells fell below the expected count of five, threatening the validity of this test statistic. The re-categorised responses were compared to participants' level of study χ^2 (3, N=167) = 7.87, $p = 0.049$. Noting this, data findings indicated that participants' level of study in the program was related to the value placed on their previous experiences in pharmacology. Participants' increasingly saw the value in their previous clinical placement experiences, although their previous clinical placement experience did not have as strong an influence on pharmacology learning whilst attending their most recent clinical placement.

Table 23.

Level of Study and Value of Previous Pharmacology Experiences When on Recent Clinical Placement

Level of Study	Participant Responses (n = 167)			
	Extremely valuable	Valuable	Somewhat valuable	Not valuable
GMED2000 – Sem III (n = 46)	4	16	18	8
GMED2001 – Sem IV (n = 41)	6	17	14	4
GMED3000 – Sem V (n = 43)	9	24	7	3
GMED3001 – Sem VI (n = 37)	19	14	4	0

Participants' were asked to consider how their pharmacology experiences on their recent clinical placement met their expectations (question 23 of online student questionnaire), shown according to level of study in Table 24.

Findings were re-categorised as 'agree' (including strongly agree and agree responses) and 'disagree' (including disagree and strongly disagree responses), and a Pearson's chi square test for independence was undertaken. Re-categorised responses were compared to students' level of study. The Pearson's chi-square test met the requirements for statistical analysis $\chi^2 (3, N=166) = 4.40, p = 0.222$, which did not support a statistically significant relationship between students' level of study in the program and their expectations of pharmacology learning experiences when on their most recent clinical placement. Re-categorised responses were also compared to timing of clinical placement in relation to pharmacology content delivery.

Pearson's chi square result was not statistically significant $\chi^2 (2, N=169) = 0.07, p = 0.966$, demonstrating the timing of pharmacology content delivery in the program did not significantly impact on their pharmacology learning experiences. Findings further support that the integrated curriculum structure employed is supportive to student pharmacology learning on clinical placement, as participants' level of agreement that their experiences met expectations was higher among semester six students than the semester three students. This follows a similar trend to previous responses to the online student questionnaire.

Table 24.*Level of Study and How Pharmacology Experiences on Recent Clinical Placement Met Expectations*

<i>Level of Study</i>	Participant Responses (n = 166)			
	Strongly agree	Agree	Disagree	Strongly disagree
GMED2000 – Sem III (n = 45)	1	31	13	0
GMED2001 – Sem IV (n = 41)	5	25	8	3
GMED3000 – Sem V (n = 43)	9	23	11	0
GMED3001 – Sem VI (n = 37)	12	21	3	1

Question 27 of the online student questionnaire asked semester six participants only to rate their preparedness for clinical practice in pharmacology as a result of their pharmacology studies. Table 25 displays descriptive statistics of responses according to the timing of clinical placement in relation to pharmacology content delivery. Semester six participants' recorded the highest mean value when they received pharmacology learning prior to clinical placement ($M = 6.82$, $SD = 2.01$), followed by parallel to clinical placement ($M = 6.71$, $SD = 1.60$) and the lowest mean value reported in those who received pharmacology content delivery after clinical placement ($M = 6.33$, $SD = 1.97$).

Table 25.*Timing of Clinical Placement and Self-Rated Preparedness for Clinical Practice in Pharmacology*

<i>Timing of Clinical Placement</i>	Semester VI Participant Responses (n = 36)		
	N	M	SD
Prior to clinical placement	17	6.82	2.01
Parallel to clinical placement	7	6.71	1.60
After clinical placement	12	6.33	1.97

Table 26 outlines findings of Kruskal-Wallis one-way ANOVA undertaken (For Kolmogorov-Smirnov results see Appendix Thirteen). Findings were not statistically significant χ^2 (2, N=36) = 0.943, p = 0.624, indicating although there is a difference in the means, timing of pharmacology content delivery for the semester six participants' was not a significant influence on their preparedness for clinical placement.

Table 26.

Kruskal-Wallis One-Way ANOVA Timing of Clinical Placement and Semester Six Participants' Self-Rated Preparedness for Clinical Practice in Pharmacology

<i>Timing of Clinical Placement</i>	Preparedness for Clinical Practice in Pharmacology	
	N	Mean Rank
Prior to clinical placement	17	20.15
Parallel to clinical placement	7	18.07
After clinical placement	12	16.42
Total	36	
Chi square	0.943	
Df	2	
Asymp. sig	0.624	

4.3.3 Phase two summary.

Phase two results have outlined responses to the online student questionnaire. Findings have demonstrated that the integrated pharmacology curriculum model employed at the study site met participant expectations for their pharmacology learning and was beneficial to pharmacology learning whilst attending clinical placement. Results indicated some positive correlations between participants understanding of pharmacology and their preparedness for clinical placement in relation to their studies within the integrated curriculum model. However not all participants were in full agreement and results indicated some levels of concern amongst respondents. The results highlighted that UG nursing students enter clinical placement with some trepidation, with 72% of participants reporting their

pharmacology knowledge still required development. Participants' also indicated difficulty identifying correct medication side effects (56% of participants) and contraindications (55% of participants). The timing of pharmacology content delivery in relation to clinical placement did not influence pharmacology learning outcomes, although it did seem to be better when delivered immediately prior to placement if mean values were compared. Clinical placement offers substantial opportunity for students to consolidate their learning in pharmacology and results demonstrated their confidence builds over time. Findings demonstrated that participants' perceived readiness for clinical placement varied according to their level of study, with reported readiness higher in semester six students than compared to the semester three students.

4.4 Summary

This chapter has reported results obtained in the two phases of this study; the verified curriculum and online student questionnaire. The verified curriculum diagram demonstrated the use of an integrated pharmacology curriculum model at the study site. Pharmacology content is scaffolded both horizontally and vertically, with the assimilation of pharmacology subject matter, medication mathematics and medico-legal, safety and quality pharmacology related concepts demonstrated within various core units of study across the program. The majority of pharmacology subject matter is delivered from semesters' three to six of the program, mostly captured in bioscience units where it relates to clinical conditions and clinical practice units. The findings of the online student questionnaire suggested that the integrated approach to pharmacology curriculum delivery met the majority of participants' expectations. Some apprehension and concern remains amongst the students surveyed around the ongoing development of their pharmacology knowledge and its application to medication side effects and contraindications in a clinical context. Satisfaction with the integrated pharmacology content provided and preparedness for pharmacology when on clinical placement was higher among semester six participants' compared to semester three participants. The value of clinical placement to support

participants' pharmacology learning within an integrated curriculum model was consistently highlighted.

Chapter Five - Discussion

5.1 Introduction

This study examined student readiness for pharmacology learning on clinical placement as a result of completing units of study within an integrated pharmacology curriculum. Phase one findings confirmed that the curriculum takes an integrated approach to pharmacology teaching through the development of a verified curriculum. This established where pharmacology is integrated and scaffolded horizontally and vertically across the core units of study. Phase two involved the administration of an online student questionnaire to UG nursing students' enrolled from semester three to semester six at the study site. The results demonstrated that students reported feeling prepared for their clinical placement from a pharmacology perspective, where semester six students appeared to have consolidated their pharmacology learning whilst attending clinical placement more than students in earlier semesters. Students' application of their pharmacology knowledge to medication side effects and contraindications in a clinical context is identified as a challenge. Further analysis of responses showed that the timing of clinical placement in relation to pharmacology content delivery did not have a significant impact on pharmacology learning or attitudes towards preparedness for clinical placement. Participants' preparedness for clinical placement in relation to their pharmacology learning was highest among semester six participants.

Study findings are discussed in this chapter to show how they situate within the existing literature and research. The implications of integrated pharmacology content in UG nursing curricula are considered. Student expectations and perceptions of an integrated pharmacology curriculum delivered are discussed. The UG nursing students' perceived readiness for pharmacology practice during clinical placement in relation to their pharmacology learning are also detailed, along with the strengths and limitations of this research, recommendations for educational practice and further research, followed by concluding remarks.

5.2 Pharmacology Within an Integrated UG Nursing Curriculum

It is important to understand how pharmacology subject matter and pharmacology related concepts are delivered within the various streams of an UG nursing curriculum (Objectives 1 and 2). Review of the literature demonstrated that integrated pharmacology curricula models are employed within UG nursing programs. The study of pharmacology units in UG nursing programs has been explored some time ago in relation to the content provided and the relevance to nursing clinical practice (Courtenay, 1991; Latter, Rycroft-Malone, et al., 2000; Latter, Yerrell, et al., 2000). A systematic approach to the integration of pharmacology content in curricula aids pharmacology learning (Lim & Honey, 2006; Meechan et al., 2011). Integrated models need to account for the pharmacology content delivered and ensure learning is not hidden or lost (Dilles et al., 2011; Foster et al., 2017; Lim & Honey, 2006; Manias, 2009; Manias & Bullock, 2002b; Meechan et al., 2011; Strayer & Beitz, 2010). Therefore there is a need to identify and map core pharmacology concepts within integrated curricula (Woodman, Dodds, Mosepele, & Frauman, 2004). Even when pharmacology is provided as a discrete subject, UG nursing students have reported that content needs to be introduced during the first year of study and scaffolded throughout their second and third years of study with more complex pharmacology learning opportunities (Manias & Bullock, 2002b).

The curriculum mapping undertaken and presented in Chapter Four demonstrates there is pharmacology subject matter and pharmacology related concepts throughout the UG nursing curriculum and confirms it is visible and well integrated (Figure 8). The integration of the pharmacology content is not uniform across all core units in the program. This result is not unexpected, given the IPFY curriculum structure which delays the introduction of nursing specific pharmacology subject matter, medication mathematics and medico-legal, safety and quality pharmacology related concepts. Findings show that pharmacology subject matter and related concepts are addressed throughout the nursing curriculum, as recommended by Manias and Bullock (2002b) and Simonsen et al. (2014). The verified

curriculum diagram (Figure 8) illustrates pharmacology integration throughout this curriculum. The majority of pharmacology subject matter is shown to be delivered in semesters' three to six across the bioscience and nursing practice stream units, with pharmacology related concepts addressed within inquiry stream units and later nursing practice units.

Student participants recognise the importance of pharmacology learning whilst undertaking their UG nursing course. Results demonstrate that the integrated pharmacology content provided and strategies employed met student expectations and are supportive to their pharmacology learning on clinical placement (73% agreement). This differs from the opinions of UG nursing students elicited by Manias and Bullock (2002b) indicating that UG nursing students preferred to undertake separate pharmacology subjects instead of studying within an integrated pharmacology curriculum structure. Some student participants in Manias and Bullock (2002b) study who had undertaken an integrated curriculum reported feeling it did not provide adequate opportunity to apply pharmacology knowledge to clinical practice. They indicated the teaching sessions lacked relevance to clinical practice and were not methodical in their approach to pharmacology, which resulted in them feeling underprepared for clinical practice. Other students who were provided a separate pharmacology subject felt this gave them a good foundation in pharmacology. Differences may exist between findings of this study and those of Manias and Bullock (2002b) as participants at the study site were only exposed to an integrated pharmacology curriculum and were not specifically asked of their experience or opinion of discrete pharmacology curricula. Neither Manias and Bullock (2002b) nor this study made a direct comparison of student experiences with a discrete pharmacology curriculum.

A somewhat unique component of the curriculum with respect to pharmacology is the IPFY structure at the study site that delays the introduction of nurse specific integrated pharmacology content in core units of study until semester three. Although this study did not elicit student opinion about when pharmacology content is best introduced in curriculum, findings show that satisfaction with the pharmacology subject matter and

pharmacology related concepts provided, moved from 'very satisfied' down to 'somewhat satisfied' as students' progress from semesters three to six, although overall dissatisfaction does not increase. This suggests that students' insight into the knowledge required to support their ongoing learning in pharmacology and its application on clinical placement develops over time. They appear to become increasingly aware of their own knowledge deficits. The reported apprehension about their pharmacology knowledge may explain the varying levels of satisfaction with the content provided. Participants reported value on self-tuition learning opportunities in pharmacology also appears to be supportive of this finding. Several authors (Dilles et al., 2011; Grandell-Niemi et al., 2005; Honey & Lim, 2008; Manias & Bullock, 2002b; Meechan et al., 2011) have also reported that UG nursing students hold these concerns about their level of pharmacology knowledge. The curriculum structure of a program impacts when pharmacology is delivered within core units, which may then influence pharmacology learning and students' resulting readiness in pharmacology whilst on clinical placement.

An integrated pharmacology curriculum may only prepare students for learning in pharmacology to a certain point. From their experience within an integrated curriculum model, approximately half (47%) of participants reported that their class work in pharmacology did not meet their expectations for clinical placement. This echoes the results of Manias and Bullock (2002b) focus group data where students reported that studying within an integrated curriculum model encouraged superficial learning in pharmacology that made it difficult to make connections between pharmacology theory and practice. Theoretical aspects of integrated curriculum design may not fulfil all of students' learning needs in pharmacology, as students also report that they still undertake some self-directed learning in pharmacology whilst attending clinical placement to support the theoretical pharmacology learning provided within the integrated curriculum delivery model. It is acknowledged that no curriculum, regardless of content or delivery method can fully prepare students in their pharmacology learning. It is the combination of adequate knowledge

provision and clinical placement learning, coupled with self-directed learning which supports student learning through an integrated curriculum approach. This is highlighted by the 90% of participants who report they value their opportunities for pharmacology learning whilst on clinical placement.

Lim and Honey (2006) emphasised the importance of faculty involvement to ensure pharmacology content is linked throughout curricula. The document mapping and subsequent UC verification demonstrate that each UC has a clear understanding of the pharmacology content provided in their units. They are able to confirm the pharmacology subject matter and related concepts delivered across this integrated pharmacology curriculum model. Bullock and Manias (2002) previously found in their qualitative study of UG nursing academics in Victoria Australia, that academic staff preferred teaching pharmacology using an integrated approach across the bioscience and nursing practice stream subjects. Most teaching staff agreed that teaching pharmacology as a separate subject reduced the opportunity to integrate pharmacology into nursing subjects. Although staff opinion of the integrated curriculum were not specifically examined in this study, phase one findings do confirm the use of an integrated structure, taking an approach used in other integrated curricula (Bullock & Manias, 2002; Lim & Honey, 2006).

Concerns regarding the time allocated to teaching pharmacology, the ability to map the level of integration of pharmacology content within curricula, and UG nursing students ability to link their pharmacology learning to medication processes within the clinical environment have been reported (Bullock & Manias, 2002; Latter et al., 2001; Manias & Bullock, 2002b; Sulosaari et al., 2014). Lim and Honey (2006) previously outlined the benefits of delivering pharmacology using an integrated curriculum model to avoid students' learning in separate silos of knowledge and to support pharmacology knowledge application in clinical practice. They stress the importance of encouraging UG nursing students to develop an understanding of pharmacology principles and concepts in place of just learning content about specific medicines. This approach enhances the development of knowledge,

skills, confidence and competence in pharmacology that can translate to clinical practice and promote life-long pharmacology learning and clinical reasoning skills (Banning, 2003; Lim & Honey, 2006). The integrated curriculum approach was adopted at the study site with the intention of supporting students' pharmacology learning for their relevant clinical placements throughout their program. The verified curriculum confirms a structured approach to pharmacology subject matter and pharmacology related concept delivery which links theoretical pharmacology learning and clinical placement. This scaffolding supports pharmacology knowledge development, as students' reported they continue to learn about pharmacology whilst attending clinical placement and are self-directed to undertake their own studies whilst on clinical placement.

As the literature review demonstrated, there is a paucity of contemporary research specific to the use of integrated pharmacology curricula in UG nursing programs and how well this method of pharmacology content delivery prepares students for the clinical area. Although highlighted by Bullock and Manias in 2002, the issue remains in Australia that unequivocal guidelines do not exist to indicate a required amount or level of pharmacology knowledge that is needed by nurses to support safe clinical practice. It is also important for students to recognise that human and system factors can also influence safe clinical practice within the healthcare environment. Manias (2009) later indicated that the UG nursing students' preparation in pharmacology is a priority that should commence during their UG nursing program and be built upon throughout their careers. Taylor et al. (2015) more recently discussed in a broader context that adequate pre-registration bioscience education (which includes pharmacology content) will better prepare nurses to meet their needs for clinical practice. In this study, 88% of participants place value on the pharmacology learning opportunities afforded to them whilst attending their clinical placement, which confirms how this supports the integrated pharmacology subject matter and pharmacology related concepts provided in theoretical aspects of the curriculum. Findings also indicate that the integrated curriculum structure has the strongest focus on pharmacology subject matter within semesters' three to six, which

corresponded with nursing practice units that incorporate clinical placements. Although no new pharmacology subject matter is delivered in the capstone semester of study, the intention of the extended period of clinical placement is to support students to consolidate their learning, including in pharmacology, prior to graduation. The benefit of this curriculum structure for students is that it develops their pharmacology knowledge at a crucial time, i.e. whilst they are also completing the bulk of their clinical placement learning, allowing opportunity to expand pharmacology knowledge within the clinical setting (Meechan et al., 2011).

Challenges in teaching pharmacology identified by Woodman et al. (2004) include placing sufficient emphasis and weight on foundation concepts to support further learning and encourage student engagement within an integrated curriculum structure. The verified curriculum confirmed the horizontal and vertical integration of pharmacology content in core units that progressively built student understanding of pharmacology in relation to particular body systems (i.e. respiratory, cardiovascular, renal). Students are unable to progress further in their course until they have successfully completed corresponding core units of study. With topics developing as students' then progress in their program from foundation to capstone, the pharmacology subject matter and related concepts provide subsequent links to student experiences on their related clinical placements. This complements the findings of Ozturk, Muslu, and Dicle (2008) who conducted a study across two nursing schools in Turkey that demonstrated a similar problem based learning approach was more effective in enhancing the critical thinking abilities of UG nursing students than a traditional didactic teaching approach (Ozturk et al., 2008). The use of tiered frameworks for pharmacology learning are confirmed by UC and demonstrated in Figure 8 of the verified curriculum diagram for this study. Findings shown in Figures 4 through 7 of the pharmacology curriculum content review also make evident the horizontal integration of content across core units of study using case based, disease specific approaches to learning.

Phase one results demonstrate how pharmacology can be comprehensively integrated within and across a seven semester undergraduate nursing course. These results verify a model for integrated pharmacology curriculum structure which offers pharmacology subject matter primarily in bioscience and nursing practice units and pharmacology related concepts in inquiry stream units and later nursing practice units. In the absence of data demonstrating actual student knowledge through assessment or test scores, the structure of the integrated pharmacology curriculum demonstrated in the verified curriculum may present as a suitable model for an evidence based approach to learning and teaching pharmacology in UG nursing curricula.

5.3 Student Expectations and Perceptions of an Integrated Pharmacology Curriculum

Conducting an online student survey allowed the researcher to obtain the students' perspective of their expectations and perceptions of an integrated curriculum (Objectives 3 and 4). Although it is not possible as a result of this study to demonstrate that an integrated curriculum approach is better than a discrete pharmacology approach, the findings do support that the integrated approach meets student needs. Students report a good to excellent level of integration of the pharmacology subject matter and related concepts that support their learning. Whilst participants express their satisfaction with the pharmacology subject matter and related concepts provided within this integrated curriculum model, across all cohorts they consistently report that their pharmacology knowledge '*requires development*'. Levett-Jones et al. (2015) found a primary concern expressed by UG nursing students whilst undertaking their courses was feeling ill-prepared for clinical placement. The findings of this study add another level of understanding about this phenomenon where it relates to pharmacology. The finding that 72% of participants classified their current level of pharmacology knowledge as '*requiring development*' illustrated that participants know they have more to learn about pharmacology but are ready for their role as a student RN on clinical placement acting under the direct supervision of a RN or clinical facilitator. Findings show that although they are not confident to practice independently, they are ready for their student role and participate in clinical placement as a student at their level of study within the program.

Although students perceive they enter their clinical placements with some further development required, no participants across semesters four, five or six indicated that their level of current pharmacology knowledge wasn't relevant to practice. This shows that students are aware of the importance of pharmacology knowledge to the nursing role. It is recognised that UG nursing students expect to continually improve their working pharmacology knowledge (Dilles et al., 2011). This is apparent in the integrated approach where participants valued the opportunity to consolidate their pharmacology learning in a practice setting, with 73% of participants identifying that their pharmacology learning experiences whilst on clinical placement met expectations and were supportive to their pharmacology learning. However this also highlights that over a quarter of students felt their experiences did not meet expectations. This might be explained by other individual student factors beyond curricula design that may influence UG nursing student pharmacology learning, as identified previously by Strayer and Beitz (2010). Therefore when considering curricula design, there is a need to acknowledge individual student factors (such as culture, CALD background, learning style, age, gender, life experiences and prior experience in healthcare) within the context of their pharmacology learning needs. Study findings may elucidate that although students are aware there is more learning to undertake, the integrated curriculum meets their beginning needs for learning in pharmacology and suggests it is supportive to their clinical placement learning in pharmacology as they progress through their program.

In surveying students about preparedness for clinical placement relative to integrated pharmacology curriculum delivery (Table 19), 88% reported that the pharmacology provided within curriculum related to their learning experiences whilst on clinical placement. The ability to link theory to practice is an important component of pharmacology learning for the UG nursing student, and methods to enhance this are considerations in integrated pharmacology curricula delivery (Honey & Lim, 2008). Nursing lecturers have previously acknowledged the need to provide meaningful, pertinent and effective pharmacology teaching that prepares for practice in the clinical setting (Krautscheid et al., 2011). In their qualitative study, Krautscheid et al.

(2011) found students' valued demonstrations, peer based learning and opportunities for practice in order to gain proficiency in medication administration. All UG nursing students surveyed valued the various learning opportunities in pharmacology provided across the curriculum, which included theoretical lessons, practical lessons, clinical placement and self-tuition, supporting the findings of Krautscheid et al. (2011) and extending their conclusions by illustrating that pharmacology learning on clinical placement ($p < 0.001$) and opportunities for self-tuition ($p = 0.024$) are highly valued. Results showed how the semester four, five and six students consistently value clinical placement learning highest, followed by self-tuition opportunities. The emphasis of these two areas of learning also increases as they progress in their program. This indicates that students increasingly recognise the importance of clinical placement learning in pharmacology and the need to undertake further self-tuition to fill their own knowledge requirements. Semester three students placed the highest value on theoretical lessons, followed by self-tuition and rated learning on clinical placement lowest. This may be explained by the curriculum structure, as semester three students have limited opportunities to undertake clinical placement during their first year of study, and therefore may not yet perceive the value and relevance of clinical placement to support their pharmacology learning within the integrated curriculum model. Clinical placement learning provides further opportunities for students to identify knowledge deficits and possible areas of weakness in relation to clinical practice. This also explains why the participants' place increasing expectation and value on their own self-guided studies in pharmacology as they progress through the program and complete additional clinical placement rotations.

The quantitative findings of this study from the UG nursing student perspective adds a more contemporary view to support the qualitative results of where clinical nurses (Manias & Bullock, 2002a) and UG nursing students (Manias & Bullock, 2002b) indicated that pharmacology theory and its associated clinical principles are important for clinical practice. Participants recognised the relationship between their pharmacology knowledge level and their ability to provide safe and effective pharmacology nursing care whilst

attending clinical placement. As shown, 88% of participants valued the opportunity for pharmacology learning whilst completing their last clinical placement and 89% recognised the link between pharmacology learning and their experiences on clinical placement. It is also acknowledged that safe practice is pharmacology is reliant on more than just pharmacology knowledge, as medication safety also includes adherence to the NSQHS standards, including Standard 4: Medication Safety and legal requirements outlined by NMBA (Australian Commission on Safety and Quality in Healthcare, 2017).

This study confirms that pharmacology knowledge acquisition for the UG nursing student remains an area of important consideration in UG nursing curricula delivery. Responses to the online student questionnaire show that students perceived the importance of pharmacology knowledge to support safe and effective care. The integrated pharmacology curriculum model met expectations as it provides scaffolding and linkage between the theoretical aspects of pharmacology subject matter and related concepts (such as medico-legal, safety and quality or medication mathematics) delivered to clinical placement learning. Students' perceived this supports ongoing learning in pharmacology as they progress in their program. As a result, exploring the student perspective of their pharmacology learning adds value to existing research in this field in relation to an integrated curriculum structure.

5.4 Student Readiness for Pharmacology Practice During Clinical Placement

The online student questionnaire specifically asked about student readiness in pharmacology whilst attending clinical placement to ascertain if student readiness varied according to their level of study within the program (Objectives 5 and 6). Clinical placements give students authentic learning experiences to support the link between theoretical learning and clinical practice (Brown et al., 2011; Levett-Jones & Reid-Searl, 2018). The value of these for UG nursing student learning cannot be underestimated (Levett-

Jones & Reid-Searl, 2018). The verified curriculum in phase one confirms that clinical placement is part of the integrated curriculum delivered. Clinical placement learning is situated in the nursing practice stream units within the UG nursing curriculum. The theoretical aspects of pharmacology learning can be applied in the clinical component of the integrated curriculum. This integrated pharmacology curriculum has been recognised by participants to support their readiness for ongoing pharmacology learning whilst attending clinical placement. In question 14 of the online student survey 89% of participants were aware of the relationship between integrated pharmacology curriculum and how this supported the application of pharmacology knowledge during their time on clinical placement. A majority (73% agreement) reported their experiences when on their most recent placement met expectations and supported their pharmacology learning. These findings illustrate that students see the link between their experiences in a clinical setting to support their ongoing pharmacology learning. Pharmacology subject matter and pharmacology related concepts link to pharmacology learning whilst on clinical placement. Findings here are consistent with the views of participants in the Manias and Bullock (2002b) study, which indicate the value of clinical placements as an opportunity to consolidate pharmacology learning in a practice setting.

Davis (2010) has previously argued from the bioscience perspective that whilst UG nursing students may recognise the knowledge they require, it may not necessarily be reflected in their actual application of knowledge in clinical practice. Student responses to questions relating to preparedness for clinical placement in relation to the integrated curriculum delivery suggest that the curriculum structure supports student readiness for the clinical component of their pharmacology learning. This provides students with the opportunity to continue their learning within the scaffolded curriculum and consolidate their confidence in pharmacology practice in a clinical context. These findings are also consistent with Meechan et al. (2011), who have previously determined that students enrolled in a new integrated curriculum were better able to apply pharmacology knowledge to case based scenarios than those students who studied within another pharmacology curriculum structure, which

supports the development of pharmacology skills in practice (Meechan et al., 2011).

Results demonstrate that participants perceived they were ready to deliver safe care in pharmacology whilst on clinical placement and continued to believe so as they progressed through the program. For the purposes of this study, safe medicine care refers to adherence to the ‘six rights’ of medication administration and avoiding medication errors, although this was not explicitly defined for participants in the online student questionnaire. Semester 6 students showed the highest self-reported readiness to deliver safe medicine care in comparison to other participants’ enrolled across the curriculum. A significant improvement in self-reported readiness to deliver safe medicine care was found in participants’ enrolled across the curriculum from earlier to later semesters ($p = 0.001$). This demonstrates how UG nursing student readiness develops over time as they progress through the program and they feel most ready when closer to graduation. Lim and Honey (2017) determined that newly graduated nurses saw the importance of applying pharmacology knowledge to their practice, but still needed to improve their knowledge of medicines used in the clinical environment.

Although students report satisfaction with the integrated nature of the pharmacology curriculum and they recognised the link to learning on clinical placement, several participants still reported concern around their ability to perform pharmacology related tasks whilst attending clinical placement (Table 20), more so as they progressed through the program. Honey and Lim (2008) previously described students’ perceived lack of confidence in their pharmacology knowledge when studying within an integrated curriculum structure. Dilles et al. (2011) study also indicated that just prior to graduation UG nursing students’ pharmacology knowledge and calculation skills were limited regardless of the pharmacology model within the curriculum. Since the integrated curriculum structure in this study appears to support student readiness for pharmacology learning, those students expressing concern about their ability to perform pharmacology related tasks could also be partially explained by them becoming increasingly aware of the depth and

breadth of pharmacology knowledge required to support clinical practice. They become aware of what they don't know. The Conscious Competence learning model developed in the 1970's refers to this stage as conscious incompetence (Burch, 1970). This may suggest that when students have the opportunity to put pharmacology learning in context as they progress in their program and attend more clinical placements, they become increasingly aware of their own knowledge deficits and seek opportunities to rectify this.

The Conscious Competence learning model proposed by Burch (1970) is adapted in Figure 10 below to show how this may reflect the UG nursing student awareness of their pharmacology knowledge as they progress in their studies. It shows the development through the four stages of competence; unconscious incompetence, conscious incompetence, conscious competence to unconscious competence (Burch, 1970). Students may begin their program in the unconscious incompetence stage where they may not be aware of what pharmacology knowledge is required nor be able to recognise their own deficits (wrong intuition). As students then progress to the conscious incompetence stage they increasingly recognise their pharmacology knowledge deficits and the value of gaining the necessary skills, but may still not know how to attain the competency required (wrong analysis). In the conscious competence stage students gain the pharmacology knowledge and learn how to apply it, but this requires increased concentration to perform the skills required (right analysis). Students can then progress towards the unconscious competence stage with further practice in pharmacology (right intuition). As students' progress in their course they have more opportunities to develop their pharmacology knowledge in a clinical placement context, which provides further application and practice opportunities.

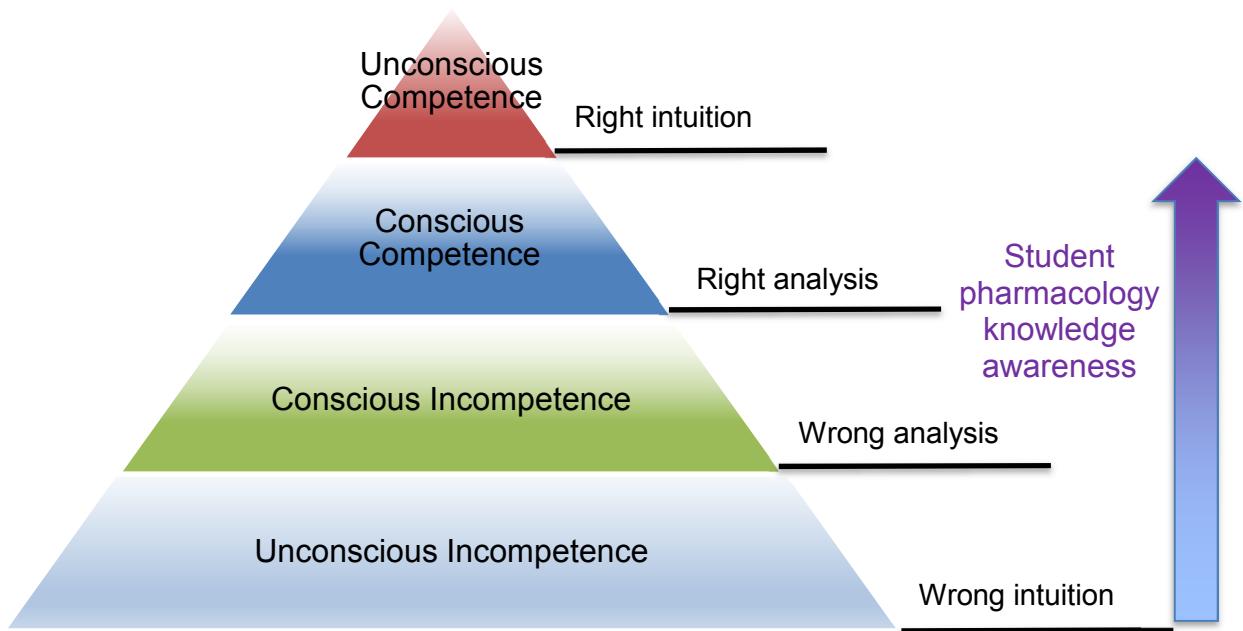


Figure 10. Stages of UG nursing student awareness of their learning in pharmacology. Adapted from “*Conscious Competence learning model*,” by N. Burch and Gordon Training International, 1970. Copyright 1970 by Gordon Training International. Reprinted with permission.

Benner (2001) Stages of Clinical Competence from novice, advanced beginner, competent, proficient to expert also acknowledges that in developing their clinical nursing practice, student nurses are not likely to attain expert level knowledge or unconscious competence. Online student questionnaire findings have acknowledged that student confidence and competence in pharmacology progresses over time. It is recognised that students oscillate within this hierarchy of the Conscious Competence learning model (Burch, 1970) and move through Benner (2001) Stages of Clinical Competence as they develop their knowledge, decision making and application in pharmacology.

Sulosaari et al. (2015) examined the individual and learning environment factors connected to Finnish nursing students’ medication competence at the start and completion of their education in pharmacology. They identified that upon commencement of their learning, a students’ previous success academically was strongly associated with medication competence. Towards the end of their degree the study found that student motivation and self-regulated study had a more significant impact on their attainment of

medication competency (Sulosaari et al., 2015). The findings of this study support Sulosaari et al. (2015), as participants increasingly value opportunities for pharmacology learning whilst on clinical placement and increasingly place importance on their own self-tuition as they progressed through the program. Previously, Latter, Rycroft-Malone, et al. (2000) also highlight that both nursing students and academics recognised that pharmacology curriculum should be complemented by self-directed learning in a clinical context.

It is apparent that clinical placement provides an opportunity to further develop pharmacology knowledge and student readiness in relation to pharmacology related tasks. The majority of participants from semesters' three to six indicated they were confident to undertake medication calculations correctly (78%) when on clinical placement and manage their patient's condition according to prescribed pharmacology regimes (70%). This suggests the pharmacology subject matter and pharmacology related concepts provided in the integrated curriculum support application of pharmacology knowledge in a clinical placement context. However these findings are not overwhelming and it is acknowledged that 22% of participants were not confident to undertake medication calculations correctly and 30% did not feel they could manage their patient's condition according to prescribed pharmacology regimes. This infers that the integrated curriculum design does not meet every student's needs all of the time. Other individual student factors such as age, culture, CALD background, education, life experiences and prior experience in healthcare could impact a student's confidence in pharmacology.

Final year nursing students in the study by Fell et al. (2016) reported that clinical placements provided an ideal opportunity to integrate bioscience learning into clinical decision making. This mirrors the reports of other studies (Jordan et al., 1999; Kyriacos, Jordan, & Van Den Heever, 2005; Meechan et al., 2011) that assert that if students are given the opportunity to receive structured pharmacology learning, they can subsequently display a clearer awareness of factors related to pharmacology such as drug actions.

Knowledge of side effects and contraindications are key elements of safe care in pharmacology. It cannot be ignored that 56% of participants reported difficulty identifying medication side effects and 55% indicated concerns around identifying contraindicated medicines in patient treatment. These are troublesome areas of pharmacology for many UG nursing students and qualified nurses alike (Simonsen et al., 2014). Literature suggests these aspects of pharmacology knowledge are important to the nurses' role in managing medicines within a clinical environment (Page & McKinney, 2007) to enhance the provision of safe and effective pharmacology care. Whilst it is acknowledged these are more complex issues of pharmacology practice (Dilles et al., 2011; Manias & Bullock, 2002a; Meechan et al., 2011), supporting students to recognise the importance and relevance of side effects and contraindications whilst on clinical placement can help support their ongoing knowledge development in this area of pharmacology practice. Safe care in pharmacology also extends beyond the task of medication administration and knowledge of side effects and contraindications, as it includes an awareness of human and system factors that influence decision making in clinical practice.

The timing of pharmacology content delivery in relation to clinical placement did not influence pharmacology learning outcomes or the student experience within the integrated curriculum model. Although it was anticipated that students who learned pharmacology subject matter and related concepts prior to attending clinical placement would respond more favourably about their pharmacology learning, the timing of clinical placement in relation to the content delivery was not reported as having a significant influence on students pharmacology learning and readiness for clinical placement. This infers that the integrated nature of the pharmacology curriculum where students may undertake their pharmacology learning before, during or after their clinical placement rotation still supports student readiness for placement learning in pharmacology, as students' pharmacology learning is of an ongoing nature. Within this integrated curriculum structure, students consistently have pharmacology subject matter and related concepts

scaffolded throughout their course. This continually places pharmacology learning within each semester of the integrated curriculum model and if students are not provided sequential theoretical-to-clinical learning opportunities this does not appear to impact pharmacology learning outcomes.

This study demonstrates the value of an integrated pharmacology curriculum and confirms an important consideration throughout UG nursing curricula is to support student readiness for safe and effective pharmacology practice. The integrated pharmacology curriculum scaffolds and links the theoretical aspects of pharmacology subject matter and related concepts to students' clinical placement learning which supports ongoing learning in pharmacology. Clinical placements have been shown to offer substantial opportunity for students to consolidate their learning in pharmacology to support their readiness for pharmacology practice. Findings acknowledge that student confidence and competence in pharmacology practice needs time to develop. Participants' perceived readiness for clinical placement varies according to their level of study within the UG nursing program, with student readiness for pharmacology practice developing as they progress through the program. The results do highlight where areas for improvement in pharmacology knowledge exist within the student cohort from their own perspective. These include student's self-reported knowledge of medication side effects and contraindications and their subsequent confidence in using medicines whilst attending clinical placement.

5.5 A Conceptual Framework for Pharmacology Curricula in UG Nursing

Based on study findings and with reference to relevant literature presented in Chapters One and Two, it became apparent there was opportunity to develop a conceptual framework for pharmacology curriculum in the Australian context. The previous work of Manias and Bullock (2002b), Honey and Lim (2008) and Foster et al. (2017) examined in the literature review have provided some valuable insight that are applied along with the findings of this

study into a proposed conceptual framework for UG nursing pharmacology curricula. In addition to the seminal work of Honey and Lim (2008), further work published by Lim, Honey, and Kilpatrick (2007) is also of relevance. Insight into the pharmacology learning needs of nurses provided by Banning (2003) and Lanz and Davis (2017) are also applicable.

Manias and Bullock (2002b) recommended providing students with collaborative, structured pharmacology education within UG nursing curricula so they can reflect on the pharmacology knowledge and skills required for practice. This includes providing supportive learning opportunities to students within a clinical placement context. Banning (2003) suggested a generic theoretical framework for pharmacology teaching within an integrated UG nursing curriculum which emphasises the importance of applied pharmacology and clinical reasoning. Their framework is supported by the concepts of knowledge acquisition, storage and utilisation, along with the reasoning style that links theoretical learning to application, practice activities, assessment strategies and performance criteria (Banning, 2003). Lim et al. (2007) proposed the use of a three-tiered framework to build graduate nurses pharmacology knowledge that begins with *knowledge*, to introduce concepts such as the principles of pharmacology, pharmacokinetics and pharmacodynamics. This is then followed by second tier information to support *application* of pharmacology knowledge within a clinical context. The top tier then builds on these levels to promote clinical *decision making*, which includes more complex areas of patient education in pharmacology, side effects and medicine interactions, which were also highlighted as areas of importance by study participants and are vital knowledge and skills for safe practice in pharmacology. Lanz and Davis (2017) suggested that structured, concept based curricula similar to that demonstrated at the study site are supportive to UG nursing students' pharmacology learning. Foster et al. (2017) also recognised the importance of utilising a case based approach to pharmacology learning so pharmacology concepts can be effectively contextualised and directly linked to clinical scenarios that may be encountered by students when attending clinical placement. Banning (2003) and Lanz and Davis (2017) also

recommend the development of clear clinical placement links combined with integrated pharmacology teaching throughout UG nursing curricula to further assimilate student learning in pharmacology within a clinical context.

Based on study findings and drawing upon the relevant existing literature, a conceptual framework outlined in Figure 11 proposes considerations for pharmacology learning within an UG nursing curriculum. The outcomes of this study suggest three main interconnected areas for consideration within this framework that have been added to the three tiered framework previously suggested by Lim et al. (2007); the structure of integrated pharmacology subject matter and pharmacology related concepts delivered (knowledge), considerations that may impact on the clinical decision making of the UG nursing student (decision making) and clinical placement learning and self-tuition opportunities in pharmacology (application).

This study has pointed to the importance of a well-structured pharmacology curriculum within these three main interconnected areas to support student readiness in pharmacology learning in a clinical context. Pharmacology curriculum needs to scaffold and link the theoretical aspects of pharmacology subject matter and related concepts to students' clinical placement learning. The importance of clinical placements and self-tuition as opportunities to continually build pharmacology learning and support readiness for pharmacology practice is included within the framework. Ongoing focus on identified areas of difficulty such as medication side effects and contraindications are also suggested within the proposed framework for students as they progress in their program.

In addition to findings of this study, the conceptual framework acknowledges that UG nursing students also bring their own individual life experiences, culture, formal learning experience and education goals that contribute to their pharmacology learning and the development of their critical thinking and clinical decision making in pharmacology. The framework diagrammatically illustrates that students carry these into curriculum and with exposure and scaffolding of their learning, they develop the pharmacology knowledge,

decision making and application to the clinical placement setting in an ongoing manner. In doing this, students' progress through their program and develop to a beginning level of capability in pharmacology practice, in preparation for graduation.

Although not explicit from this study, there is a need to ensure the pharmacology component of curricula is guided by and meets requirements for ANMAC program accreditation. The NMBA requirements for registration also shows the pharmacology knowledge needed for graduating nursing students at an individual level and help to support them for safe pharmacology practice within the clinical setting (Nursing and Midwifery Board of Australia, 2018). The opportunity to expand students' pharmacology knowledge in a clinical context should also be encouraged to continue following completion of an UG nursing program, to promote the attitude of lifelong pharmacology learning for safe medicine care beyond graduation.

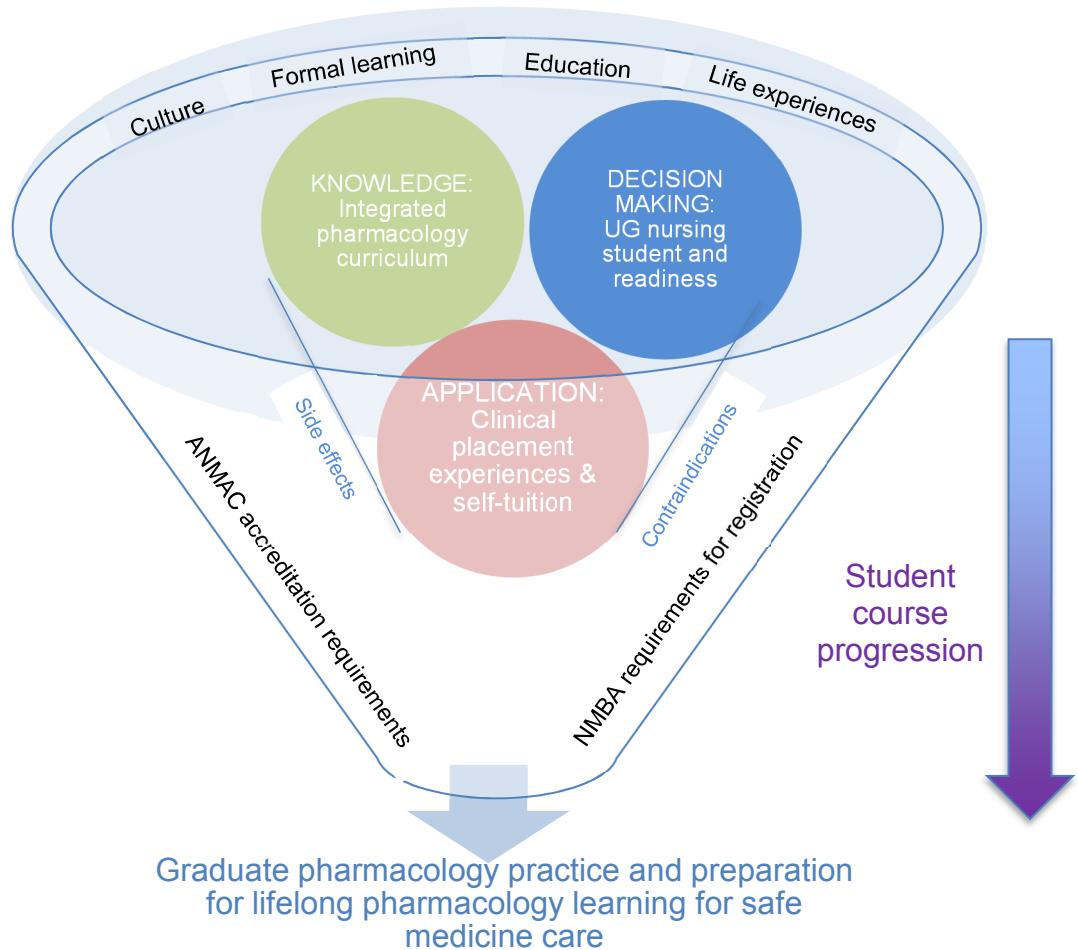


Figure 11. A Conceptual framework for pharmacology curricula in UG nursing programs

Application of this proposed conceptual framework within UG nursing pharmacology curriculum design may assist tertiary education providers to develop consistency in the teaching of pharmacology curricula across institutions, as previously advised by Bullock and Manias (2002). This approach would also aid in raising the profile of pharmacology consistently within UG nursing curricula, in particular where an integrated curriculum model is used and there is an apparent risk of pharmacology becoming 'lost'. It also provides a sound knowledge base for UG nursing students to continue to build upon as they progress through their program (Lanz & Davis, 2017). The literature supporting the conceptual framework is international, so with adaption, it could also be used outside Australia providing considerations are made around local regulatory and accreditation requirements. This conceptual framework outlines some considerations for teaching

pharmacology that may transcend individualised curriculum designs and structures across institutions.

5.6 Strengths and Limitations

This study used a two phase mixed methods approach to assess an integrated pharmacology curriculum and student opinions of their readiness for clinical placement. The quantitative nature of the online student survey adds to the existing body of literature about integrated pharmacology curriculum and complements existing, largely qualitative research conducted in the area of pharmacology curriculum delivery. The quantitative study design enabled the researcher to ascertain and examine the views of a larger number of students whilst taking into account the findings offered by previous qualitative research. In order to capture a representative sample, the researcher employed several legitimate strategies to improve response rates to the online student questionnaire (Dommeyer et al., 2004; Nulty, 2008; Plichta & Kelvin, 2013). These included assuring anonymity of participants, providing access via an online link, providing the researcher's contact details, regular reminders and by providing sufficient duration for students to respond to the survey towards the end of semester.

The findings that have been discussed support previous research undertaken in the broader biosciences context and existing pharmacology within nursing with a more specific view of integrated pharmacology learning from the UG nursing student perspective. It highlights important factors for consideration in an integrated approach to pharmacology curriculum delivery within UG nursing programs. It is one of few studies to consider UG nursing students' perceptions of their readiness for clinical placement within an integrated pharmacology curriculum. Tertiary institutions may use these findings as a foundation to assess their UG nursing programs and clinical experience structures for pharmacology learning.

There are a number of weaknesses identified with respect to this study. The synthesis of the literature presented in the integrative review only considered English language publications from the last 20 years, which may not have taken into account initiatives emerging in other non-English reports or from earlier years. Postgraduate degree programs or Nurse Practitioner study programs were not included in the review, which limits the generalisability of findings to other student groups.

A key limitation for this study is that it did not directly compare discrete and integrated pharmacology curriculum models. This study was exploratory in nature in order to assess the use of an integrated pharmacology curriculum structure at a single study site. It would be useful to replicate this on a wider scale and examine if participant expectations and perceptions vary between integrated versus discrete pharmacology curricula models. The study did not test or examine students' actual pharmacology knowledge, and recognises that student *perception* is not an indicator of their *actual* knowledge.

There are also certain limitations on the findings of this study in relation to the study context. The integrated pharmacology curriculum assessed in phase one of this study was atypical of most Australian UG nursing courses, being a seven semester degree (instead of six semesters) and comprising an interprofessional first year structure that included most health science disciplines. In particular, the first year structure of the course meant that nursing specific pharmacology subject matter learning was not commenced until the second year of the course (semester three). Although no new pharmacology subject matter is delivered to final semester students, considering responses from semester seven students would have provided further insight into their perceptions of their pharmacology learning following consolidation on their final clinical placement.

The study used a convenience sample and participation was voluntary in nature. Those students who were uncertain or not confident in their abilities may not have participated. Only 33% of potential participants responded to the online student questionnaire. This exposes the study to potential bias,

despite reaching an acceptable response rate for online surveys (Nulty, 2008). Completion of the student questionnaire was also dependent on students' computer literacy due to the online delivery method. It was considered that this would not be a barrier to these participants, as they regularly complete online surveys and use the internet and LMS Blackboard™ (Blackboard, 2015) throughout their studies (Barrios, Villarroya, Borrego, & Olle, 2011; Nulty, 2008). However, it is reasonable to accept that any survey which achieves only a sample of respondents from its target population will experience some degree of sampling error and feasibly some sample bias (Nulty, 2008).

5.7 Recommendations

5.7.1 Recommendations for educational practice.

The following pedagogical recommendations are made according to the major findings of this study, which has demonstrated that the use of an integrated pharmacology curriculum is worthy of consideration. This approach allows students to continue their pharmacology learning on clinical placement, and scaffolds and links the pharmacology subject matter provided in the bioscience and nursing practice units of study to clinical placement. It also horizontally and vertically links the pharmacology related concepts throughout curriculum to support student learning in pharmacology. This meets ANMAC requirements for pharmacology within the curriculum and provides value to the student in preparing them for NMBA requirements for registration.

Recommendations are made to assist nursing educators involved in the development, review and delivery of UG nursing curricula in relation to pharmacology teaching and learning within an integrated curriculum approach. These include:

1. Comprehensively mapping curriculum to show horizontal and vertical integration of pharmacology subject matter and related concepts to demonstrate where it is captured.

2. Mapping curriculum to validate the pharmacology content provided in an integrated model and show how it meets the minimum requirements for accreditation with bodies such as ANMAC.
3. Reinforcing with students how the integrated pharmacology curriculum links to requirements for NMBA registration and practice.
4. Providing pharmacology subject matter predominantly within the bioscience and nursing practice unit streams.
5. Linking pharmacology related concepts within other units of study (such as inquiry stream units) to assimilate pharmacology throughout the curriculum.
6. Scaffolding pharmacology subject matter and related concepts horizontally and vertically throughout curriculum to link to the clinical placement experiences of students.
7. Ensuring pharmacology within units are scaffolded and linked across aspects of teaching such as through the use of case based learning strategies to progressively build complexity from foundation to capstone as students' progress in their studies.
8. Linking pharmacology subject matter and related concepts through theoretical content, laboratory teaching and simulation learning to support ongoing development of pharmacology knowledge when on clinical placement
9. Confirming UCs are aware of the need for integration, so pharmacology subject matter and related concepts are not lost within curriculum.
10. Supporting opportunities for pharmacology learning on clinical placement.
11. Offering strategies for self-tuition and self-directed learning to support consolidation of student knowledge whilst attending clinical placement.
12. Ensuring further attention is given to the teaching of side effects and contraindications of medications within UG nursing curricula. This may include clearer application of these concepts whilst attending clinical placement, to give students the opportunity to consolidate their pharmacology knowledge and support the development of their ongoing readiness in pharmacology within the clinical context.

13. Consideration of individual learning styles, approaches that may improve the student learning experience and accommodate students who disliked the integrated approach.
14. Supporting students to develop their competence in pharmacology from unconscious incompetence towards unconscious competence as they progress through their program.
15. Implementation of integrated pharmacology curriculum (with an evaluative component) within other nursing programs such as graduate entry masters and nurse practitioner degrees.

5.7.2 Further research recommendations.

This study has revealed existing knowledge gaps that could be addressed through further research, which may include:

1. Comparison of student cohorts studying within a curriculum that utilise discrete pharmacology units with students studying in a curriculum that utilise an integrated approach, as previously recommended by Manias and Bullock (2002b). Having access to cohorts of UG nursing students undertaking studies within these differing curriculum structures across different sites would provide further insight into how student readiness for clinical placement may be the same or differs.
2. Ascertaining the extent to which the current data reflects a knowledge deficit and/or a lack of confidence of UG nursing students' in their pharmacology knowledge. It would therefore be useful to extend parts of this study using qualitative methods to allow participants the opportunity to elaborate on their feelings and views. It would add further to the work of Manias and Bullock (2002b) and provide a more contemporary, in-depth view of the perceived barriers to learning and consolidating pharmacology learning in clinical placement and offer potential strategies to enhance pharmacology learning of the UG nursing student. This would further contribute to the ongoing development of successfully integrated pharmacology content in UG nursing curricula.

3. Assessing whether students' actual and perceived knowledge are the same or different using a knowledge-based quiz alongside a self-rating questionnaire.
4. Exploring the responses of the 'self-tuition' question posed in the online student questionnaire may be beneficial. The data obtained in this study does not elucidate if 'self-tuition' refers to unit materials provided or a participants' own study. Asking about student perceptions of pharmacology content and their readiness for clinical placement in relation to either self-directed study (use of program learning materials provided on Bb) or self-tuition (self-study conducted over and above the program materials provided) may be useful.
5. Assessing the extent to which the data presented in this study reflects a national situation. A larger scale study across several sites could further inform the development of a best practice model or national guidelines, which if developed in consultation with ANMAC and NMBA could enhance consistency in pharmacology teaching across UG nursing curricula. Such a study should also consider the needs based on atypical curriculum structures such as the one presented.
6. Investigating the views of the first year and final semester UG nursing students to expand the view of the UG nursing student in relation to pharmacology learning needs for clinical placement.
7. Investigating the needs of nurses and clinical facilitators (working in the clinical setting) who mentor UG nursing students, to examine strategies that may further support UG nursing students' pharmacology learning whilst attending clinical placement.
8. Exploring different teaching modalities to support active learning in pharmacology curriculum delivery (i.e. blended learning, simulation, multimedia resources) to address different learning styles and learning needs of UG nursing students in pharmacology. How to best support pharmacology learning for UG nursing students whilst they attend clinical placement was a recommendation also previously suggested by Grandell-Niemi et al. (2005), although has not yet been adequately addressed.

9. Determining the quality of UG nursing students' pharmacology knowledge, decision making and application after they have been in the clinical practice setting for twelve months or longer. Longitudinal research into the application of pharmacology knowledge in the clinical environment could consider how effective pharmacology education at an UG level has contributed to the delivery of safe and effective pharmacology care in practice. It would also provide opportunity to develop strategies to improve pharmacology knowledge amongst groups other than just UG nursing students.

5.8 Conclusion

The key motivation for this study was the UG nursing student perceptions and expectations of their pharmacology knowledge within an integrated pharmacology curriculum delivery model and their corresponding readiness for clinical placement. Previous studies have highlighted that UG nursing programs require accountability to ensure pharmacology learning is not concealed or omitted if an integrated curriculum structure is used (Dilles et al., 2011; Foster et al., 2017; Lim & Honey, 2006; Manias, 2009; Manias & Bullock, 2002b; Meechan et al., 2011; Strayer & Beitz, 2010). Phase one has demonstrated the use of an integrated pharmacology curriculum.

The importance of using structured pharmacology subject matter and pharmacology related concepts within an integrated model, to scaffold learning horizontally and vertically throughout curriculum is illustrated. Clinical placement and self-tuition learning opportunities to support students' ongoing learning in pharmacology is also emphasised. Side effects and contraindications are challenging areas of pharmacology learning for students. Readiness in pharmacology develops over time as students' progress through their program. Analysis of findings highlight that the timing of pharmacology content delivery in relation to clinical placement does not impact student learning or attitudes when pharmacology content is continually emphasised and integrated throughout curriculum.

There are a number of implications from this study. It has demonstrated that a greater awareness of the structure of integrated pharmacology curriculum in an UG nursing program may support the development of students' ongoing learning in pharmacology. This may guide those involved in tertiary curriculum design and delivery to ensure if an integrated pharmacology curricula is delivered, it best prepares UG nursing students for pharmacology learning on clinical placement and ongoing into their clinical careers. In response to these findings, the conceptual framework presented in this study highlights key areas for consideration in pharmacology curriculum structure. These include pharmacology knowledge acquisition of the UG nursing student, application of pharmacology learning in a clinical context to help promote and support safe and effective care and pharmacology decision making in a clinical placement context. The delivery of effective pharmacology subject matter and related concepts support UG nursing students' learning experiences whilst attending clinical placement. An appreciation of the challenges faced in delivering pharmacology curricula to expand the links between theory and clinical practice is acknowledged. Those with an interest in coordinating placement experiences and clinical facilitation may find the views of UG nursing students' useful to further support students on placements.

This study adds to current research in the area of integrated pharmacology content in UG nursing curriculum from the perspective of the student experience and their own perceptions of their readiness for clinical placement. It also provides information useful for the design and delivery of an integrated pharmacology curriculum, and supports current research exploring the translation of the student experience on clinical placement into their clinical practice upon registration. There is much scope for further study into initiatives to improve the experience of nursing students whilst on clinical placement in order to support their ongoing pharmacology learning and to develop their pharmacology knowledge.

References

- AHPRA. (2015). *AHPRA annual report 2014/2015*. Retrieved from
<http://www.ahpra.gov.au/annualreport/2015/downloads.html>
- Aitken, R., Manias, E., & Dunning, T. (2006). Documentation of medication management by graduate nurses in patient progress notes: A way forward for patient safety. *Collegian*, 13(4), 5-11.
[http://dx.doi.org/10.1016/S1322-7696\(08\)60533-8](http://dx.doi.org/10.1016/S1322-7696(08)60533-8)
- Alton, S. (2016). Learning how to learn: Meta-learning strategies for the challenges of learning pharmacology. *Nurse Education Today*, 38, 2-4. <http://dx.doi.org/10.1016/j.nedt.2016.01.003>
- Andersen, E., & Moralejo, L. (2016). Using the Delphi process to attain expert consensus on bioscience concepts, topics, and skills in undergraduate nursing curricula. *Journal of Nursing Education and Practice*, 6(1), 67-75. <http://dx.doi.org/10.5430/jnep.v6n1p67>
- Andrew, S., McVicar, A., Zanganeh, M., & Henderson, N. (2015). Self-efficacy and relevance of bioscience for nursing, midwifery and healthcare students. *Journal of Clinical Nursing*, 24(19-20), 2965-2972. <http://dx.doi.org/10.1111/jocn.12933>
- Ashurst, S. (1993). Nurses must improve their knowledge of pharmacology. *British Journal of Nursing*, 2(12), 608.
<http://dx.doi.org/10.12968/bjon.1993.2.12.608>
- Australian Commission on Safety and Quality in Healthcare. (2017). National Safety and Quality Health Service Standards. Retrieved from
<https://www.nationalstandards.safetyandquality.gov.au/>

- Australian Institute of Health and Welfare. (2014). Australia's registered health workforce by location. Retrieved from
http://analytics.aihw.gov.au/Viewer/VisualAnalyticsViewer_guest.jsp?reportPath=%2FAIHW%2FReleasedPublic%2FExpenditure%2FReports&reportName=Health%20Workforce&appSwitcherDisabled=true
- Australian Nursing and Midwifery Accreditation Council. (2012). ANMAC *Registered Nurse accreditation standards 2012*. Retrieved from
http://www.anmac.org.au/sites/default/files/documents/ANMAC_RN_Accreditation_Standards_2012.pdf
- Australian Qualifications Framework. (2013). AQF levels. Retrieved from
<http://www.aqf.edu.au/aqf/in-detail/aqf-levels/>
- Banning, M. (2003). Pharmacology education: A theoretical framework of applied pharmacology and therapeutics. *Nurse Education Today*, 23(6), 459-466.
- Banning, M. (2004). The use of structured assessments, practical skills and performance indicators to assess the ability of pre-registration nursing students' to apply the principles of pharmacology and therapeutics to the medication management needs of patients. *Nurse Education in Practice*, 4(2), 100-106. [http://dx.doi.org/10.1016/S1471-5953\(03\)00035-0](http://dx.doi.org/10.1016/S1471-5953(03)00035-0)
- Barkhouse-Mackeen, C., & Murphy, A. (2013). Pharmacology in undergraduate nursing education: Innovative strategies for enhancing medication related knowledge, attitudes, skills and behaviours. *Journal of Nursing Education and Practice*, 3(6), 91-101.

- Barrios, M., Villarroya, A., Borrego, A., & Olle, C. (2011). Response rates and data quality in web and mail surveys administered to PhD holders. *Social Science Computer Review*, 29(2), 208-220.
- <http://dx.doi.org/10.1177/0894439310368031>
- Bata-Jones, B., & Avery, M. D. (2004). Teaching pharmacology to graduate nursing students: Evaluation and comparison of web-based and face-to-face methods. *Journal of Nursing Education*, 43(4), 185-189.
- <http://dx.doi.org/10.3928/01484834-20040401-01>
- Benner, P. E. (2001). *From novice to expert: Excellence and power in clinical nursing practice*. Upper Saddle River, N.J.: Prentice Hall.
- Betty, R., & Kyriacos, U. (2016). Final year nursing students self-reported understanding of the relevance of bioscience. *International Journal of Nursing and Midwifery*, 8(5), 35-46.
- <http://dx.doi.org/10.5897/IJNM2016.0208>
- Birks, M., Ralph, N., Cant, R., Chun Tie, Y., & Hillman, E. (2017). Science knowledge needed for nursing practice: A cross-sectional survey of Australian Registered Nurses. *Collegian*, 25(2), 209-215.
- <http://dx.doi.org/10.1016/j.colegn.2017.05.005>
- Birks, M., Ralph, N., Cant, R., Hillman, E., & Chun Tie, Y. (2015). Teaching science content in nursing programs in Australia: A cross-sectional survey of academics. *BMC Nursing*, 14(1), 24-32.
- <http://dx.doi.org/10.1186/s12912-015-0074-x>
- Blackboard. (2015). Blackboard Learn (Version 9.1). Washington, D.C: Blackboard Inc.

- Boggs, P., Brown-Molnar, C. S., & Delapp, T. D. (1988). Nurses' drug knowledge. *Western Journal of Nursing Research*, 10(1), 84.
- Bourbonnais, F. F., & Caswell, W. (2014). Teaching successful medication administration today: More than just knowing your 'rights'. *Nurse Education in Practice*, 14(4), 391-395.
- <http://dx.doi.org/https://doi.org/10.1016/j.nepr.2014.03.003>
- Brady, A. M., Malone, A. M., & Fleming, S. (2009). A literature review of the individual and systems factors that contribute to medication errors in nursing practice. *Journal of Nursing Management*, 17, 679-697.
- <http://dx.doi.org/10.1111/j.1365-2834.2009.00995.x>
- Brown, T., Williams, B., McKenna, L., Palermo, C., McCall, L., Roller, L., . . . Aldabah, L. (2011). Practice education learning environments: The mismatch between perceived and preferred expectations of undergraduate health science students. *Nurse Education Today*, 31(8), 22-28.
- <http://dx.doi.org/https://doi.org/10.1016/j.nedt.2010.11.013>
- Bullock, S., & Manias, E. (2002). The educational preparation of undergraduate nursing students in pharmacology: A survey of lecturers' perceptions and experiences. *Journal of Advanced Nursing*, 40(1), 7-16.
- Burch, N. (1970). Conscious competence learning model. *Gordon Training International*. Retrieved from <https://examinedexistence.com/the-four-states-of-competence-explained/>
- Büttner, P. (2015). *Epidemiology* (2nd ed.). South Melbourne: Victoria Oxford University Press.

- Casey, G. (1996). The curriculum revolution and project 2000: A critical examination. *Nurse Education Today*, 16(2), 115-120.
[http://dx.doi.org/10.1016/S0260-6917\(96\)80067-0](http://dx.doi.org/10.1016/S0260-6917(96)80067-0)
- Chan, D. S. K. (2002). Associations between student learning outcomes from their clinical placement and their perceptions of the social climate of the clinical learning environment. *International Journal of Nursing Studies*, 39(5), 517-524. [http://dx.doi.org/10.1016/S0020-7489\(01\)00057-8](http://dx.doi.org/10.1016/S0020-7489(01)00057-8)
- Choo, J., Hutchinson, A., & Bucknall, T. (2010). Nurses' role in medication safety. *Journal of Nursing Management*, 18(7), 853-861.
<http://dx.doi.org/10.1111/j.1365-2834.2010.01164.x>
- Christensen, M., Craft, J. A., Wirihana, L., & Gordon, C. J. (2015). Pathophysiology team teaching: Bioscientist contribution to knowledge integration in a nursing subject. *Journal of Clinical Nursing*, 24(23-24), 3739-3741. <http://dx.doi.org/10.1111/jocn.12959>
- Clancy, J., McVicar, A., & Bird, D. (2000). Getting it right? An exploration of issues relating to the biological sciences in nurse education and nursing practice. *Journal of Advanced Nursing*, 32(6), 1522-1532.
<http://dx.doi.org/10.1046/j.1365-2648.2000.01608.x>
- Clarke, M. (1995). Nursing and the biological sciences. *Journal of Advanced Nursing*, 22(3), 405-406. <http://dx.doi.org/10.1046/j.1365-2648.1995.22030405.x>
- Cleary-Holdforth, J., & Leufer, T. (2013). The strategic role of education in the prevention of medication errors in nursing: Part 2. *Nurse*

Education in Practice, 13(3), 217-220.

<http://dx.doi.org/10.1016/j.nepr.2013.01.012>

Courtenay, M. (1991). A study of the teaching and learning of the biological sciences in nurse education. *Journal of Advanced Nursing*, 16(9), 1110-1116. <http://dx.doi.org/10.1111/j.1365-2648.1991.tb03372.x>

Craft, J., Christensen, M., Bakon, S., & Wirihana, L. (2017). Advancing student nurse knowledge of the biomedical sciences: A mixed methods study. *Nurse Education Today*, 48, 114-119.

<http://dx.doi.org/10.1016/j.nedt.2016.10.003>

Craft, J., Hudson, P., Plenderleith, M., Wirihana, L., & Gordon, C. (2013). Commencing nursing students' perceptions and anxiety of bioscience. *Nurse Education Today*, 33(11), 1399-1405.

<http://dx.doi.org/10.1016/j.nedt.2012.10.020>

Davies, S., Murphy, F., & Jordan, S. (2000). Bioscience in the pre-registration curriculum: Finding the right teaching strategy. *Nurse Education Today*, 20(2), 123-135.

<http://dx.doi.org/10.1054/nedt.1999.0375>

Davis, G. M. (2010). What is provided and what the registered nurse needs - bioscience learning through the pre-registration curriculum. *Nurse Education Today*, 30(8), 707-712.

<http://dx.doi.org/10.1016/j.nedt.2010.01.008>

Dilles, T., Vander Stichele, R. R., Van Bortel, L., & Elseviers, M. M. (2011). Nursing students' pharmacological knowledge and calculation skills. Ready for practice? *Nurse Education Today*, 31(5), 499-505.

Retrieved from <http://www.scopus.com/inward/record.url?eid=2-s2.0->

[79957651223&partnerID=40&md5=a39bb1ff2686ed5fdae0067c45750](#)

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Dommeyer, C. J., Baum, P., Hanna, R. W., & Chapman, K. S. (2004).

Gathering faculty teaching evaluations by in-class and online surveys: Their effects on response rates and evaluations. *Assessment & Evaluation in Higher Education*, 29(5), 611-623.

[http://dx.doi.org/10.1080/02602930410001689171](#)

Duffy, M. E. (2002). Methodological issues in web-based research. *Journal of Nursing Scholarship*, 34(1), 83-88. [http://dx.doi.org/10.1111/j.1547-5069.2002.00083.x](#)

Fell, P. L., Dobbins, K., & Dee, P. (2016). Bioscience learning in clinical placement: The experiences of pre-registration nursing students.

Journal of Clinical Nursing, 25(17-18), 2694-2705.

[http://dx.doi.org/10.1111/jocn.13097](#)

Foster, V., Collins, E., Dong, H., Nteff, G., & Pinkney, L. (2017). Teaching clinical pharmacology to undergraduate nursing students: Barriers and strategies. *Open Journal of Nursing*, 7(8), 918-929.

[http://dx.doi.org/10.4236/ojn.2017.78068](#)

Friedel, J. M., & Treagust, D. F. (2005). Learning bioscience in nursing education: Perceptions of the intended and the prescribed curriculum.

Learning in Health and Social Care, 4(4), 203-216.

[http://dx.doi.org/10.1111/j.1473-6861.2005.00104.x](#)

Geist, M., Larimore, D., Rawiszer, H., & Al Sager, A. (2015). Flipped versus traditional instruction and achievement in a baccalaureate nursing

- pharmacology course. *Nursing Education Perspectives*, 36(2), 114-115.
- Godshall, M. (2010). *Fast facts for evidence-based practice: Implementing EBP in a nutshell*. New York: Springer Publishing Company.
- Grandell-Niemi, H., Hupli, M., Leino-Kilpi, H., & Puukka, P. (2005). Finnish nurses' and nursing students' pharmacological skills. *Journal of Clinical Nursing*, 14(6), 685-694.
- Hanson, J. (2016). Surveying the experiences and perceptions of undergraduate nursing students of a flipped classroom approach to increase understanding of drug science and its application to clinical practice. *Nurse Education in Practice*, 16(1), 79-85.
<http://dx.doi.org/10.1016/j.nepr.2015.09.001>
- Harris, P., Nagy, S., & Vardaxis, N. J. (2014). *Mosby's dictionary of medicine, nursing and health professions* (3rd ed.). Chatswood, N.S.W. : Elsevier Australia.
- Honey, M., & Lim, A. G. (2008). Application of pharmacology knowledge in medication management by final year undergraduate nursing students. *Contemporary Nurse*, 30(1), 12-19.
- Ives, G., Hodge, K., Bullock, S., & Marriott, J. (1996). First year RNs' actual and self-rated pharmacology knowledge. *The Australian Journal of Advanced Nursing*, 14(1), 13.
- Jordan, S., Davies, S., & Green, B. (1999). The biosciences in the pre-registration nursing curriculum: Staff and students' perceptions of difficulties and relevance. *Nurse Education Today*, 19(3), 215-226.
[http://dx.doi.org/10.1016/S0260-6917\(99\)80007-0](http://dx.doi.org/10.1016/S0260-6917(99)80007-0)

- King, R. (2004). Nurses' perceptions of their pharmacology educational needs. *Journal of Advanced Nursing*, 45(4), 392-400.
- Krautscheid, L. C., Orton, V. J., Chorpenning, L., & Ryerson, R. (2011). Student nurse perceptions of effective medication administration education. *International Journal of Nursing Education Scholarship*, 8(1), 1-15. <http://dx.doi.org/10.2202/1548-923X.2178>
- Kyriacos, U., Jordan, S., & Van Den Heever, J. (2005). The biological sciences in nursing: A developing country perspective. *Journal of Advanced Nursing*, 52(1), 91-103. <http://dx.doi.org/10.1111/j.1365-2648.2005.03555.x>
- Lanz, G. A., & Davis, G. R. (2017). Pharmacology goes concept-based: Course design, implementation, and evaluation. *Nursing Education Perspectives*, 38(5), 279-280.
<http://dx.doi.org/10.1097/01.NEP.000000000000188>
- Larcombe, J., & Dick, J. (2003). Who is best qualified to teach bioscience to nurses? *Nursing Standard*, 17(51), 38-44.
<http://dx.doi.org/10.7748/ns2003.09.17.51.38.c3451>
- Latimer, S., Chaboyer, W., & Hall, T. (2011). Non-therapeutic medication omissions: Incidence and predictors at an Australian hospital. *Journal of Pharmacy Practice and Research*, 41(3), 188-191.
<http://dx.doi.org/doi:10.1002/j.2055-2335.2011.tb00859.x>
- Latimer, S., Hewitt, J., Stanbrough, R., & McAndrew, R. (2017). Reducing medication errors: Teaching strategies that increase nursing students' awareness of medication errors and their prevention. *Nurse Education Today*, 52, 7-9.

- Latter, S., Rycroft-Malone, J., Yerrell, P., & Shaw, D. (2000). Evaluating educational preparation for a health education role in practice: The case of medication education. *Journal of Advanced Nursing*, 32(5), 1282-1290. <http://dx.doi.org/10.1046/j.1365-2648.2000.01599.x>
- Latter, S., Rycroft-Malone, J., Yerrell, P., & Shaw, D. (2001). Nurses' educational preparation for a medication education role: Findings from a national survey. *Nurse Education Today*, 21(2), 143-154.
<http://dx.doi.org/10.1054/nedt.2000.0528>
- Latter, S., Yerrell, P., Rycroft-Malone, J., & Shaw, D. (2000). Nursing, medication education and the new policy agenda: The evidence base. *International Journal of Nursing Studies*, 37(6), 469-479.
[http://dx.doi.org/10.1016/S0020-7489\(00\)00026-2](http://dx.doi.org/10.1016/S0020-7489(00)00026-2)
- Levett-Jones, T., Pitt, V., Courtney-Pratt, H., Harbrow, G., & Rossiter, R. (2015). What are the primary concerns of nursing students as they prepare for and contemplate their first clinical placement experience? *Nurse Education in Practice*, 15(4), 304-309.
<http://dx.doi.org/10.1016/j.nepr.2015.03.012>
- Levett-Jones, T., & Reid-Searl, K. (2018). *The clinical placement: An essential guide for nursing students*. (4th ed.). Chatswood, NSW: Elsevier.
- Lim, A. G., & Honey, M. (2006). Integrated undergraduate nursing curriculum for pharmacology. *Nurse Education in Practice*, 6(3), 163-168.
<http://dx.doi.org/10.1016/j.nepr.2005.11.005>
- Lim, A. G., Honey, M., & Kilpatrick, J. (2007). Framework for teaching pharmacology to prepare graduate nurse for prescribing in New

- Zealand. *Nurse Education in Practice*, 7(5), 348-353.
<http://dx.doi.org/10.1016/j.nepr.2006.11.006>
- Lim, A. G., & Honey, M. L. (2017). New graduate nurses' knowledge and skills in medication management: Implications for clinical settings. *The Journal of Continuing Education in Nursing*, 48(6), 276-281.
<http://dx.doi.org/10.3928/00220124-20170517-09>
- Lloyd, H., Hinton, T., Bullock, S., Babey, A.-M., Davis, E., Fernandes, L., . . . Ziegas, J. (2013). An evaluation of pharmacology curricula in Australian science and health-related degree programs. *BMC Medical Education*, 13(1), 1-15. <http://dx.doi.org/10.1186/1472-6920-13-153>
- Logan, P. A., & Angel, L. (2011). Nursing as a scientific undertaking and the intersection with science in undergraduate studies: Implications for nursing management. *Journal of Nursing Management*, 19(3), 407.
<http://dx.doi.org/10.1111/j.1365-2834.2011.01247.x>
- Manias, E. (2009). Pharmacology content in undergraduate nursing programs: Is there enough to support nurses in providing safe and effective care? *International Journal of Nursing Studies*, 46(1), 1-3.
<http://dx.doi.org/10.1016/j.ijnurstu.2008.06.002>
- Manias, E., & Bullock, S. (2002a). The educational preparation of undergraduate nursing students in pharmacology: Clinical nurses' perceptions and experiences of graduate nurses' medication knowledge. *International Journal of Nursing Studies*, 39(8), 773-784.
[http://dx.doi.org/10.1016/S0020-7489\(02\)00008-1](http://dx.doi.org/10.1016/S0020-7489(02)00008-1)
- Manias, E., & Bullock, S. (2002b). The educational preparation of undergraduate nursing students in pharmacology: Perceptions and

- experiences of lecturers and students. *International Journal of Nursing Studies*, 39(7), 757-769. [http://dx.doi.org/10.1016/S0020-7489\(02\)00018-4](http://dx.doi.org/10.1016/S0020-7489(02)00018-4)
- McMullan, M., Jones, R., & Lea, S. (2010). Patient safety: Numerical skills and drug calculation abilities of nursing students and Registered Nurses. *Journal of Advanced Nursing*, 66(4), 891-899.
<http://dx.doi.org/10.1111/j.1365-2648.2010.05258.x>
- McVicar, A., Andrew, S., & Kemble, R. (2014). Biosciences within the pre-registration (pre-requisite) curriculum: An integrative literature review of curriculum interventions 1990–2012. *Nurse Education Today*, 34(4), 560-568. <http://dx.doi.org/10.1016/j.nedt.2013.08.012>
- McVicar, A., Clancy, J., & Mayes, N. (2010). An exploratory study of the application of biosciences in practice, and implications for pre-qualifying education. *Nurse Education Today*, 30(7), 615-622.
<http://dx.doi.org/10.1016/j.nedt.2009.12.010>
- Meechan, R., Mason, V., & Catling, J. (2011). The impact of an integrated pharmacology and medicines management curriculum for undergraduate adult nursing students on the acquisition of applied drug/pharmacology knowledge. *Nurse Education Today*, 31(4), 383-389. <http://dx.doi.org/10.1016/j.nedt.2010.07.011>
- Midgley, K. (2006). Pre-registration student nurses perception of the hospital-learning environment during clinical placements. *Nurse Education Today*, 26(4), 338-345. <http://dx.doi.org/10.1016/j.nedt.2005.10.015>
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA group. (2009). Preferred reporting items for systematic reviews and meta-

- analyses: The PRISMA statement. *PLOS Medicine*, 6(7), e1000097.
<http://dx.doi.org/10.1371/journal.pmed.1000097>
- Molesworth, M., & Lewitt, M. (2016). Preregistration nursing students' perspectives on the learning, teaching and application of bioscience knowledge within practice. *Journal of Clinical Nursing*, 25(5-6), 725-732. <http://dx.doi.org/10.1111/jocn.13020>
- Morrison-Griffiths, S., Snowden, M. A., & Pirmohamed, M. (2002). Pre-registration nurse education in pharmacology: Is it adequate for the roles that nurses are expected to fulfill? *Nurse Education Today*, 22(6), 447-456.
- National Health and Medical Research Council. (2007). *Australian code for the responsible conduct of research: Revision of the joint NHMRC/AVCC statement and guidelines on research practice*. Canberra: Australian Government.
- Ndosi, M., & Newell, R. (2009). Nurses' knowledge of pharmacology behind drugs they commonly administer. *Journal of Clinical Nursing*, 18, 570-580. <http://dx.doi.org/10.1111/j.1365-2702.2008.02290.x>
- Nolan, C. A. (1998). Learning on clinical placement: The experience of six Australian student nurses. *Nurse Education Today*, 18(8), 622-629. [http://dx.doi.org/10.1016/S0260-6917\(98\)80059-2](http://dx.doi.org/10.1016/S0260-6917(98)80059-2)
- Nulty, D. (2008). The adequacy of response rates to online and paper surveys: What can be done? *Assessment & Evaluation in Higher Education*, 33(3), 301-314. <http://dx.doi.org/10.1080/02602930701293231>

Nursing and Midwifery Board of Australia. (2010). Registration standard for endorsement for scheduled medicines registered nurses. Retrieved from <http://www.nursingmidwiferyboard.gov.au/Registration-Standards.aspx>

Nursing and Midwifery Board of Australia. (2018). Registration standards. Retrieved from <https://www.nursingmidwiferyboard.gov.au/registration-standards.aspx>

NVivo. (2012). NVivo 10 for Windows (Version 10, 2012): QSR International Pty Ltd.

Ozturk, C., Muslu, G. K., & Dicle, A. (2008). A comparison of problem-based and traditional education on nursing students' critical thinking dispositions. *Nurse Education Today*, 28(5), 627-632.

<http://dx.doi.org/10.1016/j.nedt.2007.10.001>

Page, K., & McKinney, A. A. (2007). Addressing medication errors: The role of undergraduate nurse education. *Nurse Education Today*, 27(3), 219-224. <http://dx.doi.org/10.1016/j.nedt.2006.05.002>

Papp, I., Markkanen, M., & Von Bonsdorff, M. (2003). Clinical environment as a learning environment: Student nurses' perceptions concerning clinical learning experiences. *Nurse Education Today*, 23(4), 262-268.

[http://dx.doi.org/10.1016/S0260-6917\(02\)00185-5](http://dx.doi.org/10.1016/S0260-6917(02)00185-5)

Parkes, M. E. (1984). Blueprint for change: An overview of developments in nursing education in Australia. *International Journal of Nursing Studies*, 21(3), 177-182. [http://dx.doi.org/10.1016/0020-7489\(84\)90038-5](http://dx.doi.org/10.1016/0020-7489(84)90038-5)

- Plichta, S. B., & Kelvin, E. A. (2013). *Munro's statistical methods for health care research* (6th ed.). Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.
- Polit, D. F., & Beck, C. T. (2014). *Essentials of nursing research: Appraising evidence for nursing practice* (8th ed.). Philadelphia: Wolters Kluwer Health /Lippincott Williams & Wilkins.
- Prowse, M. A., & Heath, V. (2005). Working collaboratively in health care contexts: The influence of bioscientific knowledge on patient outcomes. *Nurse Education Today*, 25(2), 132-139.
<http://dx.doi.org/10.1016/j.nedt.2004.11.007>
- Robinson, J. E. (1987). Separate or integrated pharmacology content? *Nurs Outlook*, 35(4), 185-188.
- Roughead, E. E., Semple, S. J., & Rosenfeld, E. (2016). The extent of medication errors and adverse drug reactions throughout the patient journey in acute care in Australia. *International Journal of Evidence-Based Healthcare*, 14(3), 113-122.
<http://dx.doi.org/10.1097/XEB.0000000000000075>
- Saleem, Z., Tabassum, N., & Asif, N. (2014). Case based scenarios: Evidence based teaching learning strategy in nursing education pharmacology course. *International Journal of Nursing*, 1(2)
<http://dx.doi.org/10.15640/ijn.v1n2a11>
- Sansnee, J. (2011). *Research methods in nursing and midwifery: Pathways to evidence-based practice*. South Melbourne, Victoria: Oxford University Press.

Schulz, K. F., Altman, D. G., & Moher, D. (2010). CONSORT 2010

Statement: Updated guidelines for reporting parallel group randomised trials. *BMC Medicine*, 8(1), 18. <http://dx.doi.org/10.1186/1741-7015-8-18>

Shuldhams, C., Fleming, S., Yorke, J., (2008). Undertaking a systematic review: the road to successful completion. *Journal of Research in Nursing*, 13(4), 282-298.

Simonsen, B. Ø., Dæhlin, G. K., Johansson, I. S., & Farup, P. G. (2014). Differences in medication knowledge and risk of errors between graduating nursing students and working registered nurses: Comparative study. *BMC Health Services Research*, 14, 1-11.
<http://dx.doi.org/10.1186/s12913-014-0580-7>

Smales, K. (2010). Learning and applying biosciences to clinical practice in nursing. *Nursing Standard*, 24(33), 35-39.

Sodha, M., McLaughlin, M., Williams, G., & Dhillon, S. (2002). Nurses' confidence and pharmacological knowledge: A study. *British Journal of Community Nursing*, 7(6), 309-315.

Strayer, R. M., & Beitz, J. M. (2010). Factors influencing pharmacology knowledge acquisition in traditional versus nontraditional baccalaureate nursing students. *Journal of Professional Nursing*, 26(5), 301-308.

Sulosaari, V., Huupponen, R., Hupli, M., Puukka, P., Torniainen, K., & Leino-Kilpi, H. (2015). Factors associated with nursing students' medication competence at the beginning and end of their education. *BMC Medical*

Education, 15, 223 - 233. <http://dx.doi.org/10.1186/s12909-015-0513-0>

- Sulosaari, V., Huupponen, R., Torniainen, K., Hupli, M., Puukka, P., & Leino-Kilpi, H. (2014). Medication education in nursing programmes in Finland: Findings from a national survey. *Collegian, 21*(4), 327-335.
<http://dx.doi.org/10.1016/j.colegn.2013.08.003>
- Sulosaari, V., Kajander, S., Hupli, M., Huupponen, R., & Leino-Kilpi, H. (2012). Nurse students' medication competence: An integrative review of the associated factors. *Nurse Education Today, 32*(4), 399-405.
<http://dx.doi.org/10.1016/j.nedt.2011.05.016>
- Taylor, V., Ashelford, S., Fell, P., & Goacher, P. J. (2015). Biosciences in nurse education: Is the curriculum fit for practice? Lecturers' views and recommendations from across the UK. *Journal of Clinical Nursing, 24*(19-20), 2797-2806. <http://dx.doi.org/10.1111/jocn.12880>
- Teddlie, C., & Tashakkori, A. (2009). Foundations of mixed methods research : integrating quantitative and qualitative approaches in the social and behavioral sciences. Thousand Oaks: Sage Publications.
- The Joanna Briggs Institute. Critical appraisal tools. Retrieved from
<http://joannabriggs.org/research/critical-appraisal-tools.html>
- The Joanna Briggs Institute. (2014). *Joanna Briggs Institute Reviewers' Manual*. Australia: The Joanna Briggs Institute.
- Trnobrański, P. H. (1993). Biological sciences and the nursing curriculum: a challenge for educationalists. *Journal of Advanced Nursing, 18*(3), 493-499. <http://dx.doi.org/10.1046/j.1365-2648.1993.18030493.x>

- Tse, M. M., & Lo, L. W. (2008). A web-based e-learning course: Integration of pathophysiology into pharmacology. *Telemedicine and eHealth*, 14(9), 919-924. <http://dx.doi.org/10.1089/tmj.2008.0006>
- Vaismoradi, M., Jordan, S., Turunen, H., & Bondas, T. (2014). Nursing students' perspectives of the cause of medication errors. *Nurse Education Today*, 34(3), 434-440.
<http://dx.doi.org/10.1016/j.nedt.2013.04.015>
- Weaver, K., & Olson, J. K. (2006). Understanding paradigms used for nursing research. *Journal of Advanced Nursing*, 53(4), 459-469.
<http://dx.doi.org/10.1111/j.1365-2648.2006.03740.x>
- Whitehair, L., Provost, S., & Hurley, J. (2014). Identification of prescribing errors by pre-registration student nurses: A cross-sectional observational study utilising a prescription medication quiz. *Nurse Education Today*, 34(2), 225-232.
<http://dx.doi.org/https://doi.org/10.1016/j.nedt.2012.12.010>
- Whittemore, R., & Knafl, K. (2005). The integrative review: Updated methodology. *Journal of Advanced Nursing*, 52(5), 546-553.
<http://dx.doi.org/10.1111/j.1365-2648.2005.03621.x>
- Woodman, O. L., Dodds, A. E., Mosepele, M., & Frauman, A. G. (2004). Teaching pharmacology to medical students in an integrated problem-based learning curriculum: An Australian perspective. *Acta Pharmacologica Sinica*, 25(9), 1195-1203.
- World Health Organisation. (2017). Global health workforce statistics database. Geneva: World Health Organisation. Retrieved from <http://www.who.int/hrh/statistics/hwfstats/>

Wright, K. (2007). Student nurses need more than maths to improve their drug calculating skills. *Nurse Education Today*, 27(4), 278-285.

<http://dx.doi.org/10.1016/j.nedt.2006.05.007>

Wright, K. (2010). Do calculation errors by nurses cause medication errors in clinical practice? A literature review. *Nurse Education Today*, 30(1), 85-97. <http://dx.doi.org/10.1016/j.nedt.2009.06.009>

Wynne, N., Brand, S., & Smith, R. (1997). Incomplete holism in pre-registration nurse education: The position of the biological sciences. *Journal of Advanced Nursing*, 26(3), 470-474.

<http://dx.doi.org/10.1046/j.1365-2648.1997.t01-4-00999.x>

Zellner, K., Boerst, C., & Semling, K. (2003). Teaching separate versus integrated pharmacology content. *Western Journal of Nursing Research*, 25(3), 338-348.

<http://dx.doi.org/10.1177/0193945902250422>

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Appendix One - JBI Standardised Critical Appraisal Tools

JBI QARI Critical Appraisal Checklist for Interpretive and Critical Research

Reviewer _____ Date _____

Author _____ Year _____ Record Number _____				
	Yes	No	Unclear	Not applicable
1. Is there congruity between the stated philosophical perspective and the research methodology?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Is there congruity between the research methodology and the research question or objectives?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Is there congruity between the research methodology and the methods used to collect data?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Is there congruity between the research methodology and the representation and analysis of data?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Is there congruity between the research methodology and the interpretation of results?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Is there a statement locating the researcher culturally or theoretically?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Is the influence of the researcher on the research, and vice- versa, addressed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Are participants, and their voices, adequately represented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion) _____

JBI MASTARI Critical Appraisal Checklist for Descriptive/Case Series

Reviewer _____ Date _____

Author _____ Year _____ Record Number _____

	Yes	No	Unclear	Not applicable
1. Was study based on a random or pseudo-random sample?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Were the criteria for inclusion in the sample clearly defined?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Were confounding factors identified and strategies to deal with them stated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Were outcomes assessed using objective criteria?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. If comparisons are being made, was there sufficient descriptions of the groups?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Was follow up carried out over a sufficient time period?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Were the outcomes of people who withdrew described and included in the analysis?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Were outcomes measured in a reliable way?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Was appropriate statistical analysis used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Overall appraisal: Include Exclude Seek further info
Comments (Including reason for exclusion)

Appendix Two - Critical Assessment Using QARI (Qualitative Assessment Tool)

Rankings for Included Studies

Study	Q1 Congruity between the stated philosophical perspective and the research methodology <i>It was agreed that if the study demonstrated a sound qualitative approach rather than a stated philosophical perspective, it would be rated as satisfactory.</i> (desirable but not essential criterion)	Q2 Congruity between the research methodology and the research question or objectives <i>It was agreed that a study design that was congruent with the interpretative paradigm would be rated as satisfactory.</i> (essential criterion)	Q3 Congruity between the research methodology and the methods used to collect data <i>It was agreed that if the methods used were congruent with the interpretative paradigm, it would be rated as satisfactory.</i> (essential criterion)	Q4 Congruity between the research methodology and the representation and analysis of data <i>It was agreed that if the representation and analysis of the data was congruent with the interpretative paradigm, it would be rated as satisfactory.</i> (essential criterion)	Q5 There is congruence between the research methodology and the interpretation of results <i>It was agreed that the interpretation of results would be congruent with the interpretative paradigm.</i> (essential criterion)	Q6 Locating the researcher culturally or theoretically <i>It was agreed that the context of the study would suffice to meet these criteria.</i> (essential criterion)	Q7 Influence of the researcher on the research, and vice-versa, is addressed <i>(desirable but not essential criterion)</i>	Q8 Representation of participants and their voices <i>(essential criterion)</i>	Q9 Ethical approval by an appropriate body <i>(essential criterion)</i>	Q10 Relationship of conclusions to analysis, or interpretation of data. <i>(essential criterion)</i>	Score
Honey and Lim (2008)	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	9/10
King (2004)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
Manias and Bullock (2002a)	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	9/10

Study	Q1 Congruity between the stated philosophical perspective and the research methodology <i>It was agreed that if the study demonstrated a sound qualitative approach rather than a stated philosophical perspective, it would be rated as satisfactory.</i> (desirable but not essential criterion)	Q2 Congruity between the research methodology and the research question or objectives <i>It was agreed that a study design that was congruent with the interpretative paradigm would be rated as satisfactory.</i> (essential criterion)	Q3 Congruity between the research methodology and the methods used to collect data <i>It was agreed that if the methods used were congruent with the interpretative paradigm, it would be rated as satisfactory.</i> (essential criterion)	Q4 Congruity between the research methodology and the representation and analysis of data <i>It was agreed that if the representation and analysis of the data was congruent with the interpretative paradigm, it would be rated as satisfactory.</i> (essential criterion)	Q5 There is congruence between the research methodology and the interpretation of results <i>It was agreed that if the interpretation of results would be congruent with the interpretative paradigm.</i> (essential criterion)	Q6 Locating the researcher culturally or theoretically <i>It was agreed that the context of the study would suffice to meet these criteria.</i> (essential criterion)	Q7 Influence of the researcher on the research, and vice-versa, is addressed <i>(desirable but not essential criterion)</i>	Q8 Representation of participants and their voices <i>(essential criterion)</i>	Q9 Ethical approval by an appropriate body <i>(essential criterion)</i>	Q10 Relationship of conclusions to analysis, or interpretation of data. <i>(essential criterion)</i>	Score
Manias and Bullock (2002b)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/10
Morrison-Griffiths et al (2002)*	x	x	x	x	x	✓	x	✓	x	✓	3/10

Note. *Indicates assessment of qualitative data from study reported as mixed methods

Appendix Three - Critical Assessment Using MAStARI (Descriptive Case Studies)

Rankings for Included Studies

Study	Q1 Study based on a random or pseudo-random sample (desirable, but not an essential item)	Q2 Criteria for inclusion in the sample clearly defined (essential criterion)	Q3 Confounding factors identified and strategies to deal with them stated (essential criterion)	Q4 Outcomes assessed using objective criteria (essential criterion)	Q5 If comparisons are being made (within or between groups), is there sufficient description of groups?	Q6 Follow-up carried out over a sufficient period of time	Q7 Outcomes of people who withdraw are described and included in the analysis	Q8 Outcomes are measured in a reliable way (essential criterion)	Q9 Appropriate statistical analysis used (essential criterion)	Q10 Ethical considerations addressed (essential criterion)	Score
Bullock and Manias (2002)*	x	✓	✓	✓	n/a	n/a	✓	✓	✓	✓	7/8
Dilles et al (2011)	x	✓	✓	✓	✓	n/a	✓	✓	✓	✓	8/9
Foster et al (2017)	x	✓	✓	✓	✓	n/a	✓	✓	✓	✓	8/9

Study	Q1 Study based on a random or pseudo-random sample (desirable, but not an essential item)	Q2 Criteria for inclusion in the sample clearly defined (essential criterion)	Q3 Confounding factors identified and strategies to deal with them stated (essential criterion)	Q4 Outcomes assessed using objective criteria (essential criterion)	Q5 If comparisons are being made (within or between groups), is there sufficient description of groups?	Q6 Follow-up carried out over a sufficient period of time	Q7 Outcomes of people who withdraw are described and included in the analysis	Q8 Outcomes are measured in a reliable way (essential criterion)	Q9 Appropriate statistical analysis used (essential criterion)	Q10 Ethical considerations addressed (essential criterion)	Score
Grandell-Niemi et al (2005)	x	✓	✓	✓	✓	n/a	x	✓	✓	✓	7/9
Latter et al (2001)*	x	✓	✓	✓	✓	n/a	✓	✓	✓	✓	8/9
Meechan et al (2011)	x	✓	✓	✓	✓	n/a	x	✓	✓	✓	7/9
Morrison-Griffiths et al (2002)*	x	✓	x	✓	n/a	n/a	✓	x	x	x	3/8

Study	Q1 Study based on a random or pseudo-random sample (desirable, but not an essential item)	Q2 Criteria for inclusion in the sample clearly defined (essential criterion)	Q3 Confounding factors identified and strategies to deal with them stated (essential criterion)	Q4 Outcomes assessed using objective criteria (essential criterion)	Q5 If comparisons are being made (within or between groups), is there sufficient description of groups?	Q6 Follow-up carried out over a sufficient period of time	Q7 Outcomes of people who withdraw are described and included in the analysis	Q8 Outcomes are measured in a reliable way (essential criterion)	Q9 Appropriate statistical analysis used (essential criterion)	Q10 Ethical considerations addressed (essential criterion)	Score
Strayer and Beitz (2010)	x	✓	✓	✓	✓	n/a	x	✓	✓	✓	7/9
Sulosaari et al (2014)	x	✓	✓	✓	✓	n/a	✓	✓	✓	✓	8/9
Zellner et al (2003)	x	✓	✓	✓	✓	n/a	n/a	✓	✓	x	6/8

Note. *Indicates assessment of quantitative data from study reported as mixed methods.

Appendix Four - Program Stream and Unit Structure in the BSc Nursing Curriculum

Semester	Inquiry stream	Behavioural science stream	Bioscience stream	Nursing practice stream
1	CMHL1000 Foundations for Professional Health Practice	NURS1003 Imagining Health in Social and Cultural Contexts	HUMB1000 Human Structure and Function	NURS1000 Foundations of Nursing Practice
2	CMHL1001 Evidence Informed Health Practice	INDH1000 Indigenous Cultures and Health & CMHL1003 Health and Health Behaviour	HUMB1001 Integrated Systems Anatomy and Physiology	NURS1002 Fundamentals of Nursing Practice
3	NURS2001 Inquiry for Chronic Care	NURS2003 Behavioural Perspectives of Lifespan	GMED2000 Applied Bioscience for Chronic Conditions	NURS2002 Integrated Nursing Practice
4	NURS2004 Inquiry for Professional Practice	NURS2000 Behavioural Responses to Chronic Illness	GMED2001 Applied Bioscience for Acute Conditions	NURS2005 Integrated Clinical Practice
5	NURS3003 Inquiry for Evidence-based Practice	NURS3001 Behavioural Responses to Acute Illness	GMED3008 Applied Bioscience for Complex Conditions	CRIT3000 Complex Nursing Practice 1
6	NURS3002 Inquiry for Complex Care	MENT3000 Behavioural Perspectives of Mental Wellbeing	GMED3009 Applied Bioscience for Critical Conditions	CRIT3001 Complex Nursing Practice 2
7	NURS4001 Nursing and Midwifery Capstone			NURS4002 Transitional Nursing Practice

Appendix Five - Document Mapping and Integration Review Key Search Terms

Thesaurus search terms applied using NVivo™ across all core unit outlines (n = 27) included:

Main themes (pharmacology content)

Major categories:

Medication(s)/Medicine(s)/Drug(s)/ Medicinal/ Medicative
Prescription
Prescription medicine(s)
Pharmacology
Pharmacotherapy
Pharmacotherapeutics
Pharmacological
Pharmaceutical
Pharmacokinetics
Pharmacodynamics
Therapeutic use

Subcategories/minor categories:

Pill
Toxicology
Apothecary
Posology/ Posologist
Curative/Healing/Remedy
Complementary medicines
Alternative medicines

Adverse event(s)
Adverse reaction(s)
Interaction(s)
Drug interaction
Allergy/Allergies
Side effect(s)
Efficacy
Therapeutic range
Therapeutic effect
Peak level
Loading dose
Duration of action
Half life
Toxic range
Therapeutic index
Agonist
Antagonist
Absorption
Distribution
Metabolism
Excretion

Biotransformation

Syrup

Tablet

Capsule

Lozenge

Wafer

Enteral

Parenteral

topical

Syringe

Tonic

Oral

Elixir

Suppository

Injection

Subcutaneous/ SC

Intravenous/ IV

Intramuscular/ IM

Sublingual/ SL

Buccal

Lotion

Cream

Patches

Vaccine(s)/ Vaccination(s)

Dose(s)/ Dosage(s)

Route

Placebo

Subthemes (pharmacology related concepts)

Medicolegal

Medication mathematics

Medication calculations

Dosage calculations

Drug calculations

Appendix Six - Verification of Document Mapping: Tool for Unit Coordinators

Integrated pharmacology in an undergraduate nursing curriculum: the nursing students' perceptions of their readiness for clinical placement

Unit Coordinator document analysis verification

Thank you for agreeing to participate in this document verification as part of my MPhil research study.

My name is Katie Sutton. I am a Masters student at Curtin University in Western Australia. I am currently undertaking research to evaluate the nursing students' perceptions of their readiness for clinical placement in relation to the integrated pharmacology content provided in undergraduate nursing curriculum.

Purpose of the research

The purpose of this document analysis is to gather data to determine the placement of integrated pharmacology teaching within the undergraduate nursing curriculum delivered at Curtin University, School of Nursing, Midwifery and Paramedicine.

Your role

Unit coordinators teaching Undergraduate Nursing units of study at Curtin University, School of Nursing, Midwifery and Paramedicine, in Semesters I through Semester VII inclusive are requested to participate.

Data generated will enable the researcher to determine where pharmacology knowledge is delivered to the Undergraduate nursing student. The questionnaire will take approximately 10-15 minutes of your time to complete.

Consent to participate

Please be aware that your participation is entirely voluntary. You can withdraw at any time without adverse consequence to yourself, or your involvement in current and future research studies. In completing this document, it is assumed that you have agreed to participate in the research.

Confidentiality

All data will remain confidential and your privacy will be respected and maintained. The ongoing storage and security of research records will be undertaken in accordance with the Western Australian University Sector Disposal Authority. Data will be kept in a locked cabinet and in password protected files for at least seven years.

Further information

This study has been approved under Curtin University's process for lower-risk Studies (Approval Number SONM41-2014). This process complies with the National Statement on Ethical Conduct in Human Research (Chapter 5.1.7 and Chapters 5.1.18-5.1.21), and Curtin University Office of Strategy and Planning.

For further information on this study contact the researchers named above or the Curtin University Human Research Ethics Committee c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth 6845 or by telephoning 9266 9223 or by emailing hrec@curtin.edu.au. If you would like further information or clarification about the study, please contact the researcher at any time via email at katie.sutton@student.curtin.edu.au. Thank you for your valued participation.
Kind regards,
Katie Sutton, MPhil Candidate.

Integrated pharmacology in an undergraduate nursing curriculum: the nursing students' perceptions of their readiness for clinical placement
Katie Sutton MPhil Candidate
Supervisors: Prof G Leslie and Dr Janie Brown

Thank you for agreeing to participate in the document analysis review and verification, which forms part of my MPhil (Nursing) research. Your involvement as Unit Coordinator of your specified Undergraduate unit is greatly appreciated.

This study has been approved under Curtin University's process for lower-risk Studies (Approval Number SONM41-2014). This process complies with the National Statement on Ethical Conduct in Human Research (Chapter 5.1.7 and Chapters 5.1.18-5.1.21).

For further information on this study contact the researchers named above or the Curtin University Human Research Ethics Committee c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth 6845 or by telephoning 9266 9223 or by emailing hrec@curtin.edu.au

PLEASE COMPLETE:

Unit Coordinator Name:

Undergraduate Nursing Unit:

Please review the document analysis undertaken on your unit run in Semester 1 2015, as provided in the attached file (Appendix A). Please review the entire document analysis first before completing feedback. After you have finished, please answer the four questions below, answering either **YES** or **NO**. Answer by circling or highlighting the response you choose under each question. Please add any relevant comments if you wish to further explain your answers. I will then arrange a time to meet with you to clarify any information provided if required. Please send response via return email to katie.sutton@student.curtin.edu.au

Definition:

For the purposes of this study, the term 'Pharmacology' is defined as the study of the preparation, properties, uses, and actions of drugs.

Please circle your chosen answer and provide comments below:

1. Are pharmacology concepts taught in your unit of study?

YES

NO

If answering NO – thank you for your participation – end of questions.

If answering YES, what concepts are taught?

2. Are these pharmacology concepts documented in your unit outline for this unit of study?

YES

NO

If answering NO, please explain below:

3. Does the terminology *treatment*, *therapeutic management* or *medicolegal* if used in your unit outline relate to the teaching of pharmacology content (as per definition provided on page 2)?

YES

NO

If answering YES, please explain below:

4. Does the document analysis provided accurately represent where pharmacology content sits within your unit?

YES

NO

If answering NO, please outline what has been omitted and clarify where and how pharmacology content is provided?

After you finish, you may wish to discuss your comments further with me, or I may need to seek further clarification from you about the information provided. If so, please contact me via katie.sutton@curtin.edu.au to arrange a mutually agreeable time.

Thank you for your assistance in assessing the accuracy of the results of the document analysis undertaken.

Kind regards,
Katie Sutton.

Appendix Seven - Existing Tools Modified and Adapted With Author Permission for Online Student Questionnaire

APPENDIX 5A – Manias & Bullock (2002b)

Nursing and Pharmacology Education (NPE) Questionnaire for Undergraduate Nursing courses

Interview Questions for Focus Groups

Student group:

Do you have a subject called pharmacology in your course? What do you regard as pharmacology?

What aspects of pharmacology are essential for practice?

What are the most difficult aspects relating to the learning of pharmacology?

What is the relationship between the theory of pharmacology knowledge and clinical practice?

What is your perception of the degree of integration between theory and practice with respect to pharmacology?

If there are problems, what is the nature of these problems?

Comment on the number of hours devoted to pharmacology in your course.

How valuable do you find your classwork in pharmacology?

How valuable do you find your clinical experiences in pharmacology?

How is the subject taught?

Could the subject be taught differently? If so, how?

In your ideal course, how would you organise the pharmacological component to gain the greatest benefit?

Academic staff group:

What aspects of pharmacology should students be expected to know? Why?

How is the pharmacology subject taught?

What resources are used in teaching pharmacology?

What assessment processes are used in pharmacology? How accurately do these assessment processes measure the students' level of pharmacology knowledge?

What is your perception of the teaching and learning of pharmacology in your course?

If there are problems, what is the nature of these problems?

Hospital nursing staff group:

In your view, what is the knowledge base of graduate nurses?

How do graduate nurses address their continuing educational development in pharmacology?

What aspects of pharmacology are essential for practice?

What aspects of theoretical pharmacology knowledge are important for practice?

What is the role of nurses in medication education?

What are your perceptions of your education in pharmacology?

How could undergraduate education in this area be improved?

How could continuing education in this area be improved?

Nursing and Pharmacology Education Questionnaire for Undergraduate Nursing Courses

- This questionnaire has been designed to obtain an overview of issues relating to the teaching of pharmacology in Victorian nursing programs.
- The focus of this research is on undergraduate nursing courses.
- A pilot study of the questionnaire has indicated that it takes approximately 20 minutes to complete.
- Please return the completed questionnaire and any course documentation in the pre-paid envelope enclosed.
- Completion of this questionnaire will indicate your consent to participate in this study.

The questionnaire is divided into two sections:

Section 1.

Questions where an overview of undergraduate nursing programs is required in relation to pharmacology teaching and assessment, together with the areas of communication and consumer education skills. The majority of these questions are formatted according to a Likert scale, although there are some open ended questions.

Section 2.

More detailed questions about the delivery of pharmacology teaching. These questions are formatted according to a Likert scale. There is also the opportunity for you to make further comments about pharmacology teaching and learning issues.

Section 1

Demographic Information

1. Please give your current job title.

.....
.....

2. Please indicate your background discipline (eg., nursing, pharmacy, pharmacology).

.....
.....

Pharmacology and the Curriculum

For the purposes of the questionnaire, you may find the following definition of pharmacology useful. Pharmacology: the study of the properties, uses and actions of drugs (Mosby's Medical, Nursing and Allied Health Dictionary, 1994).

3. Please indicate, by ticking the boxes provided, whether pharmacology is taught as a separate subject or not. If it is taught within a subject (eg., biosciences or nursing), please specify which subject it is a part of:

A separate subject	Yes <input type="checkbox"/>	No <input type="checkbox"/>
--------------------	---------------------------------	--------------------------------

If No, please specify which subject it is part of:
.....
.....

4. How many taught/teacher directed hours in the undergraduate nursing curriculum are dedicated to the teaching of pharmacology? *Please tick the time period that is the best approximation.*

Total hours in the undergraduate nursing program

0 <input type="checkbox"/>	1-5 <input type="checkbox"/>	6-10 <input type="checkbox"/>	11-15 <input type="checkbox"/>	16-20 <input type="checkbox"/>	21-25 <input type="checkbox"/>	>30 <input type="checkbox"/>
-------------------------------	---------------------------------	----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	---------------------------------

5. Where is the teaching of pharmacology located in the undergraduate curriculum? *Please answer by ticking the boxes provided.*

First year, first Semester	<input type="checkbox"/>
First year, second semester	<input type="checkbox"/>
Second year, first semester	<input type="checkbox"/>
Second year, second semester	<input type="checkbox"/>
Third year, first semester	<input type="checkbox"/>
Third year, second semester	<input type="checkbox"/>

6. In relation to clinical placement* for students, please specify when students are first taught pharmacology. *Please answer by ticking the boxes provided.*

*The term 'clinical placement' refers to students' exposure to the clinical environment either in terms of a number of clinical weeks ('blocks') or allocated days per week.

Prior to first clinical placement

Parallel to first clinical placement
After the first clinical placement

Assessment of Knowledge/Skills

7. Please specify how students' knowledge about pharmacology is academically assessed. *Please tick the option(s) that apply.*

Examination
Assignment
Other (Specify)
.....
Not assessed
Not applicable

8. Please provide details about the format of any academic assessment identified in question 7. *It would be very helpful if you could include course documentation to respond to this question.*

Examination:

.....
.....
.....

Assignment:

.....
.....
.....

Other:

.....
.....
.....

9. Please indicate whether the undergraduate nursing course includes clinical/practice based competency assessments related to the administration of medications.

Yes No

10. Please provide details about the format of any competency assessments in medication administration used for clinical practice.

.....
.....
.....
.....
.....

Pharmacology, Consumer Education and Communication Skills

11. With regard to the academic curriculum, are there opportunities for students to practise integrating pharmacology knowledge with principles of consumer education (eg., learning that as part of medication education, consumers' existing knowledge about their medications should be assessed)?

Yes No

12. If yes, please explain how and when this occurs.

.....
.....
.....
.....
.....

13. With regard to the academic curriculum, are there opportunities for students to practise integrating pharmacology knowledge with principles of communication skills (eg., using listening and questioning skills to assess consumers' existing knowledge about their medications)?

Yes No

14. If yes, please explain how and when this occurs.

.....
.....
.....
.....
.....

Section 2

Specific Perceptions about Pharmacology Teaching

15. Please indicate the extent to which you agree with each of the following statements by placing a circle around the number that best reflects your opinion, based on your experience within the university where you currently work.

	Strongly Agree 5	Agree 4	Uncertain 3	Disagree 2	Strongly Disagree 1
1. In hospital the pharmacist is in the best position to educate patients about their medication.	5	4	3	2	1
2. Single nurse drug administration in the hospital setting has reduced the number of learning opportunities for nursing students to learn about drugs.	5	4	3	2	1
3. Ideally, the person who teaches pharmacology to nursing students should have a background in nursing.	5	4	3	2	1
4. The teaching of pharmacology as a separate subject reduces the opportunity for its integration into nursing subjects.	5	4	3	2	1
5. Generally, there is sufficient time in the nursing curriculum dedicated to pharmacology.	5	4	3	2	1
6. There is an adequate number of pharmacology textbooks written for nursing students.	5	4	3	2	1
7. Science lecturers pitch their teaching at an appropriate level for nursing students.	5	4	3	2	1
8. Shorter hospital stays have reduced the opportunities for nurses to educate patients and their families about medication.	5	4	3	2	1

	Strongly Agree 5	Agree 4	Uncertain 3	Disagree 2	Strongly Disagree 1
9. Nurses are in the best position to educate patient and their families about medication.	5	4	3	2	1
10. Science lecturers are ideally qualified to teach pharmacology to nurses.	5	4	3	2	1
11. The majority of nurses give medication education a low priority.	5	4	3	2	1
12. It is only on clinical placements that students can integrate pharmacology theory with practice issues.	5	4	3	2	1
13. Pharmacology knowledge is more important than knowledge about communication skills when it comes to educating patients and their families about medication.	5	4	3	2	1
14. Science lecturers who do not have a nursing background rarely integrate pharmacology theory with practice issues.	5	4	3	2	1
15. The majority of pharmacology teaching should take place in the hospital setting where it can be made more relevant to a particular clinical setting.	5	4	3	2	1
16. Clinical practice-based competency assessments of pharmacology knowledge are less important than theoretically based assessments.	5	4	3	2	1
17. The integration of pharmacology and patient education skills is difficult for lecturers to achieve.	5	4	3	2	1

	Strongly Agree 5	Agree 4	Uncertain 3	Disagree 2	Strongly Disagree 1
18. Pharmacology should be taught by lecturers from more than one discipline.	5	4	3	2	1
19. Pharmacology should be taught as a separate subject not as part of a biosciences subject.	54	4	3	2	1
20. Ideally, nursing students should be introduced to pharmacology prior to their first clinical placement.	5	4	3	2	1
21. Generally, there is a lack of integration of theory and practice in nurse education.	5	4	3	2	1
22. It does not matter if the lecturer teaching pharmacology has not got a nursing background as long as there are opportunities in the curriculum for someone to relate pharmacology to nursing practice.	5	4	3	2	1
23. In the community, the pharmacist is in the best position to educate patients about their medication.	5	4	3	2	1
24. Pharmacology knowledge is more important than knowledge about patient education when it comes to educating patients and their families about medication.	5	4	3	2	1
25. The integration of pharmacology and communication skills is difficult for lecturers to achieve.	5	4	3	2	1

Additional Comments

- 16.** Please add any other comments you have about the above statements (question 15) or about pharmacology teaching in general.

Thank you very much for your time and effort in completing this questionnaire.

To ensure that your valuable contribution is included in the project, please return the questionnaire in the stamped addressed envelope by [Date].

Appendix 7B: Meechan, Mason and Catling (2011)

4 point Likert scale used to assess the following questions (Strongly Agree, Agree, Disagree, Strongly Disagree):

1. I feel confident that I am able to identify the correct drug use all of the time.
2. I feel confident that I am able to identify the correct drug side effects all of the time.
3. I feel confident that I am able to identify drugs that may be contraindicated in my patient's treatment.
4. I feel confident that I am able to undertake drug calculations all of the time.
5. I feel confident that I am able to manage my patient's condition in accordance with prescribed regimes.
6. I feel confident in my ability to interpret clinical observations and relate them to prescribed regimes.
7. I feel confident that I can educate patients regarding their medication all of the time.

Appendix 7C: Dilles et al (2011)

Through your education, there are different ways to learn about pharmacology. For every possibility, give on a 10-points scale how much you learned during your education about pharmacology where 1 is the lowest and 10 is the highest score.

- Theoretical lessons
- Practical lessons
- On traineeship
- Self-tuition

Shortly, you will graduate as a nurse and you will start to work somewhere. How good do you think you are prepared concerning pharmacotherapy and the whole medication process. Score yourself a number between 1 and 10 where 1 is the lowest and 10 is the highest score.

Appendix Eight - Online Student Questionnaire Expert Panel Review Checklist

Integrated pharmacology in an undergraduate nursing curriculum: the nursing students' perceptions of their readiness for clinical placement

Katie Sutton MPhil Candidate

Supervisors: Prof G Leslie and Dr Janie Brown

Thank you for agreeing to participate in the expert panel review of my student questionnaire for my MPhil (Nursing) research.

This study has been approved under Curtin University's process for lower-risk Studies (Approval Number SONM41-2014). This process complies with the National Statement on Ethical Conduct in Human Research (Chapter 5.1.7 and Chapters 5.1.18-5.1.21).

For further information on this study contact the researchers named above or the Curtin University Human Research Ethics Committee c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth 6845 or by telephoning 9266 9223 or by emailing hrec@curtin.edu.au

Checklist for Clarity

CHECKLIST A – Clarity of the Student Questionnaire Instruction Sheet:

Please read the entire student questionnaire first via the following link:

https://curtin.asia.qualtrics.com/SE/?SID=SV_41O2LlaSKfMiB

- (a) Are the questionnaire instructions clear? Please circle either yes or no on the next line.

YES NO

(b) Read each question in the student questionnaire separately that corresponds to the same number on the attached response sheet. Beside each question number on the response sheet circle: **C (clear)** or **U (unclear)** to indicate whether the question is **clear** or **unclear** to you.

After you finish you may wish to discuss your comments with me. Thank you for your assistance in assessing the clarity of the student questionnaire design (Lynn, 1986).

13	C	U	
14	C	U	
15	C	U	
16	C	U	
17	C	U	
18	C	U	

19	C	U	
20	C	U	
21	C	U	
22	C	U	
23	C	U	
24	C	U	
25	C	U	
26	C	U	
27	C	U	
28	C	U	
29	C	U	

Checklist for Content Validity

CHECKLIST B – Content Validity of the Student Questionnaire

Instruction Sheet:

In this section, you are asked to look at the questions in the student questionnaire and decide if you think they seem to flow easily in a logical order.

Please read the entire student questionnaire first. After you have finished reading the survey, answer questions (a) at the top of the response sheet - either **YES** or **NO**. Then answer question (b) for each question. Answer by circling the response you choose under question (b) – either **Y (YES)** or **N (NO)**. Please add any relevant comments you wish to explain your answers.

Thank you for your assistance in assessing the content validity of the questionnaire design (Lynn, 1986).

Response Sheet for Checklist B – Content Validity

Definition: The student questionnaire is intended to gather data to determine the effectiveness of integrated pharmacology curriculum in meeting student's expectations and perceptions of the pharmacology knowledge required to support their readiness for clinical placement.

In general, do the label and definition fit the whole set of questions?
Answer once for the whole student questionnaire by circling either **YES** or **NO** on the next line.

YES **NO**

(a) Does each question fit the label and definition? Please circle **Y (YES)** or **N (NO)**

Question	<u>Circle One</u>		Comments
	Yes	No	
13	Y	N	
14	Y	N	
15	Y	N	
16	Y	N	
17	Y	N	
18	Y	N	
19	Y	N	
20	Y	N	
21	Y	N	

22	Y	N	
23	Y	N	
24	Y	N	
25	Y	N	
26	Y	N	
27	Y	N	
28	Y	N	
29	Y	N	

(b) Is the question unique, i.e. not repetitive? Please circle Y (YES) or N (NO)

Question	<u>Circle One</u>		Comments
	Yes	No	
13	Y	N	
14	Y	N	
15	Y	N	
16	Y	N	
17	Y	N	
18	Y	N	
19	Y	N	
20	Y	N	
21	Y	N	
22	Y	N	
23	Y	N	
24	Y	N	
25	Y	N	
26	Y	N	
27	Y	N	
28	Y	N	
29	Y	N	

Checklist for Apparent Internal Consistency

CHECKLIST C – Internal Consistency of the Student Questionnaire

Instruction Sheet:

In this section, you are being asked to look at questions in the student questionnaire and decide if you think they belong together.

Read the entire student questionnaire first. After you finish reading the questionnaire, answer question (a) at the top of the response sheet, then answer the following question (b) for each question. Answer by circling the response you choose under question (b). Add any comments you wish to explain your answers.

Thank you for your assistance in assessing the internal consistency of the student questionnaire design (Lynn, 1986).

Response Sheet for Checklist C – Apparent Internal Consistency

- (a) Do these questions generally belong together? Answer once for the whole student questionnaire by circling either **YES** or **NO** on the next line.

YES

NO

- (b) Does each question belong in the questionnaire? Please circle **Y (YES)** or **N (NO)**.

Question	<u>Circle One</u>		Comments
	Yes	No	
13	Y	N	
14	Y	N	
15	Y	N	
16	Y	N	
17	Y	N	
18	Y	N	
19	Y	N	
20	Y	N	
21	Y	N	
22	Y	N	
23	Y	N	
24	Y	N	
25	Y	N	
26	Y	N	

27	Y	N	
28	Y	N	
29	Y	N	

Appendix Nine - Mapping of Online Student Questionnaire With Study Objectives and Research Questions

Research Question 1: How is the UG nursing curriculum structured in relation to integrated pharmacology content?

Study objectives 1 & 2:

- Addressed by the verified curriculum component of this study (Phase One)

Research Question 2: What are the students' expectations of the integrated pharmacology content provided in the UG nursing curriculum?

Study objective 3:

- Students' opinions of their own perceived confidence, proficiency, knowledge & satisfaction in pharmacology content. Questions used a 4 point Likert scale (Questions 13, 15, 16) and an 11 point visual analogue scale (Question 25)

Research Question 3: How prepared for clinical placement do students' feel as a result of completing units of study with integrated pharmacology curriculum?

Study objective 4:

- Students' perceptions of confidence, proficiency, knowledge & satisfaction in their readiness for clinical placement in relation to pharmacology content provided. Questions used a 4 point Likert scale (Questions 14, 18-24) and an 10 point visual analogue scale (Qu 26)
- Semester 6 students only asked how prepared their feel re: the medication process as a result of their studies in pharmacology using a 11 point visual analogue scale (Qu 27)

Research Question 4: Does a student's perceived readiness for clinical placement vary according to their level of study within the UG nursing program?

Study objectives 5 & 6:

- Analysis of data using Pearson's chi-square, Kolmogorov-Smirnov and Kruskal-Wallis tests according to timing of clinical placement and semester of study against question responses –significant findings outlined in results section

Appendix Ten - Online Student Questionnaire: Information Sheet and Qualtrics™ Survey Tool

Integrated pharmacology in an undergraduate nursing curriculum: the nursing students' perceptions of their readiness for clinical placement

Thank you for agreeing to participate in this survey.

My name is Katie Sutton. I am a Master of Philosophy student at Curtin University in Western Australia. I am currently undertaking research to evaluate the nursing students' perceptions of their readiness for clinical placement in relation to the integrated pharmacology content provided in undergraduate nursing curriculum.

Purpose of the research

The purpose of this survey is to gather data to determine the effectiveness of integrated pharmacology curriculum in meeting student's expectations and perceptions of the pharmacology knowledge required to support their readiness for clinical placement. Integrated pharmacology curriculum refers to pharmacology content addressed across several course units (as opposed to discrete units of study in pharmacology).

Your role

I am inviting you as an Undergraduate Nursing Student enrolled at Curtin University, School of Nursing, Midwifery and Paramedicine, in Semester III through Semester VI inclusive to participate in this survey. Data generated will enable the researcher to determine what, if any, relationships exist between a student's perceived level of pharmacology knowledge and their readiness for clinical placement as an Undergraduate Nursing Student. The questionnaire will take approximately 10-15 minutes of your time to complete.

Consent to participate

Please be aware that your participation in this survey is entirely voluntary. You can withdraw at any time without adverse consequence to yourself, or your involvement in current and future research studies. In completing this survey it is assumed that you have agreed to participate in the research. This online survey is anonymous.

Confidentiality

All data from the questionnaire will remain confidential and your privacy will be respected and maintained. The ongoing storage and security of research records will be undertaken in accordance with the Western Australian University Sector Disposal Authority. Data will be kept in a locked cabinet and in password protected files for at least seven years.

Further information

This study has been approved under Curtin University's process for lower-risk Studies (Approval Number SONM41-2014). This process complies with the National Statement on Ethical Conduct in Human Research (Chapter 5.1.7 and Chapters 5.1.18-5.1.21), and Curtin University Office of Strategy and Planning.

For further information on this study contact the researchers named above or the Curtin University Human Research Ethics Committee c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth 6845 or by telephoning 9266 9223 or by emailing hrec@curtin.edu.au

If you would like further information or clarification about the study, please contact the researcher at any time via email at

katie.sutton@student.curtin.edu.au

Thank you for your valued participation.

Kind regards,

Katie Sutton MPhil Candidate

1. In relation to your current enrolment at the School of Nursing, Midwifery and Paramedicine, are you an Undergraduate Nursing Student?
(For Midwifery students, EN to RN conversion Nursing Students or Graduate Entry Master in Nursing students, please select 'No')
 - Yes
 - No

(If 'No' is selected, then Skip to End of Survey – Skip logic in Qualtrics™)

Demographic information

2. What is your gender?

- Male
- Female

3. Please give your age (in years) at your last birthday:

4. Prior to enrolling in your degree, what is your highest education qualification completed?
 - School education
 - Certificate
 - Diploma
 - Advanced Diploma
 - Bachelor Degree
 - Graduate Certificate
 - Graduate Diploma
 - Postgraduate Degree
 - Master's Degree
 - PhD

5. What was the primary language spoken in your childhood home?
(please choose only one)

- English
- French
- German
- Italian
- Dutch
- Spanish
- Chinese
- Vietnamese
- Korean
- Japanese
- Other (please specify) _____

6. Please indicate if you have any work experience (paid or volunteer) in healthcare. This may include traineeship, holiday work or weekend work?

- No
- Yes.
- If yes;

How many years? _____

In what position(s)? _____

7. What semester of study in your Undergraduate Nursing degree are you currently enrolled in?

- Semester III
- Semester IV
- Semester V
- Semester VI

8. What is your current Applied Bioscience unit of study?

- GMED2000 Applied Bioscience for Chronic Conditions
- GMED2001 Applied Bioscience for Acute Conditions
- GMED3000 Applied Bioscience for Complex Care
- GMED3001 Applied Bioscience for Critical Care

9. Are you also currently completing the corresponding Nursing Practice unit of study?

- Yes
- No
- If no; please explain _____

10. What was your last Clinical Placement unit of study?

- NURS1002 Fundamentals of Nursing Practice (formerly Nursing Practice 162)
- NURS2002 Integrated Nursing Practice (formerly Nursing Practice 263)
- NURS2005 Integrated Clinical Practice (formerly Nursing Practice 264)
- CRIT3000 Complex Nursing Practice 1 (formerly Nursing Practice 365)Please
- CRIT3001 Complex Nursing Practice 2 (formerly Nursing Practice 366)

11. When was your last clinical placement undertaken?

- Last semester
- This semester

12. What was the context of your last clinical placement?

- Aged Care
- Community
- Mental Health
- Medical
- Surgical
- Critical Care
- Operating theatres
- Paediatrics
- Maternity
- Practice Nursing
- Justice Health
- Indigenous Health
- Palliative Care
- Other please specify _____

Please rate your responses to the following questions by choosing 1 of the options provided:

The term ‘Pharmacology’ is defined as the study of the preparation, properties, uses and actions of drugs. The study of pharmacology usually relates to the therapeutic use of medicines, rather than recreational use.

13. How do you perceive your current level of pharmacology knowledge?

- Satisfactory
- Requires development
- Not relevant to my practice

14. Do you perceive there to be a relationship pharmacology knowledge and clinical placement?

- Yes
- No
- Unsure

15. In relation to your current Applied Bioscience unit of study, how satisfied are you with the pharmacology content provided?

- Very satisfied
- Satisfied
- Somewhat satisfied
- Not satisfied

16. In your current Applied Bioscience unit of study, how integrated is the pharmacology content provided, in linking theory to practice?

Please note: the term *Integrated* refers to pharmacology content addressed across several course units (as opposed to discrete units of study in pharmacology).

- Excellent integration
- Good integration
- Poor integration
- Not integrated

For questions 17 -23 please reflect on your most recent clinical placement.

17. In relation to your most recent clinical placement, please specify when you were taught pharmacology content:

- Prior to clinical placement
- Parallel to clinical placement
- After the clinical placement

18. How valuable did you feel the pharmacology you learned in class was during your last clinical placement?

- Extremely Valuable
- Valuable
- Somewhat Valuable
- Not Valuable

19. Did the class work completed in pharmacology meet your expectations for your most recent clinical placement?

- Yes
- No

20. When on your most recent clinical placement, did you feel adequately prepared to administer medicines within your scope of practice?

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

21. When on your most recent clinical placement, did you value the opportunity to further develop your knowledge and understanding in pharmacology?

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

22. When on your most recent clinical placement, how valuable were your previous clinical experiences in pharmacology?

- Extremely Valuable
- Valuable
- Somewhat Valuable
- Not Valuable

23. Your pharmacology experiences when on your most recent clinical placement met your expectations and support your pharmacology learning:

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

Please rate your responses to the statements below.

24. When on your most recent Clinical Placement, did you feel confident that you were able to:

- a. Identify the correct medicine use all of the time
- b. Identify the correct medicine side effects all of the time
- c. Identify medicines that may be contraindicated in your patient's treatment
- d. Undertake medicine calculations correctly all of the time
- e. Manage your patient's condition(s) in accordance with prescribed pharmacology regimes
- f. Interpret clinical observations and relate them to prescribed pharmacology regimes
- g. Educate patients regarding how to take their medicines

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

25. Through your education, there are different ways to learn about pharmacology. For every possibility listed, rate how much you feel you have learned during your education about pharmacology:

- a. Theoretical lessons
 - b. Practical lessons in the laboratory
 - c. On clinical placement
 - d. Self-tuition

26. Please indicate on the scale below (where 1 is the lowest and 10 is the highest score) your perceived readiness to deliver safe medicine care as a student nurse on your next clinical placement, as a result of your pharmacology studies:

1 2 3 4 5 6 7 8 9 10
(10 point scale utilised)

Displayed on Qualtrics™ for Semester VI students only

27. In the near future, you will graduate as a Registered Nurse and will commence working in the clinical setting. How well prepared do you feel concerning pharmacology and the whole medication process as a result of your pharmacology studies? Please score yourself a number between 1 and 10 below (where 1 is the lowest and 10 is the highest score).

0 1 2 3 4 5 6 7 8 9 10
(11 point scale utilised)

*Questions 13 -15 have been modified from Manias and Bullock study
Question 20-24 have been modified from the Meechan et al study
Questions 25-26 have been modified from the Dilles et al study
Permissions were sought by the researcher and granted by all authors to modify and use questions in this study*

Appendix Eleven - Researcher Candidacy Approval

ID:121112190 Date:Tue 07/10/2014 12:44 PM From:Graduate Studies - Health Sciences

To:Katie Sutton Attachments:

[Katie Ann SUTTON.pdf](#)

Subject:Candidacy Approval - Katie Sutton

Dear Katie

Application for Candidacy:

Course: 189903 - Master of Philosophy - Nursing and Midwifery

Student ID: 09319792

I am pleased to advise that your application for candidacy has been approved by the Faculty Research Training Committee (FRTC). Please find attached an updated Research Student Profile as confirmation for your records.

FORM C has been recommended by the FRTC and Ethics approval must be granted by the Human Research Ethics Committee prior to the commencement of your data collection. Please refer to the Research Ethics webpage for further details <http://research.curtin.edu.au/guides/ethics.cfm>.

Please note that under Higher Degree by Research (HDR) Rules * Section 6 (e), any changes to your thesis title or thesis committee must be approved by the FRTC. Where a change of title reflects a change of focus, a new research proposal must be submitted.

* <http://research.curtin.edu.au/graduate/policies.cfm#rules>

If you have any queries regarding the administration of your program please do not hesitate to contact myself on Email: ResearchStudents@health.curtin.edu.au or Phone No: 08 9266 9932.

On behalf of the Committee may I take this opportunity to wish you success in your research findings.

Yours sincerely

Dee John
Faculty Graduate Studies Administrator
Faculty of Health Sciences

Curtin University
GPO Box U1987 | Perth | Western Australia | 6102
Tel | +61 8 9266 9932

Email | ResearchStudents@health.curtin.edu.au
Web | healthsciences.curtin.edu.au/research

Appendix Twelve - Curtin University Human Research Ethics Committee Approval



Memorandum

To	Dr Janie Brown and Ms Katie Sutton
From	Professor Dianne Wynaden
Subject	Protocol Approval SONM41-2014
Date	17 November 2014
Copy	

Office of Research and Development
Human Research Ethics Committee
Telephone 9266 2784
Facsimile 9266 3793
Email hrec@curtin.edu.au

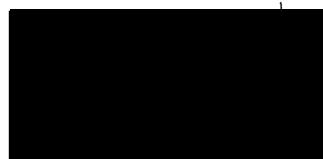
Thank you for your "Form C Application for Approval of Research with Low Risk (Ethical Requirements)" for the project titled: Integrated pharmacology in an undergraduate nursing curriculum: The nursing students' perceptions of their readiness for clinical placement. On behalf of the Human Research Ethics Committee, I am authorised to inform you that the project is approved.

Approval of this project is for a period of four years from the 17th November 2014 to 20th November 2016.

Your approval has the following conditions:

- (i) Annual progress reports on the project must be submitted to the Ethics Office.
- (ii) **It is your responsibility, as the researcher, to meet the conditions outlined above and to retain the necessary records demonstrating that these have been completed.**

The approval number for your project is **SONM41-2014**. Please quote this number in any future correspondence. If at any time during the approval term changes/amendments occur, or if a serious or unexpected adverse event occurs, please advise me immediately.



Professor Dianne Wynaden
Minimal Risk Coordinator/ Ethics Advisor
School of Nursing and Midwifery

Please Note: The following standard statement must be included in the information sheet to participants:
This study has been approved under Curtin University's process for lower-risk Studies (Approval Number SONM41-2014). This process complies with the National Statement on Ethical Conduct in Human Research (Chapter 5.1.7 and Chapters 5.1.18-5.1.21).

For further information on this study contact the researchers named above or the Curtin University Human Research Ethics Committee c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth 6845 or by telephoning 9266 9223 or by emailing hrec@curtin.edu.au.

Appendix Thirteen - Phase Two Results Kolmogorov-Smirnov Normality Testing

Normality testing for self-rated education in pharmacology

	Kolmogorov-Smirnov Statistic	df	Sig.	Shapiro-Wilk Statistic	df	Sig.
Theoretical lessons	.143	164	.000	.961	164	.000
Practical lessons	.141	163	.000	.948	163	.000
Clinical placement	.165	162	.000	.881	162	.000
Self-tuition	.142	163	.000	.947	163	.000

Normality testing for self-rated readiness in pharmacology on clinical placement

	Kolmogorov-Smirnov Statistic	df	Sig.	Shapiro-Wilk Statistic	df	Sig.
Self-rated readiness for safe medicine care	.165	164	.000	.940	164	.000
Self-rated preparedness for clinical practice in pharmacology (Sem VI)	.215	36	.000	.903	36	.004