Enhancing Safe Medication Practices: An Interprofessional Education Approach

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Statement of Originality

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying subject to the provisions of the Copyright Act 1968.

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I hereby certify that this thesis is in the form of a series of published papers of which I am a joint author. I have included as part of my thesis a written statement from each co-author, endorsed by the Deputy Head of Faculty (Research) and Assistant Dean Research & Research Training, attesting to my contribution to the joint publications. I have renumbered sections of submitted or published papers in order to generate a consistent presentation within the thesis.

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Dedication

This thesis is dedicated to the memory of my dad, Duncan, who believed in the value of education and provided a solid foundation that served as a springboard for high academic achievement. I wish I could have celebrated this milestone with him, but I find comfort in the knowledge that he is in a better place.
Acknowledgements

As I sit to write acknowledgments, I cannot believe I am finally at this point. When I migrated to Australia and commenced my undergraduate studies a few years ago, I had no idea where this journey would take me. Had I known, I may never have started. Nevertheless, I am glad I did and grateful for the experiences I had and the things I learned along the way. This thesis represents an end, but also a new beginning.

Firstly, I would like to express my sincere gratitude to my supervisors, Professor Tracy Levett-jones and Doctor Conor Gilligan. I could not have asked for better supervisors, they were always ready to read (and reread) my drafts at short notice and would provide valuable feedback to help me minimise the stress associated with a project of this magnitude. I will be forever grateful for their ongoing support, motivation, confidence and academic direction necessary to bring this project to completion. They demonstrated unequivocal belief in my ability and knew when to let me wander, but, also, when to redirect me towards reaching my goal. I also thank Doctor Helen Bellchambers for having been part of the supervision team in the preliminary phase of the thesis.

I must also acknowledge the support of my mother Winnet, partner Brenda, brother Lucky, and my sister Pamela. Of course, without the participation of the students and academics from various universities in Australia and New Zealand and other individuals this research would have been impossible.

This research was supported by an Australian Postgraduate Award.
Outcomes of this thesis

This thesis is submitted in the form of a series of published papers as per the University of Newcastle Rules Governing Research Higher Degrees (Rule 000830). It forms a component of a teaching and learning project, funded by the Office of Learning and Teaching, which sought to develop web-based multimedia resources to engage students with interactive and authentic ‘patient journeys’ and enhance their interprofessional skills related to medication practices.

The thesis is comprised of an introduction, four papers, and a final chapter providing an overall discussion of the key results. I was the first author of each of the papers and had responsibility for the study design, data collection, and analysis and manuscript preparation. Professor Tracy Levett-Jones and Doctor Conor Gilligan contributed to study design, data analysis and manuscript preparation within the capacity of their roles as PhD supervisors.

Chapter 1 introduces and justifies the study and reviews current literature related to medication safety. This is followed by a discussion of the potential for interprofessional education to enhance collaborative practice and promote medication safety. The rationale for the project and aims of each stage of the research are then detailed. Each of the four papers presented in the thesis provides further relevant background literature, methods, results, discussion and implications of the research project. At the time of submission, two papers have been published in peer-reviewed journals and two manuscripts are undergoing review. Style, structure and content of each paper are in accordance with the guidelines of each journal the papers were submitted to. While there is some repetition of literature and methods according to specific journal requirements, each chapter is preceded by an introduction that
explains how it contributes to the overall body of knowledge. The papers are listed below in the order in which they appear in the thesis.

**Manuscripts in peer-reviewed journals**


**Lapkin, S., Levett-Jones, T., & Gilligan, C. (2011).** A cross-sectional survey examining the extent to which interprofessional education is used to teach nursing, pharmacy and medical students in Australian and New Zealand universities. *Journal of Interprofessional Care, 26*(5), 390-396.


**Conference presentations [Abstracts are provided in Appendix A].**


**Lapkin, S., Levett-Jones, T., & Gilligan, C. (2012, October).** Measuring health professional student’s intention to behave in a way that promotes medication safety using the Theory of Planned Behaviour. Paper presented at the All Together Better Health VI (ATBHVI) conference, Kobe Gakuin University, Kobe, Japan. 938
Additional publications associated with thesis [Appendix B]


Travel Grant

Conference Travel Grant: Australasian Interprofessional Practice and Education Network.
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IPE: Interprofessional Education

TPB: Theory of Planned Behaviour

TPB-MSQ: Theory of Planned Behaviour Medication Safety Questionnaire
Abstract

This thesis by publication reports on four interconnected research stages that explore the effectiveness of university based interprofessional education (IPE) in relation to medication safety. At the time of submission, two papers have been published in peer-reviewed journals and two manuscripts are undergoing review.

It is widely accepted that health professional students who learn together will be better prepared for contemporary practice and more able to work collaboratively and communicate effectively. In Australia, IPE is recognised as important for preparing nursing, pharmacy and medical students for their roles in the medication team. Evidence indicates that inadequate communication between health care professionals is the primary issue in the majority of medication errors. Despite this, IPE is seldom used for teaching medication safety.

This project began with a literature review exploring issues of IPE as they relate specifically to medication safety. This was followed by a systematic review to appraise and synthesise the best available evidence on the effectiveness of IPE in university based health professional programs. Few rigorously evaluated studies of IPE were found, indicating an inadequate evidence base to inform future activities, particularly in relation to medication safety. A cross-sectional survey of IPE in Australian and New Zealand Universities reinforced these findings, with respondents reporting few examples of true IPE, a lack of structured and integrated IPE activities, and few links to student assessment. The pragmatic challenges associated with evaluating behavioural outcomes of educational activities, as well as timetabling and inadequate resources, were identified as key challenges to the systematic implementation and evaluation of IPE.

In an effort to address some of these barriers the Theory of Planned Behaviour Medication Safety Questionnaire (TPB-MSQ) was developed to assess nursing, medical and nursing students’ behavioural intentions in relation to medication safety.
as a proxy for actual behaviour change. Pilot-testing proved the questionnaire to be a valid and reliable instrument for evaluating students' behavioural intentions. The questionnaire was subsequently used in a quasi-experimental study to examine the effectiveness of a web-based module incorporating IPE and communication as strategies to promote medication safety. Students who were exposed to the web-based module demonstrated significantly greater intention to practice in a way that enhances medication safety and collaborative practice than those who were not, as evidenced by higher scores on the TPB-MSQ.

Taken together, the findings presented in this thesis provide evidence to support the use of web-based learning modules which incorporate IPE as an innovative approach to promote patient safety. Web-based IPE offers health professional students an opportunity to learn about and from other disciplines even when they do not have the opportunity to learn with them. However, further research is necessary to explore to the transferability of the acquired behaviours into clinical practice and the impact of these on medication related patient outcomes such as length of stay and medication incidents.
CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW

1.1 Overview

The following literature review, conducted in May 2013 set out to explore the broad issues of interprofessional education as they relate to medication safety. Unlike the systematic review in Chapter 2, this narrative review includes a range of studies and publications from descriptive and opinion pieces to rigorous evaluations of interprofessional education (IPE) efforts as they relate specifically to medication safety. It presents a distillation of the literature on interprofessional collaboration relating to medication safety, and the barriers to interprofessional education. This is followed by critical analysis of current literature in relation to IPE and medication safety. The literature review identifies several knowledge gaps and concludes by outlining the structure and design of this thesis as it sets out to address these gaps.

1.2 Introduction

Medication safety is a component of a broader global strategy to improve patient safety and quality of care. Over the last decade it has become a key focus of national and international organisations. The goal of medication administration is to achieve optimum therapeutic outcomes for patients. However, medication incidents remain the second most common type of incident reported both in Australia and internationally (Fogarty & McKeon, 2006). The potential consequences of medication errors include
extending the duration of stay of inpatients, through failures to initiate medications or less than therapeutic medication regimens, or administering incorrect medications that cause harm.

Despite efforts to enhance medication safety through reporting, evaluating and preventing medication errors, the prevalence of adverse patient outcomes associated with medication errors remains unacceptably high (Westbrook et al., 2010). There is increasing awareness that interprofessional communication and collaborative skills such as mutual understanding of others’ roles and ability to appreciate one another’s skills and contributions can enhance medication safety practices (Courtenay, 2012; Taylor, Yuen, Hunt, & Emond, 2012). This is not surprising considering that medication management is a complex multi-stage and interprofessional process, involving doctors, pharmacists, nurses and patients.

1.3 Medication safety

Promotion of medication safety is a key focus of national and international health care organisations. The European Medicines Agency (2013) represents various stakeholder groups, including regulators, national patient safety agencies, patient and healthcare professional representatives, academia and the pharmaceutical industry. This agency recognises medication safety as an urgent, and major, global challenge. The prevalence of adverse patient outcomes associated with medication errors remains unacceptably high (World Health Organisation, 2012), despite efforts to enhance medication safety through reporting, evaluating and preventing medication errors. The World Health Organization (WHO) estimates that more than 50% of all medications are prescribed, dispensed or used inappropriately. In the United States at least one medication error occurs per day per hospitalised adult patient (Institute of Medicine, 2007).

In Australian hospitals, medication related incidents remain the second most common
type of incident reported (Australian Commission on Safety and Quality in Health Care, 2012a). It is estimated that more than 77,000 preventable medication errors occur per year, of which 27% cause patient harm (Hospira Pty Ltd, 2006). An Australian literature review of medication safety in acute care found that medication errors accounted for between 14 and 26% of all incidents reported, and that medication administration errors occurred in 6-18% of all drugs administered (Roughead & Semple, 2009). It has been suggested that only between only between 4 and 21% of patients achieve optimum therapeutic benefit as a result of medication errors (Garfield, Barber, Walley, Willson, & Eliasson, 2009). A systematic review and meta-analysis of fifteen studies reported that 59% of medication incidents were actually preventable (Winterstein, Sauer, Hepler, Poole, 2002). It is likely, however, that the available figures underestimate the actual rate of errors (Johnson & Young, 2011).

Although the impact of adverse medication incidents on mortality and patients’ quality of life is difficult to quantify and has not to date been thoroughly explored, available data suggest that the cumulative personal and financial burden to society is substantial. Adverse medication incidents extend the duration of stay of inpatients and increase recovery time (Santell, Hicks, McMeekin, & Cousins, 2003). The US Institute of Medicine (2007) has estimated that approximately 1.5 million patients experience adverse outcomes as a result of medication errors, costing at least $3.5 billion annually. In Australia, medication errors are reported to cost more than $660 million annually (Roughead & Semple, 2009) and add $10.4 million to the cost of a 250 bed hospital over five years (Hospira Pty Ltd, 2006).

The high rate of medication errors and associated adverse effects reflect the complexity of the medication process. The delivery of a single medication can involve 30 to 40 steps across the entire spectrum of prescribing, dispensing, administering and
monitoring; and each of these steps allows opportunity for medication error (Leape, 2007). In addition, multiple health professions are involved in the medication process. The risk of error increases with increasing numbers of medications, polypharmacy, patient acuity, facility design, and the numerous policies and procedures that govern medication administration (Grigg, Garrett, & Craig, 2011; Joint Commission, 2004; Liu, Manias, & Gerdtz, 2012).

Misunderstandings in communication between health professionals and patients can potentially lead to an accumulation of errors resulting in adverse patient outcomes (Stebbing, Wong, Kaushal, & Jaffe, 2007). A cross-sectional analysis of the characteristics of 13,932 medication errors from 496 Emergency Departments in the US indicated that poor communication accounted for 11% of medication errors (Pham et al., 2011). Fortescue and colleagues (2003) conducted a prospective cohort study at two academic medical centres, investigating 10,778 medication orders, and reported that 86% of medication errors could have been avoided by improved communication among nurses, pharmacists and doctors. Importantly, evidence indicates that the most significant factor contributing to medication errors is ineffective collaboration between members of the interprofessional team or between members of the team and patients (Khoo, Teng, Lim, Tai, & Lau, 2013). Therefore, any interventions aimed at improving collaboration and communication will significantly improve patient safety and the quality use of medicines (European Medicines Agency, 2013). Communication strategies including those of “open disclosure” and “error reporting” are considered important in improving safe medication outcomes (Levett-Jones, Gilligan, Lapkin, & Hoffman, 2012).
1.4 Medication safety and health professional students

Preparing graduates for safe and effective clinical work, including safe medication practices, is one of the greatest challenges for undergraduate health professional education (Ross & Maxwell, 2012). Although the actual rate of medication errors made by nursing, medical and pharmacy graduates is difficult to ascertain, studies suggest that novices make significantly more errors than experienced health professionals (Dornan et al., 2009; Likic & Maxwell, 2009; Unver, Tastan, & Akbayrak, 2012). A study conducted at a 550 bed teaching hospital in the UK reported that approximately 90% of serious medication errors reported during a four week period involved recently graduated junior doctors (Dean, Schachter, Vincent, & Barber, 2002). In one Australian study, 15 new nursing graduates self-reported a total of 11 medication related adverse incidents (three medicine omissions, seven incorrect doses and one blood product error) within their first four weeks of practice (Hall & Madsen, 2009). These studies suggest that recent health professional graduates are not always sufficiently prepared for safe medication practice. This is an important finding considering always that up to ten percent of a typical hospital’s clinical staff comprise recent graduates (Health Workforce Australia, 2012).

Findings such as these have led to a range of attempts to reform health professional education, particularly in relation to medication safety. The inclusion of safe medication practice in the curricula for health professional students is considered a key component of broader strategy to improve patient safety and quality of care in the global context (World Health Organization, 2011). In the Australian context, the National Medicines Safety and Quality Scoping Study Steering Committee (2008) specifically advocates for the inclusion of safe medication practice in health professional curricula. Evidence from the literature suggests that the majority of university based educational approaches focus mainly on the technical skills involved in the medication administration, such as calculation and numeracy skills, as well as prescription related
knowledge (Blank et al., 2011). However, contemporary studies indicate that improving knowledge and calculation skills does not necessarily translate to a significant reduction in medication errors (Blank, et al., 2011; Wright, 2010). Recent interventions have mostly focused on technology-based strategies such as electronic prescribing and computerized order entry systems (Australian Commission on Safety and Quality in Health Care, 2012b). However, errors still persist even after implementing such interventions (Redley & Botti, 2012; Rodriguez-Gonzalez et al., 2012).

1.5 Interprofessional collaboration and medication safety

The safe, timely and efficient delivery and use of medicines is dependent upon not only individual responsibilities, but also effective interprofessional collaboration between all members of the medication team (Madegowda, Hill, & Anderson, 2007). There is increasing evidence that “nontechnical” or generic skills education, such as the topics of communication, leadership, team functioning and conflict negotiation as well as knowledge of, and respect for, the roles of other professions, are all essential to achieving safe medication outcomes (Calabrese et al., 2003; Dennison, 2005; Lesar, Mitchell, & Sommo, 2006; MacDonald et al., 2010; Stenner & Courtenay, 2008). Evidence indicates that interprofessional models of healthcare delivery are necessary in order to achieve optimum medication outcomes for patients (Scarsi, Fotis, & Noskin, 2002; World Health Organization, 2010). The value of interprofessional collaboration is reinforced by studies showing that medical professionals rely heavily upon pharmacists and nurses identifying and correcting medication errors (Dornan, et al., 2009).

High stake industries, such as aviation, have effectively reduced errors by targeting collaborative skills since the 1970s (Salas, Wilson, Burke, & Wightman, 2006) and these strategies have recently been implemented in
healthcare (Stevens et al., 2012; White, 2012). The non-technical skills (NOTECHS) taxonomy was originally developed for the aviation industry (Flin, Goeters, Hormann, & Martin, 1998) and has since been extensively used as a behavioural marker system for assessing nontechnical skills in the field of anaesthesia (Fletcher et al., 2003) with recent expansion to other areas of medicine (Mishra, Catchpole, & McCulloch, 2009).

The collaborative skills necessary for safe medication practices are best learned when students from various professional groups learn together in “real” healthcare contexts, through structured and facilitated interprofessional education (IPE) experiences (Anderson & Thorpe, 2010; Eccles et al., 2006; Godin, Bélanger-Gravel, Eccles, & Grimshaw, 2008; Ward, 2012). CAIPE (2002) considers that interprofessional education occurs when “two or more professions learn with, from and about each other to improve collaboration and the quality of care”. Proposals to incorporate IPE in the health professional curricula are not new. The WHO has been instrumental in the global support of IPE though various initiatives that began as early as 1973 (Ateah et al., 2011). Other international organisations, including the Organization for Economic Co-operation and Development (OECD), and the World Federation of Medical Education (WFME), have also embraced strategies that facilitate IPE (Canadian Interprofessional Health Collaborative, 2007).

In Australia and New Zealand, there is increasing awareness that future health professionals must have the skills to work as part of a team in order to achieve optimal patient outcomes (Dunston et al., 2010; Pullon et al., 2013). Although undergraduate health professional education is currently delivered in a predominantly discipline and profession-specific way, an increasing body of literature about IPE demonstrates an increase interest towards this approach and
the potential to improve undergraduate health professional education. This attention is demonstrated by the significant increase in the number of published studies referring to IPE or reporting on IPE initiatives (Reeves, Perrier, Goldman, Freeth, & Zwarenstein, 2013).

1.6 Interprofessional education and communication

The area of non-technical skills, although widely recognised as important for safe medication outcomes, appears to be a relatively neglected area within the health professional curricula. Research has been carried out in order to investigate the impact of IPE interventions on student development of interprofessional communication skills. Cox and colleagues (2009) designed, delivered and evaluated an interprofessional course on patient safety, quality and teamwork. The four-week IPE course was run every year for six years with a different cohort of students from the disciplines of medicine, nursing, health administration and respiratory therapy. The IPE course included 8 hours of instruction and a 2 hour lecture covering patient safety fundamentals including the topics of human fallibility; causes of error; search for root causes; the importance of a blame-free approach to safety investigations, and the proposal of safety interventions.

After the intervention, students worked through case studies in small interprofessional teams over approximately four weeks and presented their work to the whole group at the end of that period. The researchers developed a pre-/post survey in order to evaluate IPE outcomes in the six subscales of human fallibility, disclosure, teamwork, communication, error reporting, systems of care, and curricular time spent with other professionals. At pre-test there were significant professional group differences in all the subscales. At post-test, students from all the disciplines scored similarly on the subscales of human fallibility, disclosure, teamwork, communication, error reporting and systems of
care indicating significant improvements in these outcomes post-IPE course (Cox, et al., 2009). These results suggest that the IPE curriculum improved students attitudes about patient safety and teamwork.

1.7 Measuring changes associated with interprofessional education

The ability to work interprofessionally to deliver collaborative care is considered a critical element of contemporary professional practice. An understanding of the roles and responsibilities of other health care professionals, as demonstrated by appropriate attitudes and values towards other professions, can play a significant role in enhancing safe medication practices. Such a view is supported by the results of an Australian qualitative study that examined the professional relationships between occupational therapists and Aboriginal health care workers and found that one barrier impeding patient care was the lack of knowledge regarding the roles of the respective disciplines (Hooper, Thomas, & Clarke, 2007).

In another study, the effects of IPE sessions on student attitudes and values was evaluated using a mixed method pre/post test research design (Cameron et al., 2009). The participants came from the disciplines of dentistry, medical radiation sciences, medicine, nursing, occupational therapy, pharmacy, physiotherapy, speech language pathology, and social work programs. They undertook two simulated IPE discharge scenarios in small interprofessional groups over sessions lasting two and a half hours. The scenario scripts were designed to illustrate positive images of the professions portrayed. The first scenario highlighted aspects of collaborative practice that required improvement whilst the second scenario illustrated a substantially improved model. Data was collected using modified versions of the Interprofessional Attitudes
Questionnaire (Carpenter & Hewstone, 1996) and the IEPS (Luecht, Madsen, Taugher, & Petterson, 1990). Questionnaires were administered two weeks before IPE sessions and again at the end of the sessions. Open-ended questions and focus group interviews were used to further explore emergent findings. Quantitative and qualitative data analysis revealed positive results, with students showing significant improvement in their understanding of the importance of teamwork and the roles of other professions (Cameron, et al., 2009). Curran and colleagues (2007) conducted an evaluation study that evaluated attitudes of health sciences staff towards IPE at one Canadian university. Participants were chosen from teaching staff from medicine (n= 106), nursing (n = 64), pharmacy (n= 10) and social work (n= 10). Respondents were asked to rate their attitudes towards interprofessional health care teams and IPE in an academic setting. The overall mean score of academics from the discipline of medicine was significantly lower than that of nursing faculty (p < 0.005). Such attitudinal differences among staff members and students can be a barrier to successful implementation of IPE. Therefore it is important for both staff and students to appreciate the advantages of IPE so that they can be fully engaged in implementing change.

1.8 Students’ satisfaction with interprofessional education

Student satisfaction is important as it facilitates active and purposeful participation in learning experiences (Prion, 2008). There are also suggestions that student satisfaction may have some correlation with performance (Bremner, Aduddell, Bennett, & VanGeest, 2006). Psychologists have found that student satisfaction helps to build self-confidence which in turn helps students develop skills and acquire knowledge. Pike (1991) suggests that satisfaction exerts a greater influence on academic performance than performance exerts on satisfaction. In relation to IPE, student satisfaction refers to the favourability of a student’s subjective evaluations of the IPE interventions. In the absence of valid measures of change in clinical behaviour or
longitudinal studies investigating impact on clinical practice post-graduation, determination of student satisfaction with IPE is an important evaluative measure of the effectiveness of IPE approaches.

Currently, student satisfaction significantly defines how pedagogical approaches are best implemented and integrated into university curricula (Huang, Wang, Tseng, & Wang, 2011; Smith & Worsfold, 2013). Curran, et al. (2010) conducted a time series study design between 2005 and 2007 to examine the effect of an IPE module on students’ attitudes towards IPE and teamwork. Assessment involved the sequential administration of evaluation instruments to medicine, nursing, pharmacy and social work students. The IPE module involved common learning about interprofessional collaboration with specific patient populations. Blended learning was used in this module, combining case-based asynchronous e-learning as well as a 1.5 hour face-to-face small group learning experience and a panel discussion with an interprofessional healthcare team. The face-to-face small group learning involved either paper-based case studies or interaction with standardised patients. The modules were integrated within the undergraduate curriculum of each discipline (Curran, et al., 2010). Although no significant change in attitudes regarding interprofessional collaboration over time were found, the majority (54%) of the participants were satisfied with the IPE experience and considered it an effective method of learning.

1.9 Interprofessional education and medication safety

Despite the potential for IPE approaches to substantially enhance medication safety outcomes, a review of the literature identified only one study that had specifically investigated the use of IPE to enhance medication safety (Stewart, Purdy, Kennedy, Burns, 2010). This is a significant gap in the literature considering that students and new graduates are particularly vulnerable to making medication errors due to their lack of experience and knowledge of medication
processes. Stewart, et al. (2010) evaluated the impact of IPE workshops on paediatric medication safety. The participants were 48 fourth year medical students and 21 third year nursing students who had completed their discipline specific, core teaching in the area of paediatric pharmacology principles. The IPE intervention used in this case consisted of five, two-hour practical, ward based workshops. An interprofessional group comprising of paediatricians, a paediatric clinical pharmacist and a nurse educator, as well as research staff developed the learning resources. The resources that were developed included student and tutor guides encompassing specific learning outcomes and guidelines for conducting the workshop and four clinical scenarios.

Students were allocated to small interprofessional groups of two to three students and worked through four clinical scenarios based on medications commonly used in paediatric clinical practice. Students evaluated the IPE workshop using pre and post-workshop questionnaires based on the Readiness for Interprofessional Learning Scale (RIPLS) (Parsell & Bligh, 1999). Open ended responses were thematically analysed using a Grounded Theory approach. Analysis of pre-IPE workshop mean scores revealed no significant differences between groups. Following the workshop the authors reported a statistically significant increase in students’ knowledge and awareness of paediatric medication safety issues and medication errors. However, the reported increase was significantly greater for medical students (pre 43.0; post 65.9, p < 0.001) when compared to nursing students (pre 65.2; post 72.2, p < 0.001). Students also reported significant changes in their attitudes to shared learning (pre 67.9; post 76.6; p < 0.001) following the workshop. The results of this study reinforced that paediatric drug prescribing and administration are learnt more effectively with students from other health professions than in a uniprofessional context.
1.10 Barriers to interprofessional education

Despite the core values, knowledge, and skills shared by health professionals in relation to the medication process, the majority of nursing, medicine and pharmacy students currently receive undergraduate training in isolation or “professional silos” (Engum & Jeffries, 2012). Evidence from studies conducted in the US, Canada and the UK suggest that the integration of IPE experiences into health professional students curricula is limited by pragmatic constraints inherent in university programs, such as timetabling restrictions and lack of physical space (Curran, Deacon, & Fleet, 2005; Gardner, Chamberlin, Heestand, & Stowe, 2002). In addition, systematic and consistent opportunities for students to be exposed to IPE experiences whilst on placements are limited, due to the unpredictable and dynamic nature of ward environments, and the constraints imposed by reduced clinical placement availability, as well as large and unequal numbers of students (Lapkin, Levett-Jones, & Gilligan, 2013; Levett-Jones & Bourgeois, 2011; Quality Assurance Agency, 2010).

Such challenges limit the opportunities for students to learn collaboratively, particularly in universities that offer a limited range of health programs. This lack of IPE experiences may in turn foster preconceived attitudes toward, and perceptions of, other health professionals which can perpetuate profession-specific stereotypes that might not reflect the realities of contemporary medication practices or facilitate effective teamwork (Lapkin, Levett-Jones & Gilligan, 2012). This profession specific educational practice is subsequently carried over to the professional workplace too often resulting adverse patient outcomes (Ateah, et al., 2011).

The IPE approaches implemented in some studies included in this literature review have been campus or classroom based (Anderson, Thorpe, Heney, &
Petersen, 2009; Bradley, Cooper, & Duncan, 2009). Although face to face IPE experiences might be considered the ideal approach, the constraints inherent in university programs, such as course design, scheduling, limited resources, large student numbers, and negative staff attitudes towards IPE (Buring et al., 2009; Curran, et al., 2007; Lewitt, Ehrenborg, Scheja, & Brauner, 2010) limit the opportunities for students to learn collaboratively, particularly in universities that are located on multiple campuses. Some educators have investigated the effectiveness of strategies aimed at addressing some of these barriers in order to facilitate the integration of IPE experiences in established uniprofessional programs. Curran, et al. (2010) evaluated the impact of an extra-curricula model in which IPE was scheduled at times outside of regular class contact hours. This approach has been suggested to be appropriate in situations where institutions and academics are not ready to integrate IPE into professional programs (Barr, et al., 2005). Educators and researchers have begun to investigate the use of web-based IPE strategies in an attempt to overcome the barriers of time, space, and location (Seefeldt et al., 2012).

In one study the researchers used a web-based IPE experience to deliver a patient- safety focused course to 300 first-year medical, dental, and nursing students (Blue et al., 2010a). The participants were required to complete a root cause analysis and to develop recommendations based on a fictional sentinel event case in small interprofessional groups. The online IPE experience provided participants with the opportunity to learn from, with, and about other professions perspectives through online group discussions. Students cited convenience, flexibility, the ability to discuss the case in real-time with other students, and the interactive nature of the sessions as the major advantage of the IPE experience. In addition, teaching staff and academic facilitators also perceived the web-based IPE experience to be a worthwhile learning experience (Blue, et al., 2010a).
1.11 Rationale for further research

This chapter has provided a narrative review of IPE literature particularly in relation to health professional students and medication safety. The studies discussed in this chapter demonstrate that despite a growing body of evidence and literature, the effectiveness of university based IPE approaches still remains uncertain. A high quality systematic review of relevant literature is therefore required to fully determine the effectiveness of university based IPE experiences.

Although IPE is not a new concept in Australia and New Zealand, identified studies are primarily from the UK, US and Canada. Apart from a few isolated examples of IPE experiences in Australian and New Zealand Universities, the current status of IPE of has not been explored. Therefore, further research is required to provide an overview of Australian IPE activity in those Australian and New Zealand universities offering health professional programs, particularly in relation to those courses in which the teaching of medication safety is undertaken. This review identifies that whilst extensive literature describing the increasing development and delivery of IPE experiences exists, most of the reported evaluation outcomes focus on participant satisfaction or short-term knowledge acquisition (Ateah, et al., 2011; MacDonnell, Rege, Misto, Dollase, & George, 2012; Wellmon, Gilin, Knauss, & Inman Linn, 2012). This is a significant limitation that makes it difficult to draw accurate conclusions regarding the effectiveness of IPE experiences on clinical behaviour change and patient outcomes. This observation highlights the need for the development of validated and reliable instruments to evaluate the impact university based IPE experiences on clinical practice behaviours.
Finally, this literature review identifies the potential use of web-based approaches in order to overcome some of the main barriers to face to face IPE experiences. Web-based IPE approaches offer the potential for health professional students to learn about and from other disciplines even when they do not have the opportunity to learn with them (Levett-Jones, Gilligan, Lapkin, & Hoffman, 2012). However, there is the need to examine the effectiveness of web-based IPE experiences in improving behavioural intention to behave in a way that promotes medication safety.

1.12 Aims of the research

This project aligns with national and international health care imperatives related to improving medication safety and has the potential to make a significant contribution to the emergent body of literature intended to enhancing safe medication practices.

The aims of this research were to:

1) Appraise and synthesise the best available evidence on the effectiveness of IPE in university based health professional programs

2) Scope the extent to which IPE is used to teach medication safety in Australian and New Zealand nursing, pharmacy and medical programs and the barriers and facilitators to IPE curricula integration

3) Develop and psychometrically test the Theory of Planned Behaviour Medication Safety Questionnaire (TPB-MSQ)

4) Examine the impact of a web-based IPE module on nursing, pharmacy and medical student’s behavioural intention to behave in a way that promotes medication safety
1.13 Research ethics

Ethical approval for the components of the project was obtained from the University of Newcastle ethics committee.

1.14 Thesis structure and study design

This thesis by publication reports on four interconnected research stages that explore the effectiveness of university based interprofessional education (IPE) in relation to medication safety. This introduction and literature review is followed by **Chapter 2**, which presents publication one, a systematic review examining the effectiveness of interprofessional education in university-based health professional programs. Three randomised controlled trials, five controlled before and after studies and one controlled longitudinal study assessing the effectiveness of IPE in university-based health professional programs have been included in the review. All studies that included two or more undergraduate or post-graduate health professional groups engaged in IPE were considered. Meta-analysis was not possible because of the heterogeneity of the included studies; thus the findings are therefore presented in narrative form. Whilst five of the studies identified no difference in learning outcomes for those exposed to IPE, four of the studies did report significant improvement in students’ attitudes and perceptions towards interprofessional collaboration and clinical decision making after IPE experiences. However, strong evidence of effectiveness in terms of behavioural changes and patient outcomes was lacking.

This systematic review has been published in the *Joanna Briggs Institute Database of Systematic Reviews*. A paper derived from this review has also been
Chapter 3 presents the second stage of the research project and includes publication two, which describes a cross-sectional survey of the extent to which IPE is used in Australian and New Zealand Universities to teach nursing, pharmacy and medical students.

This cross-sectional survey of 38 Australian and New Zealand universities provided information about 47 health professional programs. Responses indicated that 80% of universities currently provide IPE experiences for health professional students. However, most of these experiences do not fit the definition of IPE as “occur[ing] when two or more professions learn with, from and about each other to improve collaboration and the quality of care” (Center for the Advancement of Interprofessional Education, 2002). Consistent with findings from similar surveys conducted in the USA and Canada (Blue, Zoller, Stratton, Elam, & Gilbert, 2010b; Curran, et al., 2005) timetable restrictions, impediments to staff training, lack of appropriate teaching and learning resources, and funding limitations were identified as the main barriers to the implementation of university based IPE. The survey respondents considered innovative approaches such as web-based resources and e-learning activities to be essential to overcoming some of the barriers to the integration of IPE and these approaches were seen to hold great potential for the integration of IPE into the teaching of medication safety.

This paper has been published in the Journal of Interprofessional Care and to date has been cited four times.

Recognition of the fact that the evaluation of IPE is predominantly limited to
exploration of students’ attitudes and perceptions, along with an understanding of the educational challenges inherent in evaluating actual changes in clinical behaviour, led to the subsequent stage of the research project where alternative and more rigorous approaches for evaluation were explored.

**Chapter 4** presents manuscript three in which the development and psychometric testing of the Theory of Planned Behaviour Medication Safety Questionnaire (TPB-MSQ) was profiled. This questionnaire was designed to measure the behavioural intentions of health professional student’s in relation to medication safety and collaborative practice. It was based on the Theory of Planned Behaviour framework, which posits that three predictor variables, namely those of attitudes, subjective norms, and perceived behavioural control, are the main determinants of behaviour. Thus, behavioural intention acts as a reliable proxy for actual behaviour (Ajzen, 1991). The TPB-MSQ was developed using both qualitative and quantitative methods and the essential principles of questionnaire design and development.

The TPB-MSQ was tested with a convenience sample of 65 nursing, medical and pharmacy students. Statistical analysis provided strong support for the application of the Theory of Planned Behaviour to both explain and predict health professional students’ behavioural intentions to practice in a way that promotes medication safety. The three predictor variables of the Theory of Planned Behaviour accounted for between 30-46% of the variance in behavioural intention. These findings suggest that the TPB-MSQ is a valid and reliable instrument for explaining and predicting health professional students’ behavioural intentions in relation to medication safety.

This paper has been submitted to *Nurse Education Today* and is currently under review. Having demonstrated the reliability of this instrument, the next stage of the research
involved using the TPB-MSQ instrument to investigate the effectiveness of a specific web-based IPE experience.

Chapter 5 presents manuscript four in the thesis. This paper reports the results of a quasi-experimental study that used the TPB-MSQ to examine the impact of a web-based interprofessional learning module on health professional student’s behavioural intentions in relation to medication safety and collaborative practice. Health professional students (n = 320) from nursing, medicine and pharmacy were allocated to either an experimental (n= 155) or control group (n= 165). Participants in the experimental group were asked to view a web-based learning module focused on medication safety, interprofessional communication and preparation for interprofessional collaborative practice. The development and expert review of the module is described in Chapter 5 and a link to the module is provided.

The study found that participants in the experimental group demonstrated a significantly greater intention to practice in a way that enhances medication safety and collaborative practice than those in the control group, as evidenced by higher scores on all the outcomes of behavioural intention (p < 0.001); attitude (p < 0.001); perceived behavioural control (p = 0.107); and subjective norm (p = 0.115). These findings support the value of web-based IPE experiences as an educational strategy to promote patient safety through enhancing the safe medication practices of future health professionals. However, further research is needed to determine whether these behavioural changes will transfer to actual clinical practice.

This paper has been submitted to the Focus on Health Professional Education
and is currently under review.

Table 1 outlines how each research aim was addressed by the study by outlining the data that was utilised and the participants that were included in each analysis. Chapter 6 brings the thesis to a close. An overall discussion of the key results from the four publications is provided. The limitations of the study and implications for practice, education and further research are then discussed.
### Table 1  The Research Design

<table>
<thead>
<tr>
<th>Research method</th>
<th>Paper 1</th>
<th>Paper 2</th>
<th>Paper 3</th>
<th>Paper 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research aim</td>
<td>Systematic review</td>
<td>Cross-sectional survey</td>
<td>Instrument development</td>
<td>Quasi-experimental study</td>
</tr>
<tr>
<td>(1) Appraise and synthesise the best available evidence on the effectiveness of IPE in university based health professional programs</td>
<td>(2) Scope the extent to which IPE is used to teach medication safety in Australian nursing, pharmacy and medical programs and the barriers and facilitators to IPE curricula integration;</td>
<td>(3) Develop and test an instrument based on the Theory of Planned Behaviour which uses the variables of attitude, subjective norms, and perceived behavioural control to predict nursing, pharmacy and medical student's intention to behave in a way that promotes medication safety; and</td>
<td>(4) Examine the impact of a web-based IPE module on nursing, pharmacy and medical student's attitude, subjective norms, perceived behavioural control, and intention to behave in a way that promotes medication safety.</td>
<td></td>
</tr>
<tr>
<td>Sample</td>
<td>Nine published studies</td>
<td>27 Australian and 4 New Zealand universities</td>
<td>Convenience sample of 65 nursing (41), medicine (14) and pharmacy (10) undergraduate students</td>
<td>320 undergraduate health professional students (control = 165, experimental = 155)</td>
</tr>
</tbody>
</table>
1.15 References


Lapkin, S., Levett-Jones, T., & Gilligan, C. (2012). A cross-sectional survey examining the extent to which interprofessional education is used to teach nursing, pharmacy and medical students in Australian and New Zealand Universities. *Journal of Interprofessional Care, 26*(5), 390-396.


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World Health Organization.


CHAPTER 2: The effectiveness of interprofessional education in university-based health professional programs: A systematic review

2.1 Publication relevance to thesis

Interprofessional education (IPE) is an educational strategy that has the potential to improve teamwork and collaborative practice, leading to improved patient outcomes. A growing body of literature supports IPE as the most effective approach for preparing health professional students for interprofessional practice commensurate with future workforce needs. Review of the literature (Chapter 1) shows that IPE has been advocated as an effective strategy in many countries, including the United States, Australia, Canada, United Kingdom and New Zealand, but to date there is little rigorous research to demonstrate evidence of its effectiveness.

The aim of this foundational stage of the research was to appraise and synthesise the best available evidence on the effectiveness of IPE in university based health professional training programs by conducting a systematic literature review. This was a critical step in guiding the design and implementation of the subsequent stages of the research. The systematic review was conducted following the guidelines published by the Joanna Briggs Institute (JBI) for Evidence Based Practice (2012). These guidelines were developed to minimise bias and establish validity of the findings. A pre-defined protocol was developed, peer-reviewed by the JBI and followed
in the conduct of this review. This protocol defined the review questions and search strategy, including search terms and resources to be searched, as well as selection criteria, study quality assessment, data extraction, synthesis of extracted evidence and the projected timeline [Appendix B].

The candidate completed the Comprehensive JBI Systematic review training in 2009. The Principal Supervisor who acted as the secondary reviewer for the review completed the training in 2011.

2.2 References

The following paper reported on the systemic review and was subsequently published in collaboration with the research supervisors as:


At the time of thesis submission this paper has been cited once.

Permissions to reproduce text and figures associated with the systematic review has been obtained from the JBI [Appendix D].
The effectiveness of interprofessional education in university-based health professional programs: A systematic review

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Executive summary

Background: A key responsibility of universities is to prepare health professional graduates for their roles as effective members of the health care team. Currently, most university-based health professional education is delivered in a traditional, discipline specific way. This approach is limited in its ability to equip graduates with the necessary knowledge, skills and attitudes for effective interprofessional collaboration and for working as part of a complex health care team. Interprofessional education occurs when learners from two or more professional groups learn about, from and with each other. The fundamental premise of interprofessional education is that if health professional students learn together they will be better prepared for interprofessional collaboration ultimately leading to improved patient outcomes.

Objective - The objective of this systematic review was to identify the best available evidence for the effectiveness of university-based interprofessional education.
Inclusion criteria - The review included all randomised controlled trials and quasi-experimental studies that assessed the effectiveness of interprofessional education in university-based health professional programs. All studies that included two or more undergraduate or post-graduate health professional groups engaged in interprofessional education were considered. Outcome measures included objectively measured or self-reported educational outcomes and/or professional competencies related to interprofessional education as assessed by validated instruments such as the Readiness for Interprofessional Learning Scale and the Interdisciplinary Education Perception Scale.

Search strategy: A three-stage comprehensive search strategy was utilised to search across ten electronic databases. English language studies published between January 2000 and February 2011 were considered for inclusion.

Methodological quality: Two independent reviewers assessed the methodological quality of each study selected for retrieval using standardised Joanna Briggs Institute critical appraisal tools.

Data collection and synthesis: Data were extracted from studies using the standardised data extraction tool from the Joanna Briggs Institute. Meta-analysis was not possible because of the different outcomes, control groups and interventions of the selected studies; and the findings are therefore presented in narrative form.

Results: Nine published studies consisting of three randomised controlled trials, five controlled before and after studies and one controlled longitudinal study were eligible for inclusion in this review. Four studies reported significant improvement in attitudes and perceptions of interprofessional education. In addition, five studies reported a mixed set of outcomes related to interprofessional education interventions.

Conclusions

Implications for Practice

Student's attitudes and perceptions towards interprofessional collaboration and clinical decision making can be potentially enhanced through interprofessional education. However, the evidence for using interprofessional education to teach interprofessional communication skills and clinical skills such as resuscitation to health professions students is inconclusive and needs further investigation.

Implications for Research

Future randomised controlled studies explicitly focused on interprofessional education with rigorous randomisation procedures and allocation concealment; larger sample sizes;
and more appropriate control groups, would improve the evidence base of interprofessional education.

**Keywords:** interprofessional education, collaborative learning, health professional education, systematic review.

**Background**

Health professional programs are committed to the preparation of graduates for their roles as effective and collaborative members of the health care team. Upon completion of undergraduate programs and progression to clinical positions, nursing, medicine, and pharmacy graduates are required to work both collaboratively and autonomously in complex clinical environments. This requires effective teamwork and communication skills. Currently, most university-based health professional education is delivered in a discipline specific mode. This approach is limited in its capacity to equip graduates with the knowledge, skills or attitudes for interprofessional collaboration and for working effectively as part of a complex health care team.  

Interprofessional education (IPE) occurs when "learners from two or more professions learn about, from and with each other to enable effective collaboration and improved health outcomes". The fundamental premise of IPE is that if health professional students learn together they will be better prepared for interprofessional collaboration and teamwork, ultimately leading to improved health outcomes. However, the evidence in support of this premise tends to be more anecdotal than empirical.

**International context**

IPE has been recognised for its innovative approach for addressing many contemporary global healthcare challenges. The World Health Organization (WHO) has provided global support of IPE through various initiatives that began as early as 1973. One of the most significant examples is the Learning Together to Work Together for Health Report which called for IPE as a way to enhance collaboration and interprofessional teamwork.

More significantly, the WHO’s recently published *Framework for Action on Interprofessional Education and Collaborative Practice* has led to an interest in IPE at the global level. Other international organisations including the Organization for Economic Co-operation and Development (OECD) and the World Federation of Medical Education (WFME) have also embraced strategies that facilitate IPE.

In Canada and the UK there exists a clear policy direction and substantial government funding to incorporate IPE into health professional education. The Health Council of Canada has included a recommendation that each university health sciences program offers an IPE subject. In the UK, a
sense of urgency to implement IPE was generated by community outrage at the findings of the Bristol Royal Infirmary inquiry which attributed a significant portion of preventable errors to poor interprofessional collaboration. As a result, IPE is now a mandatory requirement in the UK for pre-registration training in health and social care. In the United States, the Institute of Medicine (IOM) published the report *Crossing the Quality Chasm: A New Health System for the 21st Century*. One of the major recommendations of this report was that “health professionals should be educated to deliver patient-centred care as members of an interdisciplinary team”.

**Australian Context**

The implementation of IPE in Australia has been slow compared to international efforts. In Australia, there is no clear policy to guide the incorporation of IPE into health curricula. This has been identified as a major barrier to its successful implementation and this is in spite of several government policy documents and independent reports that have specifically advocated for the inclusion of IPE in health professional education programs.

The Department of Health and Ageing (DOHA) in a report titled *Towards a National Primary Health Care Strategy*, referred to the importance of “multidisciplinary teams” and “interdisciplinary learning” and recommended that „the current and future primary health care workforce be provided with high quality education (undergraduate, postgraduate and vocational) and clinical training opportunities that support interdisciplinary learning” (p. 40). In the same year, Garling’s *Special Commission of Inquiry into Acute Care Services in NSW Public Hospitals* made clear recommendations supporting IPE approaches, stating that education and training should be undertaken in a manner that emphasises interdisciplinary team based patient centred care. Lastly, the *All Together Better Health* conference held in Australia in 2009 bought together leading international interprofessional health academics, researchers, experts and policy makers to endorse the inclusion of core elements of IPE in health professional education.

Some significant developments have been made in Australia, including the formation of Australasian Interprofessional Practice and Education Network (AIPPEN) and a national project undertaken by the Learning and Teaching for Interprofessional Practice (L-TIPP). AIPPEN brings together individuals, groups, and institutions with an interest in IPE across Australia and New Zealand. It aims to establish sustainable IPE through supporting and evaluating the effectiveness of relevant initiatives. The Australian Learning and Teaching Council (ALTC) funded L-TIPP project reviewed literature, undertook stakeholder interviews, and produced national IPE recommendations. The researchers identified many examples of innovative IPE initiatives across the Australian higher education sector. However, the majority of the projects were pilot initiatives involving relatively small numbers of students. The researchers noted that most of these projects were typically isolated, often in rural settings and with limited scope and funding.
Significance of interprofessional collaboration and education

An interprofessional team that collaborates effectively is characterised by its knowledge and understanding of each other’s roles and responsibilities as well as the team’s ability to respect and value the unique contribution made by each professional group to patient care.  

In this practice model, joint decision making is valued and each profession is empowered to assume leadership on patient care issues appropriate to their expertise.  

Practice-based interventions that are interprofessional have been shown to improve patient outcomes such as medication safety and length of hospital stay and improvement in health professionals’ interpersonal and communication skills are said to be associated with improved health outcomes.

The premise of IPE is that it enhances interprofessional collaboration and teamwork and ultimately leads to improved patient outcomes. Some studies report that information sharing, determining professional responsibilities, consensus building and setting common patient goals, all components of effective communication skills, can be enhanced through IPE.  

However, despite international support and a push for IPE as a key area of health professional development, there remains a lack of systematic evidence of its effectiveness.  

Although most of the assertions put forward in support of IPE are supported with references to evidence, in most cases the nature and methodological rigour of the evidence is not clear. Reviewers have argued that the concept of IPE remains unclear and that there are multiple definitions and objectives.  

Furthermore, the development and delivery of curricula that integrate IPE requires significant resources; therefore, its adoption should be based on evidence of effectiveness.

Existing reviews of IPE

In order to prevent duplication of research, a search of the Cochrane Library, Joanna Briggs Institute Library of Systematic Reviews, MEDLINE and DARE databases was undertaken to establish whether or not a recent review on IPE exists. This search identified four reviews focusing predominantly on IPE:

- A critical review of evaluations of interprofessional education
- Impact and effectiveness of inter-professional education in primary care: an RCN literature review
- Interprofessional education: effects on professional practice and health care outcomes

One of the earliest reviews was conducted by the United Kingdom Centre for the Advancement of Interprofessional Education (CAIPE) in 2002. It included 217 evaluations of IPE studies. Thirty percent of the studies included pre-registration students, however the research setting was often a health care facility rather than a university. The majority of the studies focused on continuing
professional development at post-registration levels and were undertaken within the workplace or employment training facilities. The review included nurses, medical practitioners, social workers, pharmacists, physiotherapists and other allied health care professionals. It is of note that this review was only based on studies published in Medline, CINAHL and the British Education Index, and did not include other electronic databases or grey literature.

The reviewers classified outcomes of IPE into six categories: learners’ reactions, changes in attitude or perception, changes in knowledge or skill, behavioural changes, changes in the organisation or delivery of care, and benefit to patients or clients. 23 Although some studies reported positive outcomes, the majority reported mixed results. The authors also report that the majority of the studies included in the review were variants of before-and-after studies and longitudinal studies.

In 2006, the Royal College of Nursing in the UK commissioned a literature review of published studies to determine the impact and effectiveness of IPE for primary care professionals. 24 The review included 20 studies published between 2000 and 2006 that contained some form of evaluation of the effectiveness of IPE in undergraduate courses and work-based team development programs. The professions included were nursing, medicine, dietetics, pharmacy and social work.

The findings suggested some positive outcomes associated with pre-registration IPE such as: improvement in knowledge and attitude towards the contribution of other health care professions. 24 Two of the included studies reported some negative findings such as resistance to IPE. The authors also identified limitations in the study methodologies such as a lack of control groups, limited use of validated instruments, and small samples sizes.

Another evidence synthesis was undertaken by Hammick et al (2007) 25 using selected bibliographic databases and journals published between 1981 and 2005. The review included 21 studies, 15 of which evaluated IPE delivered to undergraduate health professional students, predominantly from medicine, nursing and physiotherapy. Other professions included in the studies were pharmacy, occupational therapy, dentistry, social work and midwifery.

Due to the different methodologies and outcome measures, meta-analysis was not possible in this review so the results were presented in narrative form. The authors provided analysis of IPE outcomes related to learner reactions, knowledge, skills, attitudes, behaviour and client care. Collectively, the study results indicated a positive change in students’ perceptions in knowledge, skills, perceptions, and attitudes. Two studies reported that IPE education programs increased the volume of patients seen and the comprehensiveness of patient care. 25
The most comprehensive appraisal of the effectiveness of IPE on professional practice and health outcomes was conducted as a Cochrane review in 2000. The review considered randomised controlled trails, controlled before and after studies, and interrupted time-series studies. This review considered 1042 studies but none met the criteria for Cochrane review. The authors concluded that there was no published evidence of the effectiveness on IP collaboration in improving patient outcomes. In 2008, an update of the 2000 review identified six studies that compared the effectiveness of IPE with other teaching and learning approaches. The participants in the included studies were mainly qualified medical practitioners and registered nurses. The authors reported mixed results related to patient safety, with two of the six studies indicating no improvements on either professional practice or patient care. Four of these studies found that IPE improved the working culture in an emergency department, improved patient satisfaction; decreased errors in the emergency department; improved the management of the care delivered to domestic violence victims; and improved the knowledge and skills of professionals providing care to mental health patients. The authors concluded that due to the small number of studies and the heterogeneity of IPE approaches used, general conclusions could not be drawn.

**Methodological shortcomings**

The reviews discussed above provide some understanding of the impact of IPE on health outcomes however, the majority of the studies reported mixed results. Some of the reviews only included published studies sourced from electronic databases without exploring other unpublished and grey literature. Such review methodologies can lead to publication bias as relevant unpublished studies might have been excluded from the analysis.

While there is a slowly emerging body of evidence, the impact of IPE on education outcomes remains uncertain. The majority of the studies included in the reviews did not use rigorous research designs and validated measurement instruments which make it difficult to draw accurate conclusions regarding the effectiveness of IPE interventions. Such studies do not demonstrate cause and effect and therefore cannot address effectiveness of IPE interventions. Although the review by Hammick et al (2007) also included university health professionals it only considered studies up to 2005. There is therefore, a paucity of up-to-date evidence that specifically addressed the effectiveness of IPE in university health programs.

It is important to note that a lack sufficient evidence of the effectiveness of IPE does not necessarily equate to evidence of ineffectiveness. Rather, this presents an opportunity for searching, synthesising and summarising the available evidence on the effectiveness of IPE in university based health professional education. The systematic review will search, extract, appraise and synthesise published international research, adhering to the guidelines published by the Joanna Briggs Institute for
Evidence Based Practice. These guidelines have been developed to minimise bias and establish validity of the findings.

Definition of terms used in the review

For the purpose of this review, the following definitions of terms were used:

**Academic program**
An undergraduate or postgraduate program of study in which a participant was enrolled during the period of data collection. The academic programs included in the review are nursing, pharmacy, medicine, occupational therapy, physical therapy, and social work.

**Collaborative practice**
Collaborative practice in health-care occurs when multiple health workers from different professional backgrounds provide comprehensive services by working with patients, their families, carers and communities to deliver the highest quality of care across settings.

**Interprofessional collaboration**
In the clinical setting, Interprofessional collaboration occurs when healthcare providers, patients, and their families work together in the provision of coordinated and integrated care to enable optimal health outcomes.

**Interprofessional education**
Interprofessional education occurs when two or more professions learn with, from and about each other to improve collaboration and the quality of care.

**Interprofessional team**
An interprofessional team comprises different professions with specialised knowledge, skills and abilities; each contributing to a common goal which cannot be achieved when one individual profession acts alone.

**Multidisciplinary health care team**
A group of health professionals working together but who make autonomous or separate decisions.

**Uniprofessional education**
Uniprofessional education involves members of a single profession learning together without interactions with any other discipline.

**Objectives**
The aim of this review was to appraise and synthesise the best available evidence on the effectiveness of IPE in university-based health professional programs.
Review question

The specific question asked was:
What is the effectiveness of interprofessional education in university-based health professional programs?

Review method

Inclusion criteria

Types of participants
The review considered studies that include students of two or more undergraduate or post graduate health professions engaged in interprofessional education, regardless of gender, age or discipline.

Types of intervention(s)/phenomena of interest
The review considered studies that include any formal university-based pedagogical approaches to interprofessional education.

Types of outcomes
The review considered any objectively measured or self-reported educational outcomes and/or professional competencies related to interprofessional education assessed by validated instruments such as the Readiness for Interprofessional Learning Scale (RIPLS) and the Interdisciplinary Education Perception Scale (IEPS).

Types of studies
The systematic review considered all randomised controlled trials and quasi-experimental studies.

Search strategy
To avoid duplication of research, prior to commencing the review the Cochrane Library and the Joanna Briggs Institute databases were searched to ensure that a systematic review on this subject did not currently exist or was not in progress. It was determined that none of the systematic reviews previously discussed specifically focused on formal university-based pedagogical approaches to IPE.

The search strategy aimed to find both published and unpublished studies, limited to English language and restricted to the last decade (January 2000- February 2011). A three-step search strategy was utilised in this review. Initially a limited search of MEDLINE and Proquest was undertaken to help identify the range and type of studies potentially available for synthesis. The following keywords were used in the initial search: collaborative learning; competencies; curriculum; health professional education; practice and student teaching. This limited search was then followed by an analysis of the text words contained in the title and abstract and of the index terms used to describe the identified papers.
The second step involved searching additional electronic databases using several combinations and permutations of key words and index terms identified by the initial literature scoping. Where appropriate, key words were exploded and truncated. Using a defined search and retrieval method, the following databases were accessed and the search was limited to English publications:

1. AMED
2. CINAHL
3. Cochrane Central Register of Controlled Trials (CENTRAL)
4. Dissertation and Theses
5. EMBASE
6. ERIC
7. Journals@Ovid
8. MEDLINE
9. Proquest
10. PsycINFO

Detailed descriptions of the search strategies for each electronic database are given in Appendix I. The following were hand searched to find any additional literature and unpublished studies:

1. Journal of Interprofessional Care
2. Conference Proceedings
3. Directory of open access journals
4. Mednar

The bibliographical software package Endnote™ Version X2 was utilised to manage all references as it facilitates the importation of references and abstracts from studies obtained from the search process into the Joanna Briggs Institute (JBI) Comprehensive Review Management System (CReMS™) for assessment of methodological quality.

**Assessment of methodological quality**

Two independent reviewers assessed selected studies for methodological validity prior to inclusion in the review. For this process, the reviewers used the JBI critical appraisal instrument (Appendix II). Each retrieved study was critically appraised and the methodological quality assessed using the ten questions in the instrument. Due to the nature of the studies under review some of the criteria; for example concealing treatment groups and blinding participants; were not practical. Therefore, it was decided to include those with at least five of the ten criteria of methodological quality as determined by the JBI critical appraisal instrument (Appendix III).

**Data Collection**

Data were extracted from the papers included in the review using the standardised data extraction tool from JBI-MAStARI (Appendix IV). The extracted data included specific details about the
interventions, participant demographics, number and reasons for withdrawals and dropouts, study methods and any outcomes of significance to the objective of the review.

**Data Synthesis**

It was planned to pool quantitative papers in statistical meta-analysis where appropriate. Odds ratio (for categorical data) and weighted mean differences (for continuous data) and their 95% confidence intervals were to be calculated for each analysis. Where possible, heterogeneity between comparable studies was to be assessed using the standard chi-square analysis. However, meta-analysis was not possible because of the different outcomes, control groups and interventions of the selected studies; and the findings are therefore presented in narrative form.

**Review results**

The search strategy identified 4217 papers, of which 75 papers were deemed potentially relevant to this review, based on the assessment of title and abstracts. After removal of duplicates and detailed examination, full texts were retrieved for the remaining 12 studies. After analysis for methodological quality nine papers were identified for data extraction and analysis of results. A list of the studies excluded from the review following the methodological assessment with reasons for exclusion is provided in Appendix V.

The details of the selection process are presented in Figure 1.

**Figure 1**: Selection flow diagram

![Flow diagram showing the selection process](image-url)
Description of studies

Nine papers were included in the review as follows:

- randomised, pretest–post-test experimental design,\textsuperscript{30-32}
- controlled before and after studies\textsuperscript{33-37}
- controlled longitudinal study.\textsuperscript{38}

Of the three randomised controlled trials (RCTs), only two\textsuperscript{31, 32} gave details about the methods of randomisation. Due to the nature of the intervention and the studies, blinding of the participants or assessors was not practical in most of the studies. Only one study reported that participants were blinded to the study objectives\textsuperscript{36}, while outcome assessors and data analysts were blinded to the allocation in only one of the nine studies.\textsuperscript{31}

Participants

Undergraduate nursing and medical students accounted for the majority of participants in the included studies with four of the nine studies including nursing and medicine student participants only.\textsuperscript{30-32, 36} Other professions were: dental hygiene; dentistry; occupational therapy; pharmacy; physical therapy; physiotherapy; podiatry; prosthetics and orthotics; radiography; respiratory care. One study included postgraduate masters’ students from nursing and pharmacy\textsuperscript{32} and in one study the details of other participant’s professions were not given.\textsuperscript{33} Of the nine studies included in the review, four were from the United Kingdom\textsuperscript{30, 33, 36, 38} and one study each from Belgium,\textsuperscript{37} Canada,\textsuperscript{34} Germany,\textsuperscript{31} Japan\textsuperscript{32} and the United States of America.\textsuperscript{35}

Sample sizes

All of the studies used convenience sampling of health professional students. The number of participants ranged from 34\textsuperscript{32} to 573\textsuperscript{38} with an average sample size of 178 participants for the nine studies included in the review.

Baseline comparability of groups

Seven studies gave descriptions of baseline comparability of varying details related to participants’ demographics, including age, sex, and family status\textsuperscript{31, 32, 34-38} and prior experience.\textsuperscript{31, 36} In these studies, both the experimental and control groups were relatively homogeneous at baseline. Two of the nine studies did not give any description of baseline comparability.\textsuperscript{30, 33}

Interventions

In five studies\textsuperscript{30, 32, 33, 36, 37} the participants all received the same educational intervention with the control groups having uniprofessional participants and the experimental or intervention group consisting of interprofessional participants. In the other four studies,\textsuperscript{31, 34, 35, 38} the control group and experimental groups received different educational interventions although they consisted of
interprofessional participants. For all studies, differences in outcomes were compared between the control and experimental or intervention groups.

**Outcome assessment**

The primary outcomes were any objectively measured or self-reported educational outcomes such as knowledge, skills and attitudes towards IPE. Six of the included studies used pre-validated interprofessional instruments: Interdisciplinary Education Perception Scale; Readiness for Interprofessional Learning Scale; Student Stereotypes Rating Questionnaire and Attitudes Questionnaire. In three studies, the researchers developed their own instruments but did not give details of validity and reliability testing. A detailed summary of the characteristics of included studies including all results is given in Appendix VI.

**Results**

**Randomised controlled trials of IPE**

*Just, Schnell, Bongartz, and Schulz (2010)* conducted a RCT to examine the effects of an IPE course on interprofessional communication skills and patient care objectives with 20 undergraduate nursing and 20 undergraduate medical students in Germany. Prior to the commencement of the study, facilitators attended a two-hour training session based on the interprofessional core competencies identified by the Canadian Interprofessional Health Collaborative (respect, communication, patient-centred practice, decision making, shared knowledge and skills, problem solving and working collaboratively as a team).

The 20 nursing and 20 medical students were evenly assigned to either an experimental or a control group. All participants undertook pre-intervention case vignettes based on issues related to palliative care for elderly clients. The vignettes contained general baseline information and 15 extra profession specific items that were not included for the other professional group. The participants were asked to jointly discuss the case and determine patient care objectives in matched pairs of medical and nursing students. All participants were videotaped whilst undertaking the case vignettes.

After the pre-intervention case vignettes participants in the experimental group were taught interprofessional core competencies using a combination of PowerPoint presentations, case studies, references articles, role-play, reflection and discussion. Participants in the control group were only provided with written material containing the content of IPE curriculum. In addition, they were also asked to study the materials in silence and not to interact with other participants and this was regulated by facilitators.
Outcomes were assessed based on six different categories using a 6-point Likert Scale (1 = very unreasonable, 6 = very reasonable). The researchers reported a statistically significant improvement in patient care objective scores in the two categories of patient autonomy and psychological factors for both the experimental and control groups post-intervention. However, the effect was more significant in the experimental group: patient autonomy scores (4.30 ± 0.9, p = 0.001; 3.98 ± 0.95, p = 0.001) and psychological factors scores (3.58 ± 0.62, p = 0.001; 3.65 ± 1.06, p = 0.003) for the control and intervention groups respectively.

Considering interprofessional communication, there was a statistically significant increase in the number of information items exchanged between participants for both the experimental group (pre: 9.60 ± 1.79, p < 0.001; post: 12.25 ± 1.87; p < 0.001) and the control group (pre: 8.75 ± 2.59, p < 0.0001; post: 11.75 ± 2.22, p < 0.001). Interruptions and speaking time showed no change between or within groups. Analysis by professional groups indicated that post intervention the number of nursing student-initiated contacts increased significantly (p = 0.007). There were no statistically significant differences between the control and experimental groups in any other outcomes. The authors suggested that the results of this study indicate that IPE has a moderate positive effect on interprofessional communication style.

Nango and Tanaka (2010) undertook a RCT to evaluate the effectiveness of IPE on clinical decision-making. In this study, 20 undergraduate medical students were randomly assigned into either an interprofessional group with postgraduate nursing and pharmacy students or a uniprofessional medical student only group. The intervention consisted of a two-day facilitated problem based learning (PBL) sessions focused on evidence-based medicine (EBM). Prior to the program, all participants received a textbook that explained concepts of evidence based medicine. On day one of the session, students took a written test to evaluate their knowledge of clinical epidemiology. They were then given a 15-minute lecture explaining the concepts of EBM. After the lecture, the participants undertook facilitated small group discussions.

Participants were then required to work through a case scenario in groups to decide whether beta-blocker therapy should be used for cardiac protection in a 79-year-old man with diabetes, chronic obstructive disease, atrial fibrillation, and repeated hospitalisations for exacerbation of cardiac failure. During the sessions, clinical questions about the case scenario were generated based on the PICO model (patient, intervention, comparison and outcome). Students were provided with core information about the case, and were only given additional patient information when they specifically requested it. Additional patient information was presented on 36 information cards prepared ahead of time. Twelve of the 36 cards had biomedical information and 24 had psychosocial information.
A second four-hour session was conducted two weeks after the first. The participants spent the first 30 minutes reviewing the first session and then critically appraised an article based on a widely used oral beta-blocker. The main outcome measure was clinical decision making by medical students, measured by a visual analog scale (VAS) to quantify their likelihood of prescribing beta-blocker therapy. The VAS ranged from 0 (no desire to use at all) to 100 (absolutely want to use). Other outcomes included students’ comprehension of the case scenario and the change in knowledge of clinical epidemiology and the number of additional patient information cards requested. Students also self-evaluated the IPE experience using an eight-question 5-point Likert scale questionnaire.

At baseline both groups had similar VAS scores (38 ± 22 mm, 29 ± 23 mm and 46 ± 17 mm ($p = 0.40$) for the medical, pharmacy and nursing students respectively. At the end of the PBL program, there was a statistically significant difference in the VAS scores between the interprofessional and medical student only groups (54 ± 39 mm and 89 ± 8 mm, $p = 0.0013$ respectively). These VAS scores illustrate that the medical students in the interprofessional group showed a statistically significant tendency to avoid the beta-blocker treatment. The VAS scores for the pharmacy and nursing students at the end of the PBL program were 53 ± 29 mm and 70 ± 23 mm ($p = 0.013$) respectively.

There was no significant difference between knowledge of clinical epidemiology between medical students in the interprofessional group, medical students in the uniprofessional group, pharmacy and nursing students with scores of 4.1 ± 2.7, 3.6 ± 2.5, 4.6 ± 1.5 and 4.7 ± 1.9 ($p = 0.70$) out of a possible of 12 respectively. There were also no statistically significant differences in the number of correct scores between the different professional groups after the PBL program. However, the number of correct knowledge of clinical epidemiology answers increased significant from the beginning of the PBL program to the end for all the professions.

There were no significant differences in the number of additional patient information cards requested by the medical students in the interprofessional group (28 ± 3.8) and uniprofessional groups (22 ± 0, $p = 0.10$). However, medical students in the interprofessional group sought more psychosocial information cards (17.8 ± 3.8) than those in the uniprofessional groups (10 ± 0, $p = 0.052$), although this was not a statistically significant difference. The researchers concluded that this might suggest that non-medical students valued this kind of information more than medical students. As a result medical students in the interprofessional group tended not to use beta-blocker treatments as they were provided with additional information from nursing and pharmacy students such as the fact that the patient in the scenario did not want to be hospitalised and was at high risk of exacerbation of heart failure. Based on this small study the authors suggest that IPE experiences involving nursing and pharmacy students improved clinical decision making by medical students.
Street, et al. (2007) evaluated the effectiveness of community-based case studies of disabled children and their families on IPE outcomes using a RCT study. Participants were fourth year medical students at the University of Bristol and second year paediatric nursing students at the University of the West of England in the UK. A course administrator randomly allocated students into uniprofessional pairs (control) and interprofessional pairs (experiment).

Initially, the participants met for an introductory session that covered the case study and the research aims. Students were expected to work together in pairs to develop a holistic view of the implications of childhood disability. The students working in pairs visited disabled children at home and school and worked together to develop and present case studies. The arranged visits were conducted over 10 days and students returned for a formative assessment and evaluation session after two weeks.

The researcher used the Attitudes Questionnaire (AQ) and focus group interviews to assess attitudes towards IPE before and after the case studies. The AQ is a nine-item five-point Likert scale that measures attitudinal domains towards IPE. The AQ was developed and validated in a previous longitudinal study that was undertaken by Pollard, Miers, and Gilchrist (2005). The authors highlight that concurrent validity of the scale was established by comparing responses to the Readiness for Interprofessional Learning Scale (RIPLS) but they did not provide details of how this was achieved. The RIPLS is a 19-item questionnaire developed by Parsell and Bligh (1999) to assess the readiness of health care students from different disciplines to engage in IPE. The RIPLS is divided into three subscales labelled: teamwork and collaboration, professional identity, and roles and responsibilities. Initial psychometric testing of the instrument was based on a sample of 120 students from eight professional groups. The authors reported the internal consistency reliability of RIPLS at 0.90 in testing with health professions students.

Street, et al. (2007) then conducted one-way analysis of variance (ANOVA) and the results showed significant differences between mean attitude scores of medical participants at baseline ($p = 0.021$). Both medical and nursing in the interprofessional group showed an increase in mean scores before and after the case studies (medical: 34.2 and 33.1 and nursing: 36.0 and 36.1) although this was only statistically significant for the nursing students ($p = 0.044$). The authors suggest that this difference in mean scores might be attributed to the fact that nursing students had lower pre-intervention scores.

Quasi-experimental studies on IPE

Five controlled before and after (CBA) studies and one controlled longitudinal study were included in the review. Ateah et al. (2011) conducted a CBA to determine the effectiveness of interventions on undergraduate students' knowledge and skills related to IPE at a Canadian university. Fifty-one students from seven health professional education programs (dentistry, dental hygiene, medicine, nursing, occupational therapy, pharmacy, and physical therapy) participated in the
study. The participants were allocated into three groups consisting of a control group (n=17) and two experimental groups, namely IPE group (n=16) and immersion group (n=18).

On the first day of the study all participants were organised into small interprofessional groups of four to five students and took part in a common 30 minutes orientation to the research project. After the orientation, participants allocated to the control group were thanked and dismissed. Participants in the two experimental groups then completed the IPE intervention that consisted of a two and a half day education session that included didactic learning activities and short presentations on teamwork and participation in interprofessional interactive sessions. Patients living with chronic health conditions also provided detailed accounts of their experiences with health care professionals. Students then engaged in brainstorming and reflective activities and discussions in small interprofessional groups. Participants allocated to the immersion group then completed 8-9 days of facilitated immersive practice at various clinical sites where they shadowed various health professionals and other staff during their practice.

The researchers used the Student Stereotypes Rating Questionnaire (SSRQ) to evaluate nine IPE characteristics namely: interpersonal skills, professional competence, leadership, academic ability, being a team player, being an independent worker, confidence, decision-making and practical skills. The researchers reported that test-retest reliability of each item was examined in a previous pilot study using Pearson’s r and items that were not reliable over time were rejected at a 5% level of significance. An open-ended question was also included to obtain more in-depth information about students' knowledge of other health care professionals.

Participants rated each profession on a 5-point Likert-type scale ranging from 1 (very low) to 5 (very high). Participants also had the option of choosing “Do not know” if they had little/no knowledge of that profession. Higher scores on the SSRQ indicated more positive perceptions of other professions. The SSRQ was administered at four time points; prior to the IPE class intervention, following the IPE class intervention, following an IPE classroom intervention, following the IPE immersion experience, and four months post IPE immersion experience.

Statistical analysis of the all-trait mean scores indicated that there was a significant increase for the immersion group in the summary mean score of all traits between the first and second survey, and between the first and third survey (p < 0.05). However, there was no statistically significant increase in the summary mean score of all traits for any profession between the second survey and third survey.

The SSRQ results indicated mixed findings on the nine IPE characteristics. The mean rating of the six traits of professional competence, leadership, independence, team player, practical skills and confidence increased significantly between the first survey and third survey (p < 0.05). None of the
ratings across the nine characteristics decreased after IPE experiences. Taken together, the findings of this study support the incorporation of IPE curricula that address the role and functions of other health care professions.

Anderson et al., (2009) conducted a CBA evaluating medical students’ perceptions of IPE and knowledge gained after participating in either a uniprofessional or interprofessional workshop. A total of 199 undergraduate health professional students were allocated to either medical students only groups (control) or an experimental group in which medical students learned with other professionals (details of other professions not given). The allocation of medical students was random.

The intervention consisted of a one-day patient safety workshop. The workshop was based on a DVD depicting the hospitalisation and rehabilitation of an elderly patient that resulted in a near fatal outcome because of poor communication, ineffective teamwork and lack of professionalism. All students were given a workbook covering: professionalism, ethics, drug prescribing, written and verbal communication, and examples of incident forms. Students watched the DVD and used root cause analysis tool to identify key safety issues. Participants from both the control and experimental groups completed the activities in small groups facilitated by two educators, one of whom was a clinician.

The researchers used a multi-method evaluation, using questionnaires and focus groups. Knowledge acquisition was evaluated by a pre- and post-course eight question 5-point Likert scale questionnaire (1 = no knowledge change, 5 = a great deal of knowledge change). A second pre- and post-questionnaire- containing 16 questions scored on a 5-point Likert scale (1 = negative, 5 = positive) was used to assesses course design, content and relevance. The authors did not give details pertaining to the validity and reliability of these instruments.

The study compared outcomes for the medical student participants in the two groups. The results indicated that students in all groups increased their knowledge across all the learning outcomes ($p = 0.001$). However, of the key learning themes, medical students in the uniprofessional group achieved significantly higher scores than medical students in the interprofessional group (ranges: 80–86% uniprofessional, 56–77% interprofessional). On items related to IPE themes, medical interprofessional students achieved scores of 54.3–77.2%. They enjoyed learning interprofessionally (77%) and the input of students from the other disciplines helped them appreciate team-working roles (74%). The researchers concluded that safe clinical practice should be learned interprofessionally as this reflects the realities of practice.

Bradley, et al. (2009) conducted a CBA study in the United Kingdom (UK) to identify the effects of IPE experiences on medical and nursing students’ attitudes, leadership, team-work and performance...
of resuscitation skills. The participants consisted of second year medical and nursing students from a population of 215 students. Seventy-one randomly selected students were allocated to either the uniprofessional (control) group or the interprofessional (experimental) group. Both groups completed a one-day intermediate life support (ILS) program taught by accredited advanced life support instructors. All participants were taught airway management, semi-automatic defibrillation, and basic life support (BLS); they also completed ILS course-based assessment scenarios.

The Readiness for Interprofessional Learning Scale (RIPLS) was used to identify differences in student attitudes towards IPE. The RIPLS was completed at three points in time: before and after each course and 3-4 months later. The results indicated that for the subscales of professional identity and team-work scores increased significantly post-intervention for the interprofessional groups although they returned to pre-test levels by 3-4 months. Nursing students had significantly higher scores than medical students on the roles and responsibilities subscale at all three data collection points (p < 0.01). There were no other significant differences across the three sets of RIPLS scores for any of the participants.

Performance outcomes during assessment scenarios were rated using an adapted Leadership Behaviour Description Questionnaire (LBDQ), an Emergency Team Dynamics (ETD) scale was used to assess teamwork, and a Resuscitation Team Task (RTT) record used to evaluate resuscitation tasks. The authors did not give details of these scales but highlight that validity and reliability has been reported for the LBDQ and the ETD in previous studies. Statistical analysis of results indicated no significant difference in performance between the experimental and control groups on the LBDQ, ETD and RTT. The authors suggest that equivalent levels of learning are achievable for nursing and medical students through IPE experiences. The authors also noted that other demographic characteristics such as gender, previous interprofessional learning experiences, and previous leadership experience had no significant effect on any outcomes.

A CBA study by Goelen, et al.,(2006) 37 measured the effect of IPE modules integrated into existing curricula on students attitudes to interprofessional collaboration. The participants were 177 undergraduate medical, nursing and physiotherapy students from two universities. The participants completed the modules in small uniprofessional (control) groups and interprofessional (intervention) groups with even numbers of students from the three professions. The uniprofessional group completed the module in 2003 and the interprofessional group in 2004.

The IPE interventions consisted of five 2-hour PBL seminars that were integrated into existing medical, nursing and physiotherapy undergraduate curricula at the two participating universities. The seminars involved 20-30 minute interviews with patients who had a diagnosis of Parkinson diseases.
or a recent stroke. The students then jointly worked together in small groups and delivered a three-page essay on a selected educational goal. The authors did not provide details of the selected goals.

Changes in student’s attitudes were evaluated using the Interdisciplinary Education Perception Scale (IEPS) administered before and after the intervention. The IEPS is an 18-item Likert scale instrument developed in the USA as a pre- and post-test instrument to evaluate learners’ attitudes to IPE during a longitudinal study. Each of the 18 items are scored on a 6-point Likert scale (1= strongly agree, 6 = strongly agree). The maximum possible scores for the four factors are 96, 72, 90, and 72, respectively, and the maximum total score is 330; with a higher score indicating a more positive IPE outcomes. The developers of the IEPS reported the internal consistency alpha values for the four scales as 0.823, 0.563, 0.543 and 0.518 respectively with an alpha value of 0.872 for the entire scale. Although there is much debate about the most suitable cut off for Cronbach’s alpha coefficient values the higher the score the more valid the instrument and values greater than 0.7 are considered satisfactory.

No significant attitude improvements were detected in the uniprofessional group on any of the four IEPS subscales. However, analysis by gender showed statistically significant improvements in the overall attitudes of male students in the intervention group (before: 237.4 ± 22.1, after: 251.6 ± 21.9; \( p < 0.05 \)), and in attitudes pertaining to the competence and autonomy of individuals in one’s own profession in the interprofessional group as a whole (before: 72.1 ± 7.9, after: 73.6 ±10.7; \( p < 0.05 \)).

Becker and Godwin (2005) used pretest-posttest design to compare students attitudes following completion of an IPE module at a US university. In this study the IPE intervention for both the control and experimental groups consisted of online case studies, assignments, other web-based resources and written feedback from facilitators. Students in the experimental group also received a printed study guide, enhanced facilitation and weekly grades rewarding student interaction. Data were collected using online surveys and from online discussions between students and facilitators. The Interdisciplinary Education Perception Scale (IEPS) was administered before and after the intervention to compare outcomes between the control group and the experiment group.

The authors reported that students in the control and experimental groups had similar total IEPS scores prior to commencement of the module 70.7± 0.893 and 69.9 ± 0.983 (\( p = 0.551 \)) respectively. Following completion of the module, the two groups showed statistically significant differences in their total IEPS scores 72.4 ± 0.811 as compared to 68.2 ± 1.13 (\( p = 0.006 \)) for the control group. Analysis
of individual scale items showed that the students in the experimental group had greater pre-module to post-module changes in five of the 18 IEPS items indicating more positive attitudes towards IPE.

McFadyen, Webster, Maclaren and O’neill (2010) undertook a controlled longitudinal study in the UK to assess the impact of a four-year IPE intervention, on the attitudes of undergraduate health professional students with respect to IPE. A total of 573 nursing, occupational therapy, podiatry, prosthetics and orthotics, physiotherapy and radiography students participated in the study over four years, with 260 in the control group and 313 in the experimental group. The students in the control group commenced their undergraduate programs in 2003 and those in the experimental group commenced in 2004.

Participants in the control group received „usual” education and those in experimental group received the IPE intervention. The IPE intervention consisted of a combination of a 20-credit point formal module and themed days during each academic year. The module ran over 24 weeks and consisted of a keynote lecture followed by facilitated interprofessional seminar discussions. Themed days covering topics relevant to all professional groups occurred once during each semester for the duration of the study. The themed days involved a group lecture and facilitated small interprofessional group seminars.

Outcomes were evaluated using adapted versions of the Readiness for Interprofessional Learning Scale (RIPLS) and the Interdisciplinary Education Perception Scale (IEPS) administered at eight collection points during the four years of the study. The results from the RIPLS subscales indicated high scores of more than 75% of the maximum possible values for three subscales of teamwork and collaboration, negative professional identity, positive professional identity, and roles and responsibilities. The scores for roles and responsibilities subscale were, pre: 8.6 ± 1.8, 8.9 ± 1.7 and post: 9.1 ± 2.3, 9.1 ± 2.4 for the control and experimental groups respectively, indicating similar changes for both groups. Restricted Maximum Likelihood (REML) analysis conducted by the researchers concluded that the IPE intervention did not have a significant effect on this subscale. The authors suggest that the relatively high scores before the intervention may indicate idealistically positive attitude towards IPE among the participants at the commencement of the study.

IEPS scores were also more than 75% of the maximum possible values for each of the three subscales of competency and autonomy; perceived need for co-operation; and perception of actual cooperation. Statistical analysis of changes adjusted to baseline indicated positive attitudes toward IPE in the experimental group for the two subscales of competency and autonomy and perception of actual cooperation. All of the estimated effects from these two subscales were above zero with the IPE intervention resulting in a higher predicated mean level of support adjusted for baseline from the experimental group rather than the control group over time. The authors concluded that based on the
results of this longitudinal controlled study, health and social care undergraduate students commence their studies with idealistically strong views towards IPE.

Discussion

This systematic review was undertaken to investigate the effectiveness of university-based IPE. A systematic search of the literature resulted in nine studies that were eligible for inclusion. Four studies \(^{34-36}\) included in this review reported positive results with students in the experimental groups showing significant improvement in attitudes towards and perceptions of IPE as measured by validated instruments. However, two studies \(^{30, 37}\) reported mixed findings concerning participants attitudes towards IPE. The RCT by Street, et al. (2007) \(^{30}\) involving medical and nursing student participants, reported that the only significant change in attitudes towards IPE occurred in nursing students. Goelen, et al., (2006) \(^{37}\) found statistically significant improvements only in the attitudes of the male participants in the experimental group.

Three studies \(^{31-33}\) reported a mixed set of outcomes related to IPE interventions. Although reporting positive outcomes in relation to changes in clinical decision-making ability by medical students involved in IPE experiences, Nango and Tanaka (2010) \(^{32}\) reported no differences between the experimental and control groups in relation to knowledge of clinical epidemiology and interprofessional communication. Anderson et al., (2009) \(^{33}\) reported that mean knowledge scores improved more in the control group than in the intervention group, although there were significant changes in the experimental groups in other outcomes after IPE interventions. Just et al. (2007) \(^{31}\) reported significantly increased in patient care objective scores for both the control and experimental groups. The increase in score for the control group was statistically significant for two categories: guarding of patient’s autonomy and integration of psychological aspects. Scores for the experimental group were significant for three categories: pain therapy, guarding of patient’s autonomy, and integration of psychological aspects. In addition, there was a moderate improvement in interprofessional communication style for both the control and experimental groups.

In the study by Bradley, et al. (2009) \(^{36}\) students’ attitudes towards IPE increased significantly post-intervention for interprofessional groups but returned to pre-test levels by 3–4 months. This is an important result since the fundamental premise of IPE is that if health professional students learn together they will be better prepared for interprofessional collaboration and teamwork, ultimately leading to improved health outcomes. Given the timescale from educational intervention to professional practice and the numbers of other influencing factors that come into play over that period, it is necessary to conduct studies that fully explore the transferability of IPE outcomes to clinical practice.
The IPE approaches implemented by three of the nine studies were campus or classroom based.\textsuperscript{33, 35, 36} This might have been considered the most appropriate method to ensure delivery of IPE to large cohorts of students. However, clinically-based learning experiences form a significant component of health professional education and provide students with opportunities to integrate theoretical and practice-based skills. Only one study\textsuperscript{30} implemented IPE using practice-based learning opportunities. Ideally, on-campus IPE initiatives should be supported by deliberate opportunities for IPE during the experiential learning that occurs during clinical placements.

It is acknowledged that IPE approaches may be difficult to implement due to the pragmatic constraints inherent in university programs. Not all universities offer concurrent nursing, pharmacy and medicine programs and this makes IPE challenging to implement. Some of the logistical challenges to IPE include course design, timetabling restrictions, resource implications and large students’ cohorts. Innovations such as IPE require changes at multiple levels: institutional, curricula and individual. In one study an e-learning IPE module was successfully implemented\textsuperscript{35} with less cost and fewer logistical issues that in face-to-face methods. Although not necessarily ideal, e-learning approaches may signal the future for IPE particularly in situations where barriers seem to outweigh the benefits of face-to-face IPE initiatives.

Although overall the results indicate some positive outcomes related to IPE, a clearer understanding of the effectiveness of IPE in university-based health professional programs remains unclear due to the heterogeneity of the nine studies as well as their methodological limitations. It is important to note however that although some authors reported mixed outcomes no study reported completely negative outcomes as a result of the IPE interventions.

Limitations
All of studies considered for the review had methodological shortcomings. The studies used convenience sampling, which limits the generalisability of findings. In addition, the use of small sample sizes in some of the studies resulted in insufficient power to detect effects of the various interventions on the outcomes. In seven of studies participants were not blinded to the intervention and this may have led to is to social desirability bias as participants behaviour can be influenced by a conscious self-presentation tailored to an external audience.\textsuperscript{45} There was also a problem with studies not establishing robust baseline or comparative data in order that changes in outcomes could be accurately identified. Interpreting the findings from these studies was somewhat difficult.

Only one study\textsuperscript{36} explored potential relationships between demographic characteristics and IPE outcomes. The results indicated that gender, previous IPE experiences, professional background and previous leadership experience had no significant effect on IPE outcomes. Another study reported a gender bias in attitudes towards collaborative practice with male students showing significant overall
increase post-IPE intervention. Further studies examining the relationship between demographic characteristics and IPE outcomes are therefore warranted.

Conclusion

Implications for practice
Based on the findings from the small number of studies included in this review a number of recommendations can be made for practice based on JBI levels of evidence (Appendix VII).

- Students attitudes and perceptions towards interprofessional collaboration and clinical decision making ability can be potentially enhanced through IPE (Level II)
- The evidence for using IPE to teach interprofessional communication skills, patient care objectives and clinical skills such as resuscitation to health professional students is inconclusive and needs further investigation (Level II).
- No strong conclusion can be made on whether the gains attributed to IPE can be sustained over time (Level II)

Implications for research
Although the studies in this review reported a range of positive outcomes, the small number of studies, combined with heterogeneity of IPE interventions, means that it is not possible to draw generalisable inferences about the effectiveness of IPE. Future randomised controlled studies explicitly focused on IPE with rigorous randomisation procedures and allocation concealment, larger sample sizes, and more appropriate control groups, would improve the evidence base of IPE. Additionally, since most IPE interventions are multi-faceted and include more than one professional group future studies should consider cluster randomised designs.
Acknowledgements:
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Conflicts of interest
None known

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Appendix I– Search strategy

AMED via OvidSP (Date 25 Feb 2011)

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<td>1169</td>
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<td>2</td>
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Retrieved for further analysis based on title and abstract

Included in review 0

CINAHL (Date 25 Feb 2011)

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Included in review 4

Proquest and Dissertation and Theses (Date 27 Feb 2011)

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</table>

Lapkin et al., effectiveness of interprofessional education in university-based health professional programs © the authors 2011
education OR Interprofessional collaboration OR Interprofessional health care education)

2 IF(Interdisciplinary OR Interdisciplinary collaboration OR Interdisciplinary collaborative learning OR Interdisciplinary course OR Interdisciplinary education OR Interdisciplinary health care training OR Interdisciplinary learning OR Interdisciplinary programs OR Interdisciplinary research)

3 #1 OR #2

4 IF(Education OR Education OR Education programs OR Education undergraduates OR Education/pedagogy OR Education, higher OR Education research)

5 #3 AND #4

6 Limit Date range (>1/1/2000) AND (<12/31/2011)

7 Retrieved for further analysis based on title and abstract

8 Included in review

EMBASE via OvidSP (Date 27 Feb 2011)

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<td># 6 and # 10 and # 13</td>
<td># 6 and # 10 and # 13</td>
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15. limit 14 to (english language and (clinical trial or randomized controlled trial or controlled clinical trial or multicenter study) and yr="2000 -Current")

16. Retrieved for further analysis based on title and abstract

17. **Included in review**

### ERIC (Date 27 Feb 2011)

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### MEDLINE (Date 25 Feb 2011)

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6 //Education//  
(education$ or train$ or learn$ or teach$ or course$).tw.

7 exp Education/  
8 exp Education, Professional/  
9 exp Education, Graduate/  
10 exp Education, Public Health Professional/  
11 #6 or #7 or #8 or #9 or #10  
12 student$.tw.  
13 exp Students, Health Occupations/  
14 exp Universities/  
15 #12 or #13 or #14  
16 #5 and #11 and #15  
17 limit # 16 to (english language and yr="2000 - 2011" and randomized controlled trial)

Retrieved for further analysis based on title and abstract

Included in review  3

PsycINFO via OvidSP (Date 25 Feb 2011)

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Appendix II – Critical appraisal instruments for experimental Studies

Assessment for: Name of Assessment

Type: Primary
User: Default
Design: Randomised Control Tables / Psuedo-randomised Trial

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<td>2) Were participants blinded to treatment allocation?</td>
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<td>☑</td>
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<tr>
<td>3) Was allocation to treatment groups concealed from the allocator?</td>
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<td>4) Were the outcomes of people who withdrew described and included in the analysis?</td>
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<td>☑</td>
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<td>5) Were those assessing outcomes blind to the treatment allocation?</td>
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<td>6) Were the control and treatment groups comparable at entry?</td>
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<td>8) Were outcomes measured in the same way for all groups?</td>
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<td>9) Were outcomes measured in a reliable way?</td>
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<td>10) Was appropriate statistical analysis used?</td>
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Include: Yes
Reason:

Update  Cancel
### Appendix III: Quality assessment of included studies

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**Key** 1 = Yes, 2 = No, 3 = Unclear
## Appendix IV - Data extraction instrument for experimental studies

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<tr>
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<td># Participants</td>
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<td>Group B:</td>
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<td>Interventions</td>
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<td></td>
<td>Interventions B:</td>
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<td>Authors Conclusion</td>
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<td>Reviewers Comments</td>
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</table>

-Lapkin et al., *effectiveness of interprofessional education in university-based health professional programs* © the authors 2011
Appendix V: List of excluded papers and reasons for exclusion


Appendix VI: Characteristics of included studies

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Country</th>
<th>Setting</th>
<th>Method</th>
<th>Participants</th>
<th>IPE Interventions</th>
<th>Outcome measures</th>
<th>Results</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Anderson, et al.</td>
<td>2009</td>
<td>UK</td>
<td>University of Leicester</td>
<td>Controlled before-and-after study</td>
<td>N = 199, medical students &amp; students from other professions (no details)</td>
<td>One day patient safety workshop based on a DVD, supportive workbook, reading materials, facilitated student debates and small group discussions</td>
<td>Knowledge across eight learning outcomes- pre- and post-workshop questionnaire on a 5-point Likert scale questionnaire</td>
<td>Group 1 &amp; Group 2 Participants increased their knowledge across all the eight learning outcomes p = 0.001 Group 2 Gained an appreciation of team-working roles from interactions with other professions</td>
<td>Analysis only compared outcomes between the medical participants only No details on validity and</td>
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</table>
| Author: Ateah, et al. | Method: Controlled before-and-after study | Participants: N= 51 dental hygiene, dentistry, medicine, nursing, occupational therapy, pharmacy and physical therapy | Combination of 3 hrs orientation, two and a half days of interprofessional learning using interactive and didactic learning activities, presentations from educators, small group brainstorming activities, reflection and clinical experience | reliability of questionnaires  
• Medical student allocation was random |

| Year: 2011 | Group 1 (n = 17) Small interprofessional groups -Orientation only | • Students perspectives of health professionals- 5-point Likert scale Student Stereotypes Rating Questionnaire (SSRQ)  
• In-depth perceptions of other health care professionals- Open ended | Group 1 & Group 2 Improved knowledge, skills, perceptions and attitudes about teamwork and collaboration  
Group 2 Further increased knowledge, skills, values, and perceptions about collaboration p < 0.05 | • Small sample size  
• Convenience sample of volunteers  
• Allocation not truly random-some self-selection included |

| Country: Canada | Group 2 (n =141) Small interprofessional groups of medical students with students from other professions -details of other professions not given | relevance- pre- and post-questionnaire-containing 16 questions scored on a 5-point Likert scale  
• Students perceptions of IPE- Focus Group interviews | • Small sample size  
• Convenience sample of volunteers  
• Allocation not truly random-some self-selection included |

| Setting: University of Manitoba | Group 2 (n =16) Small interprofessional | • Small sample size  
• Convenience sample of volunteers  
• Allocation not truly random-some self-selection included |
<table>
<thead>
<tr>
<th>Author: Becker &amp; Godwin</th>
<th>Year: 2005</th>
<th>Country: USA</th>
<th>Setting: Long Island University</th>
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</table>

**Method:** Controlled before-and-after study

**Participants:** N = 153 Undergraduate students enrolled in 1st semester course in occupational therapy, physical therapy and respiratory care

**Six weeks interprofessional health professions module utilising web-based resources such as case studies assignments and written feedback. Module integrated into existing curricular / courses**

**Group 1 (n = 92)**
Small interprofessional groups undertook the control IPE module

**Group 2 (n = 61)**
Small interprofessional groups undertook the experimental IPE module

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<td>Total IEPS scores: (Mean)</td>
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</tr>
<tr>
<td>No. of student messages</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- No randomisation
- Both control and experimental modules were integrated into existing courses

Lapkin et al. Effectiveness of interprofessional education in university-based health professional programs © the authors 2011
<table>
<thead>
<tr>
<th>Author: Bradley, et al.</th>
<th>Study design: Controlled before-and-after study</th>
<th>Participants: N = 215 medical &amp; nursing students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year: 2009</td>
<td>One day Intermediate Life Support course that covered airway management, semi-automatic defibrillation and basic life support. Course-based assessment scenarios were video recorded</td>
<td></td>
</tr>
<tr>
<td>Country: UK</td>
<td>Group 1 (n = 23) Small uniprofessional medical students only groups</td>
<td></td>
</tr>
<tr>
<td>Setting: Multisite-two universities</td>
<td>Group 2 (n = 30) Small interprofessional groups of medical students &amp; nursing students</td>
<td></td>
</tr>
</tbody>
</table>

- Team work - Leadership Behaviours Description Questionnaire (LBDQ) and Emergency Team Dynamics (ETD)
- Resuscitation skills - Resuscitation Team Task (RTT)
- Student attitudes toward IPE - RIPLS
- Opinions and attitudes towards IPE - Focus group interviews

<table>
<thead>
<tr>
<th>Total &lt; 9.25</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1:</td>
<td>14</td>
</tr>
<tr>
<td>Group 2:</td>
<td>5</td>
</tr>
<tr>
<td>p: NS</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RIPLS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1: Professional identity and team-working increased significantly post-intervention p &lt; 0.01</td>
</tr>
<tr>
<td>Group 2: Nursing students had significantly higher scores than medical students on the roles and responsibilities subscale p &lt; 0.01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 1 &amp; Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>No significant differences between groups in LBDQ, ETD &amp; RTT</td>
</tr>
</tbody>
</table>

- No details on randomisation
- Participants blinded to study objectives
- RIPLS scores increased immediately post IPE but fell back after 3–4 months
<table>
<thead>
<tr>
<th>Author: Goelen, et al.</th>
<th>Study design: Controlled before and after study</th>
<th>Module consisting of five problem based learning seminars of two hours each, integrated into existing undergraduate medical, nursing and physiotherapy curricula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year: 2006</td>
<td>Participants: N = 177 medical, nursing and physiotherapy</td>
<td>Group 1 (n = 87) Student from a single profession undertook in small groups</td>
</tr>
<tr>
<td>Country: Belgium</td>
<td>Setting: Vrije Universiteit Brussel &amp; Erasmushogeschool Brussel</td>
<td>Group 2 (n = 90) Small interprofessional groups of 3-4 medical, nursing and physiotherapy students</td>
</tr>
<tr>
<td></td>
<td>Study design: Controlled before and after study</td>
<td>• Students attitudes toward IPE - IEPS</td>
</tr>
<tr>
<td></td>
<td>Participants: N = 177 medical, nursing and physiotherapy</td>
<td>• Patient views collected by facilitators before and after intervention</td>
</tr>
<tr>
<td></td>
<td>Setting: Vrije Universiteit Brussel &amp; Erasmushogeschool Brussel</td>
<td>Group 1: 67.0 ± 11.3  66.5 ± 9.7  Group 2: 72.1 ± 7.9  73.6 ± 10.7  ( p &lt; 0.05 )</td>
</tr>
<tr>
<td>Year: 2010</td>
<td>Country: Germany</td>
<td>Overall IEPS score male participants only (Mean ± SD)</td>
</tr>
<tr>
<td>Setting: Medical School</td>
<td>Study design: Randomised controlled trial</td>
<td>Before</td>
</tr>
<tr>
<td>Participants: N= 40 medical and nursing students</td>
<td>Two day seminars of 6 hours of teaching covering palliative care, geriatrics, communication and organisation</td>
<td>After</td>
</tr>
<tr>
<td>Group 1 (n =20 )</td>
<td>Care objectives</td>
<td>Group 1: Pre  Post</td>
</tr>
<tr>
<td>Group 1: 229.6 ± 32.7  220.7 ± 30.7  ( p &lt; 0.05 )</td>
<td>Pain Management</td>
<td>3.28 ± 2.00  4.70 ±</td>
</tr>
<tr>
<td>Group 2: 237.4 ± 22.1  251.6 ± 21.9  ( p &lt; 0.05 )</td>
<td>IPE module integrated in existing curricula</td>
<td>• Randomisation through computer random number</td>
</tr>
<tr>
<td>14 participants excluded due to incomplete results</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Small interprofessional groups undertook the **control IPE module**

**Group 2 (n = 20)**

Small interprofessional groups undertook the **experimental IPE module**

<table>
<thead>
<tr>
<th></th>
<th>Information exchanged</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1.26</td>
<td><strong>p = 0.076</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group 2: Pre</strong></td>
<td></td>
<td>2.88 ± 1.63</td>
<td>4.90 ± 1.23</td>
<td>1.23</td>
<td><strong>p = 0.006</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other symptoms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group 1: Pre</strong></td>
<td></td>
<td>3.63 ± 0.94</td>
<td>3.63 ± 0.57</td>
<td>0.57</td>
<td><strong>p = 0.888</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group 2: Pre</strong></td>
<td></td>
<td>3.78 ± 0.43</td>
<td>3.63 ± 0.68</td>
<td>0.68</td>
<td><strong>p = 0.630</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Patient’s autonomy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group 1: Pre</strong></td>
<td></td>
<td>1.80 ± 0.26</td>
<td>4.30 ± 0.91</td>
<td><strong>p = 0.001</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group 2: Pre</strong></td>
<td></td>
<td>1.98 ± 0.56</td>
<td>3.98 ± 0.95</td>
<td><strong>p = 0.001</strong></td>
<td></td>
</tr>
</tbody>
</table>

**generation & stratification**
- Convenience sample of volunteers
<table>
<thead>
<tr>
<th></th>
<th>Group 1: Pre</th>
<th>Post</th>
<th>Group 2: Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advance planning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.00 ± 0.67</td>
<td>1.80 ±0.91</td>
<td>3.50 ± 0.42</td>
<td>4.15 ±0.92</td>
</tr>
<tr>
<td></td>
<td>0.629</td>
<td>0.065</td>
<td>0.92</td>
<td>0.167</td>
</tr>
<tr>
<td><strong>Integration of relatives</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.05 ± 0.87</td>
<td>3.85 ±1.00</td>
<td>3.55 ± 0.98</td>
<td>4.15 ±0.88</td>
</tr>
<tr>
<td></td>
<td>0.073</td>
<td>0.167</td>
<td>0.073</td>
<td>0.167</td>
</tr>
<tr>
<td><strong>Psychological factors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.75 ± 0.17</td>
<td>3.58 ±0.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.001</td>
<td>0.001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initiation of contact</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group 1: Pre Post</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical:</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Nursing:</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>( p = 0.6547 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group 2: Pre Post</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical:</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Nursing:</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>( p = 0.0007 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Occupation of speaking time</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(%) ± SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group 1 Pre Post</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical:</td>
<td>45.54 ± 7.17</td>
<td>44.02 ± 7.30</td>
</tr>
<tr>
<td>Nursing:</td>
<td>54.42 ± 7.15</td>
<td>55.90 ± 7.19</td>
</tr>
<tr>
<td><strong>Group 2 Pre Post</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical:</td>
<td>50.52 ± 15.45</td>
<td>47.72 ± 6.29</td>
</tr>
<tr>
<td>Nursing:</td>
<td>48.95 ± 15.79</td>
<td>52.28 ± 6.29</td>
</tr>
<tr>
<td>Number of information items exchanged (Mean ± SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group 1</strong></td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>8.75 ± 2.59</td>
<td>11.75 ± 2.22</td>
<td></td>
</tr>
<tr>
<td><em>p</em> &lt; 0.0001</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group 2</strong></td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>9.60 ± 1.79</td>
<td>12.25 ± 1.87</td>
<td></td>
</tr>
<tr>
<td><em>p</em> &lt; 0.001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Author:** Lapkin et al.  
**Year:** 2011  
**Country:** UK  
**Setting:** Glasgow Caledonian University and University of Strathclyde

**Study design:** Controlled longitudinal study  
**Participants:** N= 573 nursing, occupational therapy, podiatry, prosthetics and orthotics, physiotherapy and radiography  
**20 credit point module consisting of three contact hours per week for 24 weeks consisting of themed days and facilitated small interprofessional group seminars**

| Group 1 (n=260) |  
| Students from the six professions undertook their usual programs |
| Group 2 (n=313) |  
| Students from the six professions undertook the

**Attitudes and perceptions towards IPE - RIPLS and IEPS**

<table>
<thead>
<tr>
<th>RIPLS (Mean ± SD)</th>
<th>Teamwork &amp; Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group 1:</strong></td>
<td>Pre</td>
</tr>
<tr>
<td>Year 1:</td>
<td>38.6 ± 3.8</td>
</tr>
<tr>
<td>Year 2:</td>
<td>37.8 ± 4.8</td>
</tr>
<tr>
<td>Year 3:</td>
<td>37.4 ± 5.6</td>
</tr>
<tr>
<td>Year 4:</td>
<td>37.8 ± 4.7</td>
</tr>
<tr>
<td><strong>Group 2:</strong></td>
<td>Pre</td>
</tr>
</tbody>
</table>

**Lapkin et al.** Effectiveness of interprofessional education in university-based health professional programs © the authors 2011
<table>
<thead>
<tr>
<th>Year</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>39.5 ± 4.1</td>
<td>36.5 ± 6.6</td>
</tr>
<tr>
<td>Year 2</td>
<td>35.4 ± 5.4</td>
<td>35.1 ± 5.4</td>
</tr>
<tr>
<td>Year 3</td>
<td>35.6 ± 5.6</td>
<td>34.9 ± 7.1</td>
</tr>
<tr>
<td>Year 4</td>
<td>36.1 ± 5.4</td>
<td>36.4 ± 6.0</td>
</tr>
</tbody>
</table>

**Negative Professional Identity**

**Group 1:** Pre Post

<table>
<thead>
<tr>
<th>Year</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>13.0 ± 1.6</td>
<td>12.8 ± 2.3</td>
</tr>
<tr>
<td>Year 2</td>
<td>12.6 ± 2.1</td>
<td>12.6 ± 2.1</td>
</tr>
<tr>
<td>Year 3</td>
<td>13.1 ± 4.0</td>
<td>12.6 ± 2.2</td>
</tr>
<tr>
<td>Year 4</td>
<td>12.6 ± 2.2</td>
<td>13.0 ± 2.1</td>
</tr>
</tbody>
</table>

**Group 2:** Pre Post

<table>
<thead>
<tr>
<th>Year</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>13.2 ± 1.9</td>
<td>11.8 ± 2.4</td>
</tr>
<tr>
<td>Year 2</td>
<td>11.6 ± 2.4</td>
<td>11.7 ± 2.5</td>
</tr>
<tr>
<td>Year 1</td>
<td>Year 2</td>
<td>Year 3</td>
</tr>
<tr>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>Group 1: Pre</td>
<td>Post</td>
<td>Pre</td>
</tr>
<tr>
<td>Pre:</td>
<td>Post</td>
<td>Pre</td>
</tr>
<tr>
<td>Year 1:</td>
<td>16.9 ± 2.0</td>
<td>16.4 ± 2.2</td>
</tr>
<tr>
<td>Year 2:</td>
<td>15.9 ± 2.6</td>
<td>15.8 ± 2.8</td>
</tr>
<tr>
<td>Year 3:</td>
<td>17.1 ± 2.1</td>
<td>15.1 ± 2.8</td>
</tr>
<tr>
<td>Year 4:</td>
<td>15.1 ± 2.6</td>
<td>14.6 ± 3.3</td>
</tr>
</tbody>
</table>
### Roles & Responsibilities

<table>
<thead>
<tr>
<th>Group 1:</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1:</td>
<td>8.6 ± 1.8</td>
<td>8.9 ± 2.0</td>
</tr>
<tr>
<td>Year 2:</td>
<td>9.0 ± 2.0</td>
<td>8.8 ± 2.0</td>
</tr>
<tr>
<td>Year 3:</td>
<td>9.2 ± 1.9</td>
<td>9.1 ± 2.2</td>
</tr>
<tr>
<td>Year 4:</td>
<td>9.1 ± 1.8</td>
<td>9.1 ± 2.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 2:</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1:</td>
<td>8.9 ± 1.7</td>
<td>9.1 ± 2.4</td>
</tr>
<tr>
<td>Year 2:</td>
<td>9.1 ± 2.0</td>
<td>9.1 ± 2.1</td>
</tr>
<tr>
<td>Year 3:</td>
<td>9.5 ± 1.9</td>
<td>8.7 ± 2.7</td>
</tr>
<tr>
<td>Year 4:</td>
<td>9.8 ± 1.8</td>
<td>9.1 ± 2.4</td>
</tr>
</tbody>
</table>

- **IEPS** (mean ± SD)

### Competency & Autonomy

<table>
<thead>
<tr>
<th>Group 1:</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 1:</td>
<td>25.4 ± 2.4</td>
<td>25.0 ± 2.4</td>
</tr>
<tr>
<td>Year 2:</td>
<td>24.6 ± 2.9</td>
<td>23.8 ± 3.2</td>
</tr>
<tr>
<td>Year 3:</td>
<td>23.8 ± 3.1</td>
<td>24.4 ± 3.1</td>
</tr>
<tr>
<td>Year 4:</td>
<td>24.5 ± 2.9</td>
<td>24.7 ± 3.6</td>
</tr>
</tbody>
</table>

**Group 2:**

| Year 1: | 25.0 ± 2.4 | 25.6 ± 2.6 |
| Year 2: | 24.9 ± 2.9 | 24.9 ± 2.7 |
| Year 3: | 24.5 ± 2.6 | 25.2 ± 3.1 |
| Year 4: | 25.0 ± 2.7 | 24.8 ± 3.4 |

**Perceived Need for Co-operation**

<p>| Group 1: | Pre     | Post    |
| Year 1:  | 9.8 ± 1.4 | 9.8 ± 1.3 |</p>
<table>
<thead>
<tr>
<th>Group 1</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1:</td>
<td>25.3 ± 2.6</td>
<td>24.8 ± 2.4</td>
</tr>
<tr>
<td>Year 2:</td>
<td>24.5 ± 3.2</td>
<td>23.7 ± 3.3</td>
</tr>
<tr>
<td>Year 3:</td>
<td>24.1 ± 2.9</td>
<td>24.4 ± 2.7</td>
</tr>
</tbody>
</table>

**Perception of Actual Cooperation**

<table>
<thead>
<tr>
<th>Group 2</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1:</td>
<td>9.8 ± 1.3</td>
<td>9.5 ± 1.7</td>
</tr>
<tr>
<td>Year 2:</td>
<td>9.5 ± 1.6</td>
<td>9.3 ± 1.5</td>
</tr>
<tr>
<td>Year 3:</td>
<td>9.5 ± 1.3</td>
<td>9.5 ± 1.4</td>
</tr>
<tr>
<td>Year 4:</td>
<td>9.6 ± 1.3</td>
<td>9.4 ± 1.6</td>
</tr>
</tbody>
</table>

**Year:**
- Year 2: 9.7 ± 1.5 9.4 ± 1.2
- Year 3: 9.5 ± 1.5 9.5 ± 1.6
- Year 4: 9.5 ± 1.5 9.8 ± 1.6

**Group 2:**
- Year 1: Pre 9.8 ± 1.3 9.5 ± 1.7
- Year 2: Pre 9.5 ± 1.6 9.3 ± 1.5
- Year 3: Pre 9.5 ± 1.3 9.5 ± 1.4
- Year 4: Pre 9.6 ± 1.3 9.4 ± 1.6

**Perception of Actual Cooperation**
- Group 1: Pre 25.3 ± 2.6 24.8 ± 2.4
- Group 2: Pre 9.8 ± 1.3 9.5 ± 1.7
Author: Nango & Tanaka  
Year: 2010  
Country: Japan  
Setting: Tokyo Medical and Dental University

Study design:  
Randomised controlled trial

Participants: N = 34  
Undergraduate medical students & nursing and pharmacy post graduate (masters) students

Two day problem based learning sessions using textbooks, information emails, lecture, case scenario, small group discussions and case presentations  
Group 1 (n = 10)  
Small uniprofessional groups of medical students only

- Clinical decision making -100 mm Visual Analogue Scale (VAS)
- Clinical epidemiology knowledge- written test
- Number of additional patient

3.3  
Year 4:  
Group 2: Pre Post  
Year 1: 25.1 ± 2.6 25.2 ± 2.9  
Year 2: 24.4 ± 3.0 24.8 ± 2.9  
Year 3: 24.7 ± 2.6 24.8 ± 2.6  
Year 4: 24.6 ± 2.8 24.9 ± 3.0

- Clinical decision making No statistically significant differences in  
  VAS (Mean ±SD)
  Group 1: 40 ± 20 mm 49 ± 17 mm
  Group 2: 35 ± 22 mm 18 ± 17 mm
  p = 0.096  

- Small sample size  
- Randomisation through computer generated random numbers & stratification  
- Allocation

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<table>
<thead>
<tr>
<th>Author: Street, et al.</th>
<th>Study design: Randomised controlled trial</th>
<th>Participants: N = 160</th>
<th>Case studies including introductory session, prearranged home and school visits, formative</th>
<th>• Attitudes towards IPE -9-item Attitudes Questionnaire with a 5-point Likert scale</th>
<th>• Attitudes Questionnaire score (Mean ± SD)</th>
<th>• No details of method of randomisation</th>
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<td>Year: 2007</td>
<td></td>
<td></td>
<td>• Clinical epidemiology knowledge</td>
<td>No statistically significant differences</td>
<td></td>
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<td></td>
<td>• Additional patient information</td>
<td>No statistically significant difference between the groups</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Student evaluation of program-5-point Likert scale questionnaire</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Student evaluation of PBL program- no significant differences between groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Analysis compared outcomes between the medical students participants&quot; only</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Students who dropped out (n = 3) excluded from data analysis</td>
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Group 2 (n = 24)
Small interprofessional
groups of medical students
with nursing and pharmacy
post graduate students

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<th>No statistically significant differences</th>
</tr>
</thead>
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<td>• Student evaluation of program-5-point Likert scale questionnaire</td>
<td>Group 1: 3.6 ± 2.5</td>
<td>9.7 ± 1.5</td>
</tr>
<tr>
<td></td>
<td>Group 2: 4.1 ± 2.7</td>
<td>9.7 ± 1.5</td>
</tr>
<tr>
<td></td>
<td>p = 0.002</td>
<td>(p &lt; 0.001)</td>
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<table>
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<th>Group 1: 3.6 ± 2.5</th>
<th>9.7 ± 1.5</th>
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<td>Clinical epidemiology knowledge</td>
<td>Group 2: 4.1 ± 2.7</td>
<td>9.7 ± 1.5</td>
</tr>
<tr>
<td>p = 0.002</td>
<td></td>
<td>(p &lt; 0.001)</td>
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</table>

No statistically significant difference between the groups

Group 1: 22 ± 0
Group 2: 28 ± 3.8
p = 0.10

No statistically significant difference between the groups

Group 1: Before
Group 2: After

No statistically significant difference between the groups

Clinical epidemiology knowledge
No statistically significant differences

Pre
Post
Group 1: 3.6 ± 2.5
Group 2: 4.1 ± 2.7

Additional patient information
No statistically significant difference between the groups

Group 1: 22 ± 0
Group 2: 28 ± 3.8
p = 0.10

Student evaluation of PBL program - no significant differences between groups

Concealed until randomisation was completed

Analysis compared outcomes between the medical students participants only

No statistically significant difference between the groups

Group 1: Before
Group 2: After

No statistically significant difference between the groups

Clinical epidemiology knowledge
No statistically significant differences

Pre
Post
Group 1: 3.6 ± 2.5
Group 2: 4.1 ± 2.7

Additional patient information
No statistically significant difference between the groups

Group 1: 22 ± 0
Group 2: 28 ± 3.8
p = 0.10

Student evaluation of PBL program - no significant differences between groups
**Setting:** Multisite-two universities

| medical & nursing students | assessments and evaluation session. Group 1 (n = 88) Student undertook community based child disability case studies in nurse/nurse or medical/medical uniprofessional pairs Group 2 (n = 72) Students undertook community based child disability case studies nursing and medical students interprofessional pairs | to describe (pre/post IPE) • IPE learning experience and outcomes focus group interviews 6 months post IPE session | Medical pairs: 33.9 ± 5.6 33.1 ± 5.3 Nursing pairs: 36.6 ± 4.4 37.0 ± 4.3 Group 2: Before After Medical: 32.1 ± 5.9 33.6 ± 4.3 Nursing: 32.7 ± 6.1 36.0 ± 4.4 |
|--------------------------|--------------------------------------------------------------------------------|-------------------------------------------------|----------------------------------|---------------------------------|-------------------|------------------|-------------------|

Lapkin et al effectiveness of interprofessional education in university-based health professional programs © the authors 2011
### Appendix VII: JBI levels of evidence

<table>
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<tr>
<th>JBI Levels of Evidence</th>
<th>Effectiveness</th>
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<tbody>
<tr>
<td>I</td>
<td>Meta-analysis (with homogeneity) of experimental studies (e.g. Randomized Controlled Trials (RCT) with concealed randomization) OR One or more large experimental studies with narrow confidence intervals</td>
</tr>
<tr>
<td>II</td>
<td>One or more smaller RCTs with wider confidence intervals OR Quasi-experimental studies (without randomization)</td>
</tr>
<tr>
<td>III</td>
<td>a. Cohort studies (with control group)</td>
</tr>
<tr>
<td></td>
<td>b. Case-controlled</td>
</tr>
<tr>
<td></td>
<td>c. Observational studies (without control group)</td>
</tr>
<tr>
<td>IV</td>
<td>Expert opinion, or physiology bench research, OR consensus</td>
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</table>
The Joanna Briggs Institute encourage the publication of systematic reviews in high impact journals in order to enable wider dissemination and utilisation of evidence. Therefore, a journal paper adapted from the systematic review originally published in the Joanna Briggs Institute Database of Systematic Reviews was subsequently published in *Nurse Education Today*.

Citation:


At the time of thesis submission this paper has been cited 14 times.
A SYSTEMATIC REVIEW OF THE EFFECTIVENESS OF INTERPROFESSIONAL EDUCATION IN HEALTH PROFESSIONAL PROGRAMS

SUMMARY

Objective: The objective of this systematic review was to identify the best available evidence for the effectiveness of university-based interprofessional education for health students.

Background: Currently, most health professional education is delivered in a traditional, discipline specific way. This approach is limited in its ability to equip graduates with the necessary knowledge, skills and attitudes for effective interprofessional collaboration and for working as part of a complex health care team. Interprofessional education is widely seen as a way to improve communication between health professionals, ultimately leading to improved patient outcomes.

Inclusion criteria: The review included all randomised controlled trials and quasi-experimental studies in which two or more undergraduate or post-graduate health professional groups engaged in interprofessional education.

Review methods: A three-stage comprehensive search of ten electronic databases as well as grey literature was conducted. Two independent reviewers assessed each paper prior to inclusion using the standardised critical appraisal instruments for evidence of effectiveness developed by the Joanna Briggs Institute.

Results: Nine published studies consisting of three randomised controlled trials, five controlled before and after studies and one controlled longitudinal study were included in the review.

Conclusion: Student’s attitudes and perceptions towards interprofessional collaboration and clinical decision-making can be potentially enhanced through interprofessional education. However, the evidence for using interprofessional education to teach communication skills and clinical skills is inconclusive and requires further investigation.

Implications for research: Future randomised controlled studies explicitly focused on interprofessional education with rigorous randomisation procedures, allocation concealment, larger sample sizes, and control groups, would improve the evidence base for interprofessional education.
INTRODUCTION

Universities are committed to the preparation of graduates who will be able to work as effective members of the health care team. Nursing, medicine, pharmacy, and other allied health graduates are required to work both collaboratively and autonomously in complex clinical environments. This requires effective teamwork and communication skills. Currently, most university-based health professional education is delivered in a discipline specific mode. This approach is limited in its capacity to equip graduates with the knowledge, skills or attitudes for interprofessional collaboration and for working effectively as part of a complex health care team (Garling, 2008). It is claimed that interprofessional education (IPE) is a strategy for addressing these concerns. Interprofessional education occurs when “learners from two or more professions learn about, from and with each other to enable effective collaboration and improved health outcomes” (Center for the Advancement of Interprofessional Education, 2002). The fundamental premise of IPE is that if health professional students learn together they will be better prepared for interprofessional collaboration and teamwork, ultimately leading to improved patient care (Barr, Koppel, Reeves, Hammick, & Freeth, 2005). However, the evidence in support of this premise tends to be more anecdotal than empirical.

BACKGROUND

IPE has been proposed as an innovative approach for addressing many contemporary healthcare challenges. The World Health Organization (WHO) has provided global support of IPE though various initiatives that began as early as 1973. One of the most significant examples is the Learning Together to Work Together for Health Report (World Health Organization [WHO], 1988) which promoted IPE as a way to enhance collaboration and interprofessional teamwork. More recently, the WHO’s recently published Framework for Action on Interprofessional Education and Collaborative Practice led to an increased interest in IPE. Other international organisations including the Organization for Economic Co-operation and Development (OECD) and the World Federation of Medical Education (WFME) have also embraced strategies that facilitate IPE.

In Canada and the United Kingdom (UK) there exists a clear policy direction and substantial government funding to incorporate IPE into health professional education. The Health Council of Canada has included a recommendation that each university health sciences program offers an IPE subject (Bandali, Niblett, Yeung, & Gamble, 2010). In the UK, a sense of urgency to implement IPE was generated by community outrage at the findings of the Bristol Royal Infirmary inquiry which attributed a significant portion of preventable errors to poor interprofessional collaboration (Bristol Royal Infirmary Inquiry, 2001). As a result,
IPE is now a mandatory requirement in the UK for pre-registration training in health and social care (Department of Health & Quality Assurance Agency, 2006). In the United States, the Institute of Medicine (2001) published the report *Crossing the Quality Chasm: A New Health System for the 21st Century* which recommended that “health professionals should be educated to deliver patient-centred care as members of an interdisciplinary team” (Institute of Medicine, 2001).

In Australia, The Department of Health and Ageing (DOHA) in a report titled *Towards a National Primary Health Care Strategy*, referred to the importance of “multidisciplinary teams” and “interdisciplinary learning” (Department of Health and Ageing, 2008). In the same year, Garling’s (2008) *Special Commission of Inquiry into Acute Care Services in NSW Public Hospitals* made clear recommendations supporting IPE approaches, stating that education and training should be undertaken in a manner that emphasises interdisciplinary team-based patient-centred care. However, these recommendations appear to have been made without strong evidence of the effectiveness of IPE.

**Interprofessional collaboration and education**

An interprofessional team that collaborates effectively is characterised by each member’s knowledge and understanding of each other’s roles and responsibilities as well as the team’s respect and valuing of the unique contributions made by each professional group to patient care (Canadian Interprofessional Health Collaborative, 2010). In this practice model, joint decision making is valued and each profession is empowered to assume leadership on patient care issues appropriate to their expertise (World Health Organization, 2010). Interventions that are interprofessional have been shown to improve patient outcomes such as medication safety and length of hospital stay (Zwarenstein, Goldman, Reeves, 2009). IPE is purported to enhance health professionals’ interpersonal and communication skills, collaboration and teamwork leading to improved patient outcomes (Carey, Madill, & Manogue, 2010; Stewart, 1995).

Some studies report that information sharing, determining professional responsibilities, consensus building and setting common patient goals, all components of effective communication skills, can be enhanced through IPE (Priddis & Wells, 2010). However, despite international support for IPE as a key area of health professional education, there remains a lack of systematic evidence of its effectiveness (Braithwaite et al., 2007). Although many of the assertions put forward in support of IPE are supported by research, in most cases the nature and methodological rigour of the evidence is not strong. Additionally, commentators have argued that the concept of IPE remains unclear and that there are
multiple definitions and objectives (Finch, 2000). As the development and implementation of curricula that integrate IPE requires significant resources, its adoption should be based on evidence of effectiveness.

Existing reviews of IPE

In order to prevent duplication of research, a search of the Cochrane Library, Joanna Briggs Institute Library of Systematic Reviews, MEDLINE and DARE databases was undertaken to establish whether a recent review on IPE exists. This search identified four reviews (Clifton, Dale, & Bradshaw, 2007; Freeth, Hammick, Koppel, Reeves, & Barr, 2002; Hammick, Freeth, Koppel, Reeves, & Barr, 2007; Institute of Medicine, 2001; Reeves et al., 2008). Each provide some understanding of the impact of IPE on health outcomes but the majority report mixed results. Some of the identified reviews only included published studies sourced from electronic databases without exploring unpublished and grey literature. Such review methodologies can lead to publication bias as relevant studies might have been excluded from the analysis. Although the review by Hammick et al. (2007) included university health professional students it only considered studies up to 2005. Additionally, the majority of the studies included in the reviews did not use rigorous research designs and validated measurement instruments, which make it difficult to draw accurate conclusions regarding the effectiveness of IPE interventions.

It is important to note that a lack of sufficient evidence of the effectiveness of IPE does not necessarily equate to evidence of ineffectiveness. Rather, this presents an opportunity for searching, synthesising and summarising the available evidence on the effectiveness of IPE in university programs and recommendations for future research directions. The systematic review profiled in this paper searched, extracted, appraised and synthesised international research, adhering to the guidelines published by the Joanna Briggs Institute (JBI) for Evidence Based Practice. These guidelines were developed to minimise bias and establish validity of the findings.

REVIEW METHOD

Aim of review

The aim of this review was to appraise and synthesise the best available evidence on the effectiveness of IPE in university-based health professional programs.
**Inclusion criteria**

*Types of participants* - The review considered studies that include students of two or more undergraduate or post-graduate health professions engaged in interprofessional education, regardless of gender, age or discipline.

*Types of intervention(s)/phenomena of interest* - The review considered studies that include any formal university-based pedagogical approaches to interprofessional education.

*Types of outcomes* - The review considered any objectively measured or self-reported educational outcomes and/or professional competencies related to interprofessional education assessed by validated instruments such as the Readiness for Interprofessional Learning Scale (RIPLS) and the Interdisciplinary Education Perception Scale (IEPS).

*Types of studies* - The review considered all randomised controlled trials (RCTs) and quasi-experimental studies.

**Search strategy**

The search strategy aimed to find both published and unpublished studies, limited to English language and restricted to the last decade (2000-2011). A three-step search strategy was utilised. Initially a limited search of MEDLINE and Proquest was undertaken to help identify the range and type of studies potentially available for synthesis. This was then followed by an analysis of the text words contained in the title and abstract and of the index terms used to describe the identified papers.

The second step involved searching additional electronic databases using several combinations and permutations of key words and index terms identified by the initial literature scoping. Where appropriate, key words were exploded and truncated. Using a defined search and retrieval method, the following databases were accessed:

1. AMED
2. CINAHL
3. Cochrane Central Register of Controlled Trials (CENTRAL)
4. Dissertation and Theses
5. EMBASE
6. ERIC
7. Journals@Ovid
8. MEDLINE
9. Proquest
10. PsycINFO
Detailed descriptions of the search strategies for some of the electronic database are given in Table 1. The following were hand searched to find any additional literature and unpublished studies:

1. Journal of Interprofessional Care
2. Conference Proceedings
3. Directory of open access journals
4. Mednar

### Table 1 – Search strategy

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</table>

Included in review 4
Assessment of methodological quality
Two independent reviewers assessed selected studies for methodological validity prior to inclusion in the review. Each retrieved study was critically appraised and the methodological quality assessed using the ten questions in the JBI critical appraisal instrument. Due to the nature of the studies under review some of the criteria; for example concealing treatment groups and blinding participants; were not practical. Therefore, it was decided to include those with at least five of the ten criteria of methodological quality (Table 2- Appendix A).

Data Collection
Data extracted from the papers included specific details about the interventions, participant demographics, number and reasons for withdrawals and dropouts, study methods and any outcomes of significance to the objective of the review.

Data Synthesis
It was planned to pool quantitative papers in statistical meta-analysis where appropriate. However, this was not possible because of the different outcomes, control groups and interventions of the selected studies; thus the findings are presented in narrative form.

RESULTS
The search strategy identified 4217 papers, of which 75 papers were deemed potentially relevant to this review, based on the assessment of title and abstracts. After removal of duplicates and detailed examination, full texts were retrieved for the remaining 12 studies. After analysis of methodological quality, nine papers were identified for data extraction and analysis of results. The details of the selection process are presented in Table 3.

Description of studies
Nine papers were included in the review as follows:

- randomised, pretest–post-test experimental design (Just, Schnell, Bongartz, & Schulz, 2010; Nango & Tanaka, 2010; Street et al., 2007);
- controlled before and after studies (Anderson, Thorpe, Heney, & Petersen, 2009; Ateah et al., 2011; Becker & Godwin, 2005; Bradley, Cooper, & Duncan, 2009; Goelen, De Clercq, Huyghens, & Kerckhofs, 2006);
- controlled longitudinal study (McFadyen, Webster, Maclaren, & O'Neill, 2010).
Of the three randomised controlled trials (RCTs), only two (Just, et al., 2010; Nango & Tanaka, 2010) gave details about the methods of randomisation. Due to the nature of the intervention and the studies, blinding of the participants or assessors was not practical in most of the studies. Only one study reported that participants were blinded to the study objectives (Bradley, et al., 2009), while outcome assessors and data analysts were blinded to the allocation in only one of the nine studies (Just, et al., 2010).

**Participants**
Undergraduate nursing and medical students accounted for the majority of participants in the included studies with four of the nine studies including nursing and medical students only (Bradley, et al., 2009; Just, et al., 2010; Nango & Tanaka, 2010; Street, et al., 2007). Other professions were: dental hygiene; dentistry; occupational therapy; pharmacy; physical therapy; physiotherapy; podiatry; prosthetics and orthotics; radiography; respiratory care. One study included postgraduate masters students from nursing and pharmacy (Nango & Tanaka, 2010) and in one study the details of other participant’s professions were not given (Anderson, et al., 2009). Of the nine studies included in the review, four were from the
United Kingdom (Anderson, et al., 2009; Bradley, et al., 2009; McFadyen, et al., 2010; Street, et al., 2007) and one study each from Belgium, (Goelen, et al., 2006) Canada, (Ateah, et al., 2011) Germany, (Just, et al., 2010) Japan (Nango & Tanaka, 2010) and the United States of America (Becker & Godwin, 2005).

**Sample sizes**

All of the studies used convenience sampling with sample sizes from 34 (Nango & Tanaka, 2010) to 573 (McFadyen, et al., 2010).

**Baseline comparability of groups**

Seven studies gave descriptions of baseline comparability of varying details related to participants’ demographics, including age, sex, and family status (Ateah, et al., 2011; Becker & Godwin, 2005; Bradley, et al., 2009; Goelen, et al., 2006; Just, et al., 2010; McFadyen, et al., 2010; Nango & Tanaka, 2010) or prior experience (Bradley, et al., 2009; Just, et al., 2010). In these studies, both the experimental and control groups were relatively homogeneous at baseline. Two of the nine studies did not give any description of baseline comparability (Anderson, et al., 2009; Street, et al., 2007).

**Interventions**

In five studies (Anderson, et al., 2009; Bradley, et al., 2009; Goelen, et al., 2006; Nango & Tanaka, 2010; Street, et al., 2007) the participants all received the same educational intervention with the control groups having uniprofessional participants and the experimental or intervention group consisting of interprofessional participants. In the other four studies, (Ateah, et al., 2011; Becker & Godwin, 2005; Just, et al., 2010; McFadyen, et al., 2010) the control group and experimental groups received different educational interventions. For all studies, differences in outcomes were compared between the control and experimental or intervention groups.

**Outcome assessment**

The primary outcomes were any objectively measured or self-reported educational outcomes such as knowledge, skills and attitudes towards IPE. Six of the of the studies used pre-validated interprofessional instruments: Interdisciplinary Education Perception Scale (Becker & Godwin, 2005; Goelen, et al., 2006; McFadyen, et al., 2010); Readiness for Interprofessional Learning Scale (Bradley, et al., 2009; McFadyen, et al., 2010); Student Stereotypes Rating Questionnaire (Ateah, et al., 2011); and Attitudes Questionnaire (Street, et al., 2007). In three studies, the researchers developed their own instruments but did not give details of validity and reliability testing (Anderson, et al., 2009; Just, et al., 2010; Nango & Tanaka, 2010).
Description of studies

A detailed summary of the characteristics of included studies including all results is given in Table 4 (Appendix B). The major differences between the included studies are described below.

Anderson et al. (2009) conducted a controlled before and after (CBA) study evaluating medical students’ perceptions of IPE and knowledge gained after participating in either a uniprofessional or interprofessional workshop. Undergraduate students (n=199) were allocated to either medical students’ only (control) or experimental groups in which medical students learned with other professionals (details of other professions not given).

The intervention consisted of a one-day patient safety workshop based on a DVD depicting the hospitalisation and rehabilitation of an elderly patient. All students were given a workbook covering: professionalism, ethics, drug prescribing, written and verbal communication, and examples of incident forms. Students watched the DVD and used root cause analysis tool to identify key safety issues. Participants then completed the activities in small groups facilitated by two educators, one of whom was a clinician.

The researchers used a multi-method evaluation, using knowledge acquisition questionnaires and focus groups. Students in both groups increased their knowledge across all the learning outcomes. However, of the key learning themes, medical students in the uniprofessional group achieved significantly higher scores than those in the interprofessional group. Medical interprofessional students enjoyed learning interprofessionally and the input of students from the other disciplines helped them appreciate team-working roles.

Ateah et al. (2011) conducted a CBA to determine the effectiveness of interventions on undergraduate students’ knowledge and skills related to IPE at a Canadian university. Fifty-one students from seven health programs were allocated into three groups: (control group (n=17) and two experimental groups; IPE (n= 16) and immersion (n= 18)).

On the first day of the study, all participants took part in a common 30 minute orientation to the research project in small interprofessional groups. Participants in the two experimental groups then completed the IPE intervention that consisted of a two and a half day education session with didactic learning activities, short presentations on teamwork, and participation in brainstorming, reflective activities, and discussions in small interprofessional groups. Patients living with chronic health conditions also provided detailed accounts of their experiences with health care professionals.
Participants allocated to the immersion group then completed 8-9 days of facilitated immersive practice at various clinical sites where they shadowed various health professionals and other staff during their practice. The researchers used the Student Stereotypes Rating Questionnaire (SSRQ) to evaluate outcomes following an IPE classroom intervention, following the IPE immersion experience, and four months post IPE immersion experience.

The results revealed a significant increase in the summary mean score of all traits between the first and second survey, and between the first and third survey for the students exposed to a combination of IPE classroom experience and immersion experience. The mean rating for professional competence, leadership, independence, team player, practical skills and confidence increased significantly between the first survey and third survey. None of the ratings across the nine characteristics decreased after IPE experiences.

Becker and Godwin (2005) used a pretest-posttest design to compare students' attitudes following completion of an IPE module at a US university. In this study, the IPE intervention for both the control and experimental groups consisted of online case studies, assignments, other web-based resources, and written feedback from facilitators. Students in the experimental group also received a printed study guide, enhanced facilitation and weekly grades rewarding student interaction. Data were collected using online surveys and from online discussions between students and facilitators. The IEPS was administered before and after the intervention to compare outcomes between the control group and the experiment group.

The authors reported improved learning outcomes among students in the experimental group as reflected by more positive post-module total IEPS scores. Analysis of individual scale items showed that the students in the experimental group had greater pre- to post-module changes in five of the 18 IEPS items indicating more positive attitudes towards IPE.

Bradley, et al. (2009) conducted a CBA study in the United Kingdom (UK) to identify the effects of IPE experiences on medical and nursing students’ attitudes, leadership, team-work and performance of resuscitation skills. The participants consisted of second year medical and nursing students from a population of 215 students. Seventy-one randomly selected students were allocated to either the uniprofessional (control) group or the interprofessional (experimental) group. Both groups completed a one-day intermediate life support (ILS) program taught by accredited advanced life support instructors. The RIPLS was used to
identify differences in student attitudes towards IPE at three points in time: before and after each course and 3-4 months later.

Scores on the RIPLS subscales of professional identity and team-work scores increased significantly post-intervention for the interprofessional groups although they returned to pre-test levels by 3-4 months. Nursing students had significantly higher scores than medical students on the roles and responsibilities subscale at all three data collection points. There were no other significant differences across the three sets of RIPLS scores and performance during assessment scenarios for any of the participants. The authors also noted that other demographic characteristics such as gender, previous interprofessional learning experiences, and previous leadership experience had no significant effect on any outcomes.

A CBA study by Goelen, et al. (2006) measured the effect of IPE modules integrated into existing curricula on students attitudes to interprofessional collaboration. The participants were 177 undergraduate medical, nursing and physiotherapy students from two universities in Belgium. They completed the modules in small uniprofessional (control) groups and interprofessional (intervention) groups with even numbers of students from the three professions. The uniprofessional group completed the module in 2003 and the interprofessional group in 2004. The IPE interventions consisted of five 2-hour PBL seminars that were integrated into existing medical, nursing and physiotherapy undergraduate curricula at the two participating universities. The seminars involved 20-30 minute interviews with patients who had a diagnosis of Parkinson diseases or a recent stroke. The students then jointly worked together in small groups and delivered a three-page essay on a selected educational goal. The authors did not provide details of the selected goals.

They were no significant improvements in perception towards interprofessional co-operation as measured by IEPS between students in the experimental and control groups. However, analysis by gender showed statistically significant improvements in the overall attitudes of male students in the intervention group and in attitudes pertaining to the competence and autonomy of individuals in one’s own profession in the interprofessional group as a whole.

Just, et al., (2010) conducted a RCT to examine the effects of an IPE course on interprofessional communication skills and patient care objectives with 20 undergraduate nursing and 20 undergraduate medical students in Germany. All participants undertook pre-intervention case vignettes based on issues related to palliative care for elderly clients. Participants in the experimental group were taught interprofessional core competencies using a combination of PowerPoint presentations, case studies, references articles, role-
play, reflection and discussion. Participants in the control group were only provided with written materials containing the content of IPE curriculum. In addition, they were also asked to study the materials in silence and not to interact with other participants and this was regulated by facilitators.

The effects of IPE experiences on six different categories were evaluated using a 6-point Likert Scale. The researchers reported a statistically significant improvement in patient care objective scores on patient autonomy and psychological factors for both the experimental and control groups post-intervention, though the effect was more significant in the experimental group. Exposure to IPE experiences also resulted in a moderate positive effect on interprofessional communication style.

McFadyen, et al., (2010) undertook a controlled longitudinal study in the UK to assess the impact of a four-year IPE intervention, on the attitudes of undergraduate health professional students with respect to IPE. A total of 573 nursing, occupational therapy, podiatry, prosthetics and orthotics, physiotherapy and radiography students participated in the study over four years, with 260 in the control group and 313 in the experimental group. The students in the control group commenced their undergraduate programs in 2003 and those in the experimental group commenced in 2004.

Participants in the control group received ‘usual’ education and those in experimental group received an IPE intervention consisting of a combination of a 20-credit point formal module and themed days during each academic year. The module ran over 24 weeks and consisted of a keynote lecture followed by facilitated interprofessional seminar discussions. Themed days covering topics relevant to all professional groups occurred once during each semester for the duration of the study. Outcomes were measured at eight collection points during the four years of the study.

The researchers used adapted versions of the RIPLS and the IEPS to evaluate outcomes. The results from the RIPLS subscales indicated high scores of more than 75% of the maximum possible values for three subscales of teamwork and collaboration, negative professional identity, positive professional identity, and roles and responsibilities. Statistical analysis of changes adjusted to baseline indicated positive attitudes toward IPE in the experimental group for the two subscales of competency and autonomy and perception of actual cooperation.
Nango and Tanaka (2010) undertook an RCT to evaluate the effectiveness of IPE on clinical decision-making. In this study, 20 undergraduate medical students at a Japanese university were randomly assigned into either an interprofessional group with postgraduate nursing and pharmacy students or a uniprofessional medical student only group. The intervention consisted of a two-day facilitated problem based learning session focused on evidence-based medicine. As part of the session, participants were required to work through a case scenario. Students were provided with core information about the case, and were only given additional patient information when they specifically requested it.

Analysis of results indicated statistically significant differences in clinical decision-making with medical students in the interprofessional group having higher scores. A visual analog scale to quantify their likelihood of prescribing appropriate therapy in the case scenario was used to measure clinical decision-making. The authors suggest that IPE experiences involving nursing and pharmacy students improved clinical decision making by medical students.

Street, et al. (2007) evaluated the effectiveness of using community-based case studies of disabled children and their families for IPE using an RCT study. Participants were fourth year medical students at the University of Bristol and second year paediatric nursing students at the University of the West of England in the UK. Students were expected to work together in interprofessional pairs to develop a holistic view of the implications of childhood disability. The students visited disabled children at home and school and worked together to develop and present case studies. The arranged visits were conducted over 10 days and students returned for a formative assessment and evaluation session after two weeks.

In this study, both medical and nursing in the interprofessional group showed an increase in more open and positive attitudes towards IPE after the case studies as assessed by a nine-item five-point Likert scale Attitudes Questionnaire (AQ). However, the mean scores were significantly higher in nursing student participants. The authors suggest that this difference in mean scores might be attributed to the fact that nursing students had lower pre-intervention scores.

**DISCUSSION**

**Attitudinal changes**

This systematic review was undertaken to investigate the effectiveness of university-based IPE. There was evidence of attitudinal changes in three of the studies reviewed (Ateah, et al., 2011; Becker & Godwin, 2005; Bradley, et al., 2009) and two studies (Goelen, et al., 2009).
2006; Street, et al., 2007) reported mixed findings. The RCT by Street, et al. (2007) reported significant changes in attitudes towards IPE in nursing students only, and Goelen, et al. (2006) found statistically significant improvements only in the attitudes of the male participants in the experimental group. In the study by Bradley, et al. (2009) although students’ attitudes towards IPE improved post-intervention for the interprofessional groups they returned to pre-test levels by 3–4 months. This is an important result since the fundamental premise of IPE is that if health professional students learn together they will be better prepared for interprofessional collaboration and teamwork. Given the timescale from educational intervention to professional practice and the numbers of other influencing factors that come into play over that period, it is necessary to conduct studies that fully explore the transferability of IPE outcomes to clinical practice.

**Learning outcomes**

Three studies (Anderson, et al., 2009; Just, et al., 2010; Nango & Tanaka, 2010) reported mixed results related to the learning outcomes of IPE. Nango and Tanaka (2010) reported improved clinical decision-making ability by medical students (2010). Anderson et al., (2009) reported that improved knowledge scores in the control group after IPE interventions compared to the intervention group. Just et al. (2010) reported increases in patient care objective scores for both the control and experimental groups. In addition, there was a moderate improvement in interprofessional communication style for both the control and experimental groups.

**IPE approaches**

The IPE approaches implemented by three of the nine studies were campus or classroom based (Anderson, et al., 2009; Becker & Godwin, 2005; Bradley, et al., 2009). This might have been considered the most appropriate method to ensure delivery of IPE to large cohorts of students. However, clinically based learning experiences form a significant component of health professional education and provide students with opportunities to integrate theoretical and practice-based skills. Only one study (Street, et al., 2007) implemented IPE using practice-based learning opportunities. Ideally, on-campus IPE initiatives should be supported by deliberate opportunities for IPE during the experiential learning that occurs during clinical placements.

It is acknowledged that IPE approaches may be difficult to implement due to the pragmatic constraints inherent in university programs. Not all universities offer concurrent nursing, pharmacy and medicine programs and this makes IPE challenging to implement. Some of the logistical challenges to IPE include course design, timetabling restrictions, resource
implications and large students’ cohorts. Innovations such as IPE require changes at multiple levels: institutional, curricula and individual. In one study an e-learning IPE module was successfully implemented (Becker & Godwin, 2005) with less cost and fewer logistical issues that in face-to-face methods. E-learning approaches may signal the future for IPE, particularly in situations where barriers seem to outweigh the benefits of face-to-face IPE initiatives.

**Limitations**

All of studies considered for the review had methodological shortcomings and most used convenience sampling, which limits generalisability of findings. In addition, the use of small sample sizes in some of the studies resulted in insufficient power to detect effects of the various interventions. In seven of the studies participants were not blinded to the intervention, thus increasing the potential for social desirability bias in participants’ behaviour (Paulhus, 1984). There was also a problem with studies not establishing robust baseline or comparative data in order that changes in outcomes could be accurately identified.

The validated assessment tools used in the included studies were largely limited to the measurement of attitudes and perceptions. Future work is required to develop and test effectiveness measurements through rigorous methods to enable more robust assessment of the impact of IPE (Mattick & Bligh, 2003). In addition, measurement of the long-term impact of IPE on key behaviours in clinical practice represents a challenge for future research.

**CONCLUSION**

The results of this review indicate that student’s attitudes towards interprofessional collaboration and clinical decision-making ability may be enhanced through IPE. However, little evidence exists in regards to whether the gains attributed to IPE can be sustained over time. Additionally, the evidence for using IPE to teach interprofessional communication skills, patient care objectives and clinical skills such as resuscitation is inconclusive and needs further investigation. It is important to note no study reported completely negative outcomes as a result of the IPE interventions.

Although the studies in this review reported some positive outcomes, the small number of studies, combined with heterogeneity of IPE interventions, limits the generalisability of the results. Future randomised controlled studies explicitly focused on IPE with rigorous randomisation procedures and allocation concealment, larger sample sizes, and more
appropriate control groups, would improve the evidence base of IPE. Additionally, since most IPE interventions are multi-faceted and include more than one professional group future studies should consider cluster-randomised designs.
References


## Appendix A: Table 2: Quality assessment of included studies

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<td>Just, et al., 2010</td>
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<td>Nango &amp; Tanaka, 2010</td>
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<td>Street, et al., 2007</td>
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**Key** 1 = Yes, 2 = No, 3 = Unclear
### Appendix B: Table 4: Characteristics of included studies

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Country</th>
<th>Setting</th>
<th>Method</th>
<th>Participants</th>
<th>IPE Interventions</th>
<th>Outcome measures</th>
<th>Results</th>
<th>Notes</th>
</tr>
</thead>
</table>
| Anderson, et al.| 2009 | UK            | University of Leicester  | Controlled before-and-after study           | N = 199, medical students & students from other professions (no details)     | One day patient safety workshop based on a DVD, supportive workbook, reading materials, facilitated student debates and small group discussions | • Knowledge across eight learning outcomes- pre- and post-workshop questionnaire on a 5-point Likert scale questionnaire  
• Course design, content and relevance- pre- and post-questionnaire-containing 16 questions scored on a 5-point Likert scale  
• Students perceptions of IPE- Focus Group interviews | Group 1 & Group 2  
Participants increased their knowledge across all the eight learning outcomes  
*p = 0.001*  
Group 2  
Gained an appreciation of teamwork working roles from interactions with other professions | Analysis only compared outcomes between the medical participants only  
• No details on validity and reliability of questionnaires  
• Medical student allocation was random |
| Ateah, et al.   | 2011 | Canada        | University of Manitoba   | Controlled before-and-after study           | N = 51 dental hygiene, dentistry, medicine, nursing, occupational therapy, pharmacy and physical therapy | Combination of 3 hrs orientation, two and a half days of interprofessional learning using interactive and didactic learning activities, presentations from educators, small group brainstorming activities, reflection and clinical experience  
Group 1 (n = 17)  
Small interprofessional groups -Orientation only  
Group 2 (n = 16)  
Small interprofessional groups | • Students perspectives of health professionals- 5-point Likert scale Student Stereotypes Rating Questionnaire (SSRQ)  
• In-depth perceptions of other health care professionals- Open ended questions | Group 1 & Group 2  
Improved knowledge, skills, perceptions and attitudes about teamwork and collaboration  
Group 2  
Further increased knowledge, skills, values, and perceptions about collaboration *p < 0.05* | • Small sample size  
• Convenience sample of volunteers  
• Allocation not truly random- some self-selection included |
### Study 1
**Author:** Becker & Godwin  
**Year:** 2005  
**Country:** USA  
**Setting:** Long Island University  

<table>
<thead>
<tr>
<th>Method</th>
<th>Participants</th>
<th>Description</th>
<th>Students attitudes towards IPE</th>
<th>Total IEPS scores: (Mean)</th>
<th>No. of Teaching staff messages</th>
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</thead>
<tbody>
<tr>
<td>Controlled before-and-after study</td>
<td>N = 153 Undergraduate students enrolled in 1st semester course in occupational therapy, physical therapy and respiratory care</td>
<td>Six weeks interprofessional health professions module utilising web-based resources such as case studies assignments and written feedback. Module integrated into existing curricular / courses. Group 1 (n = 92) Small interprofessional groups undertook the control IPE module. Group 2 (n = 61) Small interprofessional groups undertook the experimental IPE module.</td>
<td>Six weeks interprofessional health professions module utilising web-based resources such as case studies assignments and written feedback. Module integrated into existing curricular / courses. Group 1 (n = 92) Small interprofessional groups undertook the control IPE module. Group 2 (n = 61) Small interprofessional groups undertook the experimental IPE module.</td>
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<td></td>
<td></td>
<td></td>
<td>• Students attitudes toward IPE - IEPS</td>
<td>Group 1</td>
<td>Group 2</td>
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<tr>
<td></td>
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<td></td>
<td>• Student satisfaction with course - Online survey</td>
<td>Pre module</td>
<td>Post module</td>
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<td>p: NS</td>
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<td>70.7</td>
<td>69.9</td>
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### Study 2
**Author:** Bradley, et al.  
**Year:** 2009  
**Country:** UK  
**Setting:** Multisite-two universities  

<table>
<thead>
<tr>
<th>Study design</th>
<th>Participants</th>
<th>Description</th>
<th>Students attitudes towards IPE</th>
<th>Total IEPS scores: (Mean)</th>
<th>No. of Teaching staff messages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled before-and-after study</td>
<td>N = 215 medical &amp; nursing students</td>
<td>One day Intermediate Life Support course that covered airway management, semi-automatic defibrillation and basic life support. Course-based assessment scenarios were video recorded. Group 1 (n = 23) Small uniprofessional medical students only groups. Group 2 (n = 30) Small interprofessional groups of medical students &amp; nursing.</td>
<td>One day Intermediate Life Support course that covered airway management, semi-automatic defibrillation and basic life support. Course-based assessment scenarios were video recorded. Group 1 (n = 23) Small uniprofessional medical students only groups. Group 2 (n = 30) Small interprofessional groups of medical students &amp; nursing.</td>
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<td></td>
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<td>• Team work - Leadership Behaviours Description Questionnaire (LBDQ) and Emergency Team Dynamics (ETD)</td>
<td>Group 1 &amp; Group 2</td>
<td>No significant differences between groups in LBDQ, ETD &amp; RTT</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Resuscitation skills - Resuscitation Team Task (RTT)</td>
<td>RIPLS:</td>
<td>Group 1: Professional identity and team-working increased significantly post-intervention p &lt; 0.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Student attitudes toward IPE - RIPLS</td>
<td></td>
<td>Group 2: Nursing students had significantly higher scores than medical students on the roles and responsibilities subscale p &lt; 0.01</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Opinions and attitudes towards IPE - No details on randomisation</td>
<td></td>
<td>Participants blinded to study objectives</td>
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<td></td>
<td></td>
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<td>RIPLS scores increased immediately post IPE but fell back after 3–4 months</td>
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<tr>
<td><strong>Author:</strong> Goelen, et al.</td>
<td><strong>Year:</strong> 2006</td>
<td><strong>Country:</strong> Belgium</td>
<td><strong>Setting:</strong> Vrije Universiteit Brussel &amp; Erasmushogeschool Brussel</td>
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<tr>
<td><strong>Study design:</strong> Controlled before and after study</td>
<td><strong>Participants:</strong> N = 177 medical, nursing and physiotherapy</td>
<td><strong>Focus group interviews</strong></td>
<td><strong>Module consisting of five problem based learning seminars of two hours each. integrated into existing undergraduate medical, nursing and physiotherapy curricula</strong></td>
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<tr>
<td><strong>Group 1 (n =87)</strong></td>
<td><strong>Students attitudes toward IPE- IEPS</strong></td>
<td></td>
<td><strong>Competence &amp; autonomy own profession (Mean ± SD)</strong></td>
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<tr>
<td>Student from a single profession undertook in small groups</td>
<td><strong>Group 1:</strong> 67.0 ± 11.3</td>
<td><strong>Before</strong></td>
<td><strong>Before</strong></td>
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<tr>
<td><strong>Group 2 (n =90 )</strong></td>
<td><strong>Patient views collected by facilitators before and after intervention</strong></td>
<td><strong>After</strong></td>
<td><strong>After</strong></td>
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<tr>
<td>Small interprofessional groups of 3-4 medical, nursing and physiotherapy students</td>
<td>Group 1: 66.5 ± 9.7</td>
<td>p &lt; 0.05</td>
<td>Group 2: 73.6 ± 10.7</td>
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<tr>
<td><strong>Students attitudes toward IPE</strong></td>
<td></td>
<td></td>
<td><strong>Overall IEPS score male participants only (Mean ± SD)</strong></td>
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<tr>
<td><strong>Patient views collected by facilitators before and after intervention</strong></td>
<td>Group 1: 67.0 ± 11.3</td>
<td><strong>Before</strong></td>
<td><strong>Before</strong></td>
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<td></td>
<td>Group 2: 72.1 ± 7.9</td>
<td><strong>After</strong></td>
<td><strong>After</strong></td>
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<tr>
<td></td>
<td>p &lt; 0.05</td>
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<td>Group 1: 66.5 ± 9.7</td>
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<td></td>
<td>Group 2: 73.6 ± 10.7</td>
<td>p &lt; 0.05</td>
<td>Group 2: 73.6 ± 10.7</td>
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<td></td>
<td><strong>Scores not comparable at baseline-physiotherapy students had higher pre-intervention scores</strong></td>
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<td></td>
<td><strong>14 participants excluded due to incomplete results</strong></td>
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<tr>
<th><strong>Author:</strong> Just, et al.</th>
<th><strong>Year:</strong> 2010</th>
<th><strong>Country:</strong> Germany</th>
<th><strong>Setting:</strong> Medical School</th>
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<tbody>
<tr>
<td><strong>Study design:</strong> Randomised controlled trial</td>
<td><strong>Participants:</strong> N= 40 medical and nursing students</td>
<td><strong>Focus group interviews</strong></td>
<td><strong>Two day seminars of 6 hours of teaching covering palliative care, geriatrics, communication and organisation</strong></td>
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<td><strong>Group 1 (n =20 )</strong></td>
<td><strong>Care objectives</strong></td>
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<td><strong>Care objectives scores (Mean ± SD)</strong></td>
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<td>Small interprofessional groups undertook the control IPE module</td>
<td><strong>Initiation of contact</strong></td>
<td><strong>Pain Management</strong></td>
<td><strong>Group 1:</strong> Pre</td>
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<td><strong>Group 2 (n = 20)</strong></td>
<td><strong>Occupation of speaking time</strong></td>
<td><strong>Group 1:</strong> 3.28 ± 2.00</td>
<td>4.70 ± 1.26</td>
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<td>Small interprofessional groups undertook the experimental IPE module</td>
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<td><strong>Care objectives scores not comparable at baseline-physiotherapy students had higher pre-intervention scores</strong></td>
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<td><strong>Other symptoms</strong></td>
<td><strong>Group 2:</strong> Pre</td>
<td>Post</td>
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<td><strong>Group 1:</strong> 2.88 ± 1.63</td>
<td>4.90 ± 1.23</td>
<td>p = 0.006</td>
<td></td>
</tr>
<tr>
<td><strong>Group 2:</strong> 3.78 ± 0.43</td>
<td>3.63 ± 0.68</td>
<td>p = 0.630</td>
<td></td>
</tr>
<tr>
<td><strong>Patient's autonomy</strong></td>
<td><strong>Group 1:</strong> 1.80 ± 0.26</td>
<td>4.30 ± 0.91</td>
<td><strong>Randomisation through computer random number generation &amp; stratification</strong></td>
</tr>
<tr>
<td><strong>Group 1:</strong> 3.63 ± 0.94</td>
<td>3.63 ± 0.57</td>
<td>p = 0.888</td>
<td></td>
</tr>
<tr>
<td><strong>Group 2:</strong> 3.78 ± 0.43</td>
<td>3.63 ± 0.68</td>
<td>p = 0.630</td>
<td></td>
</tr>
<tr>
<td><strong>14 participants excluded due to incomplete results</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group 1: Pre</td>
<td>Post</td>
<td>p</td>
</tr>
<tr>
<td>--------------------------------------</td>
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<td>-----</td>
</tr>
<tr>
<td><strong>Advance planning</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.00 ± 0.67</td>
<td>1.80 ± 0.91</td>
<td>0.629</td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Integration of relatives</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.05 ± 0.87</td>
<td>3.85 ± 1.00</td>
<td>0.073</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Psychological factors</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>1.75 ± 0.17</td>
<td>3.58 ± 0.62</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>• Initiation of contact</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>• Occupation of speaking time (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>± SD</td>
<td></td>
</tr>
<tr>
<td>Author:</td>
<td>McFadyen, et al.</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>2010</td>
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<td>Country:</td>
<td>UK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Setting:</td>
<td>Glasgow Caledonian University and University of Strathclyde</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Study design:** Controlled longitudinal study

**Participants:** N = 573 nursing, occupational therapy, podiatry, prosthetics and orthotics, physiotherapy and radiography

**Group 1 (n = 260)**
Students from the six professions undertook their usual programs

**Group 2 (n = 313)**
Students from the six professions undertook the IPE module

**20 credit point module consisting of three contact hours per week for 24 weeks consisting of themed days and facilitated small interprofessional group seminars**

**Group 1 Pre Post**
- **Medical:** 45.54 ± 7.17 44.02 ± 7.30
- **Nursing:** 54.42 ± 7.15 55.90 ± 7.19

**Group 2 Pre Post**
- **Medical:** 50.52 ± 15.45 47.72 ± 6.29
- **Nursing:** 48.95 ± 15.79 52.28 ± 6.29

**Attitudes and perceptions towards IPE - RIPLS and IEPS**

**Teamwork & Collaboration**

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>38.6 ± 3.8</td>
<td>38.4 ± 5.3</td>
</tr>
<tr>
<td>Year 2</td>
<td>37.8 ± 4.8</td>
<td>37.2 ± 5.1</td>
</tr>
<tr>
<td>Year 3</td>
<td>37.4 ± 5.6</td>
<td>37.2 ± 5.8</td>
</tr>
<tr>
<td>Year 4</td>
<td>37.8 ± 4.7</td>
<td>37.7 ± 5.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 2</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>39.5 ± 4.1</td>
<td>36.5 ± 6.6</td>
</tr>
<tr>
<td>Year 2</td>
<td>35.4 ± 5.4</td>
<td>35.1 ± 5.4</td>
</tr>
<tr>
<td>Year 3</td>
<td>35.6 ± 5.6</td>
<td>34.9 ± 7.1</td>
</tr>
<tr>
<td>Year 4</td>
<td>36.1 ± 5.4</td>
<td>36.4 ± 6.0</td>
</tr>
</tbody>
</table>

**Negative Professional Identity**

<table>
<thead>
<tr>
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<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>13.0 ± 1.6</td>
<td>12.8 ± 2.3</td>
</tr>
<tr>
<td>Year 2</td>
<td>12.6 ± 2.1</td>
<td>12.6 ± 2.1</td>
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<tr>
<td>Year 3</td>
<td>13.1 ± 4.0</td>
<td>12.6 ± 2.2</td>
</tr>
<tr>
<td>Year 4</td>
<td>12.6 ± 2.2</td>
<td>13.0 ± 2.1</td>
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</table>

<table>
<thead>
<tr>
<th>Group 2</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>13.2 ± 1.9</td>
<td>11.8 ± 2.4</td>
</tr>
<tr>
<td>Year 2</td>
<td>11.6 ± 2.4</td>
<td>11.7 ± 2.5</td>
</tr>
<tr>
<td>Year 3</td>
<td>12.0 ± 2.5</td>
<td>11.6 ± 3.0</td>
</tr>
</tbody>
</table>

**Number of information items exchanged (Mean ± SD)**

<table>
<thead>
<tr>
<th>Group 1 Pre</th>
<th>Post</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.75 ± 2.59</td>
<td>11.75 ± 2.22</td>
<td>&lt;0.001</td>
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<table>
<thead>
<tr>
<th>Group 2 Pre</th>
<th>Post</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.60 ± 1.79</td>
<td>12.25 ± 1.87</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Year</td>
<td>Group 1: Pre</td>
<td>Post</td>
</tr>
<tr>
<td>------------</td>
<td>--------------</td>
<td>------</td>
</tr>
<tr>
<td>Year 1</td>
<td>16.9 ± 2.0</td>
<td>16.4 ± 2.2</td>
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<td>Year 2</td>
<td>16.0 ± 2.6</td>
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<tr>
<td>Year 3</td>
<td>15.9 ± 2.7</td>
<td>15.8 ± 2.8</td>
</tr>
<tr>
<td>Year 4</td>
<td>15.8 ± 2.9</td>
<td>16.1 ± 2.7</td>
</tr>
<tr>
<td>Year 4</td>
<td>12.2 ± 2.5</td>
<td>11.9 ± 2.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Group 2: Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>17.1 ± 2.1</td>
<td>15.1 ± 2.8</td>
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<td>Year 2</td>
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<td>15.1 ± 2.6</td>
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</tr>
<tr>
<td>Year 4</td>
<td>15.0 ± 2.8</td>
<td>14.9 ± 3.1</td>
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<table>
<thead>
<tr>
<th>Year</th>
<th>Group 1: Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>8.6 ± 1.8</td>
<td>8.9 ± 2.0</td>
</tr>
<tr>
<td>Year 2</td>
<td>9.0 ± 2.0</td>
<td>8.8 ± 2.0</td>
</tr>
<tr>
<td>Year 3</td>
<td>9.2 ± 1.9</td>
<td>9.1 ± 2.2</td>
</tr>
<tr>
<td>Year 4</td>
<td>9.1 ± 1.8</td>
<td>9.1 ± 2.3</td>
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</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Group 2: Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>8.9 ± 1.7</td>
<td>9.1 ± 2.4</td>
</tr>
<tr>
<td>Year 2</td>
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<td>9.1 ± 2.1</td>
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<tr>
<td>Year 3</td>
<td>9.5 ± 1.9</td>
<td>8.7 ± 2.7</td>
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<tr>
<td>Year 4</td>
<td>9.8 ± 1.8</td>
<td>9.1 ± 2.4</td>
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<table>
<thead>
<tr>
<th>Year</th>
<th>Group 1: Pre</th>
<th>Post</th>
</tr>
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<tbody>
<tr>
<td>Year 1</td>
<td>25.4 ± 2.4</td>
<td>25.0 ± 2.4</td>
</tr>
<tr>
<td>Year 2</td>
<td>24.6 ± 2.9</td>
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<td>Year 3</td>
<td>23.8 ± 3.2</td>
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<tr>
<td>Year 4</td>
<td>24.5 ± 2.9</td>
<td>24.8 ± 3.4</td>
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<table>
<thead>
<tr>
<th>Year</th>
<th>Group 2: Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>25.0 ± 2.4</td>
<td>25.6 ± 2.6</td>
</tr>
<tr>
<td>Year 2</td>
<td>24.9 ± 2.9</td>
<td>24.9 ± 2.7</td>
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<td>Year 4</td>
<td>25.0 ± 2.7</td>
<td>24.8 ± 3.4</td>
</tr>
<tr>
<td>Author: Nango &amp; Tanaka</td>
<td>Year: 2010</td>
<td>Country: Japan</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------</td>
<td>----------------</td>
</tr>
<tr>
<td>Study design:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participants: N = 34</td>
<td></td>
<td></td>
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</table>

### Perceived Need for Co-operation

<table>
<thead>
<tr>
<th>Group 1:</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1:</td>
<td>9.8 ± 1.4</td>
<td>9.8 ± 1.3</td>
</tr>
<tr>
<td>Year 2:</td>
<td>9.7 ± 1.5</td>
<td>9.4 ± 1.2</td>
</tr>
<tr>
<td>Year 3:</td>
<td>9.5 ± 1.5</td>
<td>9.5 ± 1.6</td>
</tr>
<tr>
<td>Year 4:</td>
<td>9.5 ± 1.5</td>
<td>9.8 ± 1.6</td>
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</table>

<table>
<thead>
<tr>
<th>Group 2:</th>
<th>Pre</th>
<th>Post</th>
</tr>
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<tbody>
<tr>
<td>Year 1:</td>
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<td>9.5 ± 1.7</td>
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<td>Year 2:</td>
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<td>9.3 ± 1.5</td>
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<td>Year 3:</td>
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</tr>
<tr>
<td>Year 4:</td>
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### Perception of Actual Co-operation

<table>
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<td>23.7 ± 3.3</td>
</tr>
<tr>
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<td>24.1 ± 2.9</td>
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</tr>
<tr>
<td>Year 4:</td>
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<td>24.8 ± 3.8</td>
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<table>
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<tr>
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<th>Post</th>
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<tbody>
<tr>
<td>Year 1:</td>
<td>25.1 ± 2.6</td>
<td>25.2 ± 2.9</td>
</tr>
<tr>
<td>Year 2:</td>
<td>24.4 ± 3.0</td>
<td>24.8 ± 2.9</td>
</tr>
<tr>
<td>Year 3:</td>
<td>24.7 ± 2.6</td>
<td>24.8 ± 2.6</td>
</tr>
<tr>
<td>Year 4:</td>
<td>24.6 ± 2.8</td>
<td>24.9 ± 3.0</td>
</tr>
</tbody>
</table>

**• Small sample size**
- Randomisation through computer generated random numbers & stratification
- Allocation concealed until randomisation was completed
<table>
<thead>
<tr>
<th>Author: Street, et al.</th>
<th>Study design: Randomised controlled trial</th>
<th>Participants: N = 160 medical &amp; nursing students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year: 2007</td>
<td>Case studies including introductory session, prearranged home and school visits, formative assessments and evaluation session.</td>
<td>Group 1 (n = 88) Student undertook community based child disability case studies in nurse/nurse or medical/medical uniprofessional pairs Group 2 (n = 72) Students undertook community based child disability case studies nursing and medical students interprofessional pairs</td>
</tr>
<tr>
<td>Country: UK</td>
<td></td>
<td>• Attitudes towards IPE - 9-item Attitudes Questionnaire with a 5-point Likert scale to describe (pre/post IPE) • IPE learning experience and outcomes - focus group interviews 6 months post IPE session</td>
</tr>
<tr>
<td>Setting: Multisite-two universities</td>
<td></td>
<td>Attitudes Questionnaire score (Mean ± SD) Group 1: Before After Medical pairs: 33.9 ± 5.6 33.1 ± 5.3 Nursing pairs: 36.6 ± 4.4 37.0 ± 4.3 Group 2: Before After Medical: 32.1 ± 5.9 33.6 ± 4.3 Nursing: 32.7 ± 6.1 36.0 ± 4.4</td>
</tr>
</tbody>
</table>

| scale questionnaire | p = 0.002 (p < 0.001) • Additional patient information No statistically significant difference between the groups Group 1: 22 ± 0 Group 2: 28 ± 3.8 p = 0.10 • Student evaluation of PBL program - no significant differences between groups |

• Analysis compared outcomes between the medical students participants’ only • Students who dropped out (n = 3) excluded from data analysis

- No details of method of randomisation
CHAPTER 3: A cross-sectional survey examining the extent to which interprofessional education is used to teach nursing, pharmacy and medical students in Australian and New Zealand universities

3.1 Publication relevance to thesis

A number of universities in Australia and New Zealand are implementing IPE as part of their curricula after recognizing the potential of IPE to successfully prepare graduates for professional practice. Although previous studies have identified isolated pockets of IPE activities in Australia and New Zealand (Dunston et al., 2010; Pullon et al., 2013; Thistlethwaite, 2007) the current status of IPE implementation and assessment has not been fully explored. The aim of this component of the thesis was to scope the current status of interprofessional education in Australian and New Zealand universities. A cross-sectional survey was considered the most effective way to gather data to most accurately capture the status of IPE in health professional education across relevant Australian and New Zealand universities. At the time of thesis submission this Chapter is the first comprehensive attempt to present a national profile of IPE experiences within Australian and New Zealand Universities.
3.2 References


This paper has been published in the *Journal of Interprofessional Care*.

Citation:

**Lapkin, S.,** Levett-Jones, T., & Gilligan, C. (2012). A cross-sectional survey examining the extent to which interprofessional education is used to teach nursing, pharmacy and medical students in Australian and New Zealand Universities. *Journal of Interprofessional Care, 26*(5), 390-396.

At the time of thesis submission this paper has been cited four times.

Additional documents associated with this publication are attached as follows:

- Appendix E: Ethics Approval
- Appendix F: Cross Sectional Survey Content Validity Results
- Appendix G: Interprofessional Education Survey
- Appendix H: Text of invitation email to Heads of Schools
- Appendix I: Information Statement for Cross-sectional survey.
ABSTRACT

The current status of interprofessional education in Australian and New Zealand universities is largely unexamined despite its generally acknowledged benefit. Data is also limited about the use of interprofessional education in teaching medication safety to nursing, pharmacy and medical students. For this reason a web-based cross sectional survey was used to gather information from Australian and New Zealand universities offering nursing, pharmacy or medical programs. Responses were received from 31 of the 43 (72%) target universities. Eighty percent of the participants indicated that they currently offer interprofessional education experiences, but only 24% of these experiences met the accepted definition of interprofessional education. Of the participants who offer interprofessional education as defined by Center for the Advancement of Interprofessional Education only 50% use it to teach medication safety. Timetabling restrictions and lack of appropriate teaching and learning resources were identified as the main barriers to implementation of interprofessional education. All participants reported that staff development, multi-media and e-learning resources would be beneficial to interprofessional education initiatives and the teaching of medication safety. Innovative approaches will be needed to overcome the barriers and facilitate the uptake of quality interprofessional education more broadly. Web based and e-learning options promise a possible way forward, particularly in the teaching of medication safety to nursing, pharmacy and medical students.

Keywords: cross-sectional survey; e-learning; health professional students; interprofessional education; medication safety
INTRODUCTION

Interprofessional education (IPE) has been recognised as an innovative approach for the development of a collaborative, practice-ready health workforce (World Health Organization, 2010a). “Interprofessional education occurs when two or more professions learn with, from and about each other to improve collaboration and the quality of care” (Center for the Advancement of Interprofessional Education, 2002). In Australia, several government policy documents and independent reports have specifically advocated for the inclusion of IPE in health professional education programs (Department of Health and Ageing, 2008; Garling, 2008). However, despite international support and a push for IPE as a key area of health professional education the current status of interprofessional education in Australian and New Zealand universities is largely unexamined. Therefore, we sought to scope the extent to which IPE is currently used in Australian and New Zealand universities and identify barriers and facilitators to curriculum integration of IPE.

Interprofessional education is believed to enhance learners’ understanding of other professionals’ roles and responsibilities, while fostering mutual respect and understanding between members of the health care team (Freeth, Hammick, Reeves, Barr, & Koppel, 2005). The fundamental premise of IPE is that if students from different health professions learn together, they will develop communication and teamwork skills and be better prepared for collaborative practice, ultimately leading to improved health outcomes (Canadian Interprofessional Health Collaborative, 2010).

A brief appraisal of IPE activity undertaken in 2006 identified pockets of IPE activities across Australia such as in rural clinical placement programs and simulation centres (ACT Health, 2006). An editorial in the Journal of Interprofessional Care identified a number of IPE initiatives across the Australian higher education sector.
(Thistlethwaite, 2007). A significant development is the formation of Australasian Interprofessional Practice and Education Network (AIPPN) which brings together individuals, groups, and institutions with an interest in IPE across Australia and New Zealand (Australasian Interprofessional Practice and Education Network, 2010).

**Interprofessional education and medication safety**

There is an increasing awareness that medication safety is a significant component of a broader global strategy to improve patient safety and quality of care. The impact of medication errors is not readily quantifiable, but it is clear that the cumulative personal and financial burden is substantial. The World Health Organization (2010b) estimates that more than 50% of all medications globally are either prescribed, dispensed, administered, or used inappropriately. Medication adverse events cost Australia approximately $6 billion dollars per year and inappropriate use of medicines $380 million (National Health and Hospitals Reform Commission, 2008). Such figures are not unique to Australia, with research undertaken by the National Health Service in the UK and the Institute of Medicine (2001) in the US regarding medication errors reporting similar figures. In fact, it is possible that the available figures are an underestimate; likely due to the underreporting of medication errors.

The medication process requires a broad spectrum of knowledge and expertise that requires the complementary skills of various professionals. While each member of the team has unique responsibilities for ensuring medication safety, it is acknowledged that medication errors and adverse patient outcomes often result from ineffective communication between members of the interprofessional team (Joint Commission, 2004). It is likely that educational strategies aimed at only one discipline are limited in their ability to prepare students for this interprofessional process. Approaches that emphasise the importance of teamwork and interprofessional communication such as IPE therefore have the potential to enhance
medication safety (Fortescue et al., 2003; Stewart, Kennedy, & Cuene-Grandidier, 2010). Despite this, the extent to which IPE has been integrated into nursing, pharmacy and medical programs in Australian and New Zealand universities remains unclear. Therefore in order to inform efforts to enhance IPE, and in particular, that relating to medication safety, this study aimed to:

1. scope the extent to which IPE is currently used in Australian and New Zealand nursing, pharmacy and medical programs;
2. scope the extent to which IPE is currently used to teach medication safety;
3. identify barriers and facilitators to curriculum integration of IPE.

**METHODS**

This study used a cross-sectional survey approach to gather descriptive data. A cross-sectional survey is considered the most appropriate systematic method by which information on a specific population at a single point in time can be gathered (Midanik & Drescher-burke, 2010).

**Development of questionnaire**

No established questionnaire was available to address the aims of the study. An instrument was therefore developed using key principles of questionnaire design to ensure accurate data collection (Pittman & Bakas, 2010) and avoid non-sampling error (Brace, 2008). To ensure content validity of the survey a two-step process involving a development stage and a judgment-quantification process was used (Lynn, 1986).

**Development stage**

Initially, a pool of items related to the aims of the project was developed. These items were informed by a review of relevant research literature and university health professional curricula. Potential questions were grouped into the following sections: university demographics, IPE initiatives, IPE and medication safety, and barriers to and facilitators of IPE.
To provide a broad perspective on the use of IPE both open and closed-ended questions were used. In addition, a combination of questionnaire scales was utilised. Five point-Likert type scales were used to measure opinions and beliefs regarding barriers to and facilitators of IPE. These rating scales are considered to be simple for participants to respond to (McCarty & Shrum, 2000). Binary response options (“yes” or “no”) (Pittman & Bakas, 2010), multiple-choice questions and drop-down menus were used to restrict the variability of responses for analysis purposes, and when it was necessary for the participant’s response to automatically direct them to the next relevant question. Free text boxes were used for open-ended questions. The final draft questionnaire consisted of 35 items.

**Judgment-quantification process**
Accurate data collection depends upon the clarity, concision, relevance and specificity of the items (Dillman, 2006; Groves, et al., 2009; Seymour & Bradburn, 1983). Poorly worded items can result in measurement error (Dillman, 2006). In order to address this issue, an expert panel reviewed the quality of the initial item pool (Zaichkowsky, 1985). The expert panel consisted of 11 researchers and clinicians from the nursing (4), pharmacy (3), medicine (3), and education (1) fields. This panel size was considered appropriate, given that in a report of the judgment quantification process used in the development of over 200 instruments, the average membership of expert panels was ten (Hardesty & Bearden, 2004).

Each member was provided with the draft questionnaire and asked to judge each item for relevance, clarity, conciseness, and ambiguity. A rating tool designed for this purpose was utilised to ensure consistent and focused feedback. As suggested by Berk (1990) the expert panel was also asked to make suggestions for any necessary
revisions to items that were not consistent with the research aims and to suggest wording for those that they considered unclear or ambiguous. Lastly, the panel assessed the entire instrument for overall comprehensiveness (Lynn, 1986).

The expert panel agreed that 96% of the items were relevant, 80% were clear and concise, and only 8% were considered ambiguous. A total of 31 suggested changes were made and eight questions were added as a result of this process. The final instrument was composed of 43 questions distributed as follows: demographics (7), IPE (16), IPE and medication safety (13), and barriers and facilitators (7).

Sampling strategy and inclusion criteria
The target population was all Australian and New Zealand universities offering nursing, pharmacy, or medical programs. A census or complete enumeration method was appropriate given the small target population and detailed analysis required (Dillman, 2006). Heads of schools were identified using the databases of the Council of Medical Deans Australia and New Zealand, the Council of Deans of Nursing and Midwifery (Australia & New Zealand) and Pharmacy Council of Australia. The contact details of the heads of schools were then verified using university websites. In total 77 nursing, pharmacy and medical programs within 43 universities were identified.

Administration of survey
The web-based survey was administered to the target population through a commercial survey service (SelectSurvey.NET). Electronic mail messages (email) were sent to heads of schools identified in the above process. The email included a detailed cover letter explaining the importance of the research and an information statement with a hypertext link to the web-based survey. The heads of schools were asked to forward the message to a staff member who had the authority and
knowledge to report on how IPE and/or medication safety were integrated in their academic program to complete the survey.

A web-based survey was used as it is a less expensive option and offers a shorter data collection period in comparison to mail, telephone and face-to-face surveys for example (Couper, 2000; Kellner, 2004). It has also been suggested that the anonymity of respondents and absence of researchers may minimise social desirability bias, leading to more accurate responses (Couper, 2000; Johnson, 2001). Other studies have shown that web-based surveys are completed more quickly than equivalent telephone or face-to-face administered versions thus decreasing the burden for participants and potentially increasing the response rate. Further, it has been shown that data collected via web-based surveys is consistent with that collected via other self-completion methods such as mail and fax (Cobanoglu, Warde, & Moreo, 2001).

**Methods to increase response rate**
A review of the literature undertaken by Schonlau, Fricker, and Elliott (2002) indicated that response rates typically range from 7 to 44 % for web surveys. A number of strategies were therefore used to ensure an adequate response rate. A reminder message was sent to non-respondents two weeks after the initial email, and another reminder was sent to remaining non-responders after a further three weeks. Multiple contacts are more effective than other techniques in achieving satisfactory response rates to self-administered surveys regardless of the methodology (Schaefer & Dillman, 1998). Approaches similar to the one adopted here have been shown to increase response rates by between 4% and 10% in mail based surveys (Scott & Edwards, 2006).
Ethical considerations
The survey was anonymous. Participants were assured that no individual or university would be identifiable within any written reports. Confidentiality of information collected was maintained throughout all phases of study. This study was approved by the University’s Human Research Ethics Committee.

Statistical analysis
The responses were checked for errors and the data was cleaned by removing multiple entries or contradictory responses. There were no significant differences between the Australian and New Zealand programs and the data were therefore combined for analysis. Survey responses were analysed using descriptive statistics.

RESULTS
The questionnaire was completed by 27 of the 38 (71 %) Australian universities and by 4 of the 5 (80%) New Zealand universities. Two invitees declined to participate, citing a lack of IPE in their programs. The combined response rate for Australia and New Zealand was 72%.

Demographics
The table below shows the level of response from each of the professional groups targeted in the survey. Response rates by academic professions were: pharmacy: 63% (n = 10); nursing: 61% (n = 25); and medicine: 60% (n= 12).

<table>
<thead>
<tr>
<th>Academic program type</th>
<th>No. of potential respondents</th>
<th>No. of actual responses</th>
<th>Response rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing</td>
<td>41</td>
<td>25</td>
<td>61%</td>
</tr>
<tr>
<td>Medicine</td>
<td>20</td>
<td>12</td>
<td>60%</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>16</td>
<td>10</td>
<td>63%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>77</strong></td>
<td><strong>47</strong></td>
<td><strong>61%</strong></td>
</tr>
</tbody>
</table>

Interprofessional education
Eighty percent (80%) of the respondents indicated that they currently offer IPE experiences to their students, 8% indicated they were in the planning or development stages for adding IPE to their program, 4% responded they had considered but not
implemented IPE and 2% indicated that IPE experiences were not being considered at the time. Students involved in the IPE offerings were primarily from nursing (28%), followed by medicine (24%), pharmacy (16%) and midwifery (11%). Physiotherapy, health and medical science students, indigenous health, paramedics, human movement dietetics, health information management, laboratory medicine, occupational therapy, psychology, social work, speech pathology, and clinical psychology students were involved in a total of 21% of the offerings. For those programs offering IPE experiences 26% were offered to students in their first year of enrolment followed by 23% in their third year. Post-graduate students represent 9% of the students undertaking IPE activities. The majority of the programs were conducted as face-to-face sessions (46%), with a substantial proportion delivered purely online (22%). Distance and blended modes accounted for a combined 28%.

**Description of IPE offerings**

Of the IPE offerings provided, 69% were required, 12% were elective for academic credit and 19% were extracurricular with no academic credit. IPE coordinators were primarily from nursing (33%), followed by medicine (27%) and pharmacy (21%). The majority of IPE experiences involved lectures (16%) or tutorials (16%), followed by clinical placements (15%) and simulation (12%). About 60% of the respondents who indicated that they offered IPE provided a description of their offerings. The majority (29%) of the reported IPE experiences involved lectures or tutorials being conducted by staff from human bioscience departments. IPE opportunities on clinical placement accounted for 17% of the IPE efforts, however, most of these occurred without structured opportunities for interaction between students or staff from different health professions.

Seventy-one percent of the IPE experiences were evaluated by students. The Readiness for Interprofessional Learning Scale was used in 24% of evaluations, the
Interprofessional education and medication safety
Half of the respondents who offer IPE said that they use it to teach medication safety. Nursing (39%), medicine (26%), and pharmacy (26%) were represented in the majority of IPE medication safety experiences. The majority of these experiences were offered in second year for nursing students, first and second years for pharmacy students and third and fourth years for medical students. Clinical placements and the use of standardised patients (actors) accounted for 6% of these experiences. Most respondents reported that medication errors were the main focus of the IPE medication safety experiences (19%), followed by patient safety (15%), prescribing (13%), interprofessional communication (12%), and dispensing (8%). Forty-six percent of the IPE medication safety offerings were assessed using Objective Structured Clinical Examination (OSCE) or written examinations. In relation to medication safety, respondents indicated that students in their profession mostly learn medication safety in clinical laboratories.

Perceptions of potential barriers to interprofessional education
All of the respondents agreed that IPE experiences would be beneficial to student learning. Respondents were also asked to identify perceived barriers to the implementation of IPE experiences using a 5 point-Likert scale (1= no barrier and 5= major barrier). The results suggested that timetabling restrictions followed by lack of appropriate teaching and learning resources, and funding limitations were the most significant barriers to the implementation of IPE initiatives. Student resistance to IPE, policy or legislative requirements, and lack of institutional support were the least reported barriers (Table 2).
Table 2: Perceived barriers to implementing interprofessional education activities by Australian and New Zealand universities (%)

<table>
<thead>
<tr>
<th>Perceived barrier</th>
<th>1 - No barrier</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 - Major barrier</th>
<th>Response Average (out of 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of institutional support</td>
<td>32.14</td>
<td>21.43</td>
<td>28.57</td>
<td>7.14</td>
<td>10.71</td>
<td>2.43</td>
</tr>
<tr>
<td>Student resistance to IPE</td>
<td>42.86</td>
<td>21.43</td>
<td>17.86</td>
<td>14.29</td>
<td>7.14</td>
<td>2.14</td>
</tr>
<tr>
<td>Lack of appreciation of the benefits of IPE by staff</td>
<td>14.29</td>
<td>21.43</td>
<td>21.43</td>
<td>32.14</td>
<td>10.71</td>
<td>3.04</td>
</tr>
<tr>
<td>Lack of appreciation of the benefits of IPE by students</td>
<td>25</td>
<td>25</td>
<td>21.43</td>
<td>21.43</td>
<td>7.14</td>
<td>2.61</td>
</tr>
<tr>
<td>Staff education/experience with IPE</td>
<td>7.14</td>
<td>14.29</td>
<td>25</td>
<td>42.86</td>
<td>10.71</td>
<td>3.36</td>
</tr>
<tr>
<td>Lack of staff confidence</td>
<td>7.14</td>
<td>17.86</td>
<td>42.86</td>
<td>21.43</td>
<td>10.71</td>
<td>3.11</td>
</tr>
<tr>
<td>Funding limitations</td>
<td>7.14</td>
<td>10.71</td>
<td>21.43</td>
<td>21.43</td>
<td>39.29</td>
<td>3.75</td>
</tr>
<tr>
<td>Timetabling restrictions</td>
<td>3.57</td>
<td>3.57</td>
<td>17.86</td>
<td>10.71</td>
<td>64.29</td>
<td>4.29</td>
</tr>
<tr>
<td>Lack of appropriate classroom space</td>
<td>10.71</td>
<td>17.86</td>
<td>21.43</td>
<td>10.71</td>
<td>39.29</td>
<td>3.5</td>
</tr>
<tr>
<td>Lack of IPE appropriate teaching and learning resources</td>
<td>10.71</td>
<td>21.43</td>
<td>21.43</td>
<td>17.86</td>
<td>28.57</td>
<td>3.79</td>
</tr>
<tr>
<td>Policy or legislative requirements</td>
<td>42.86</td>
<td>21.43</td>
<td>17.86</td>
<td>10.71</td>
<td>7.14</td>
<td>2.18</td>
</tr>
</tbody>
</table>

Respondents were also asked to indicate on a 5-point Likert scale (1= “The least priority” and 5= “The highest priority”), what they thought should be the main focus of IPE resources. There was widespread agreement that medication errors, teamwork, and interprofessional communication should be taught through IPE experiences (Table 3).

Table 3: Perceived focus of IPE medication safety teaching resources (%)

<table>
<thead>
<tr>
<th>Perceived focus of IPE medication safety teaching resources</th>
<th>1 - Least Priority</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 - Highest priority</th>
<th>Response Average (out of 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitudes towards other professions</td>
<td>3.57</td>
<td>7.14</td>
<td>21.43</td>
<td>35.71</td>
<td>32.14</td>
<td>3.79</td>
</tr>
<tr>
<td>Interprofessional communication</td>
<td>0</td>
<td>7.14</td>
<td>7.14</td>
<td>25</td>
<td>60.71</td>
<td>4.32</td>
</tr>
<tr>
<td>Knowledge of roles of other professions</td>
<td>3.57</td>
<td>3.57</td>
<td>17.86</td>
<td>39.29</td>
<td>35.71</td>
<td>4</td>
</tr>
<tr>
<td>Medication errors</td>
<td>0</td>
<td>7.14</td>
<td>7.14</td>
<td>17.86</td>
<td>67.86</td>
<td>4.42</td>
</tr>
<tr>
<td>Teamwork</td>
<td>0</td>
<td>0</td>
<td>10.71</td>
<td>32.14</td>
<td>57.14</td>
<td>4.42</td>
</tr>
</tbody>
</table>

All respondents indicated that academic staff development and multi-media IPE resources such as DVDs, websites and online scenarios for teaching medication safety would be of benefit to teaching.
DISCUSSION

While the results suggest that the majority of Australian and New Zealand universities are using IPE, it is apparent that what constitutes IPE has variable interpretations. Although 31 universities reported using IPE, analysis of open-ended responses revealed that the majority of the cited experiences do not involve students learning with, from or about each other but instead alongside each other in a somewhat passive way. Examples of such experiences include having staff from one profession delivering lectures on subjects such as anatomy and physiology to students from other health professionals or simply combining students from different health professional groups for bioscience lectures without any planned or structured interaction. Other respondents reported largely unstructured and ad hoc IPE experiences that occur during clinical placements. It is apparent that such experiences do not meet the criteria for the definition of IPE put forward by the Centre for the Advancement of Interprofessional Education (CAIPE). Ideally, IPE experiences should involve the moulding of different professions’ contributions and understandings through collaboration and learning ‘with, from and about’ other professions. According to this definition, the results show that in fact there is very little formal IPE occurring with health professional students in Australian and New Zealand universities.

The results indicate that although the IPE experiences include the main professions involved in the medication process, only half of those who offer IPE in a way that meets the CAIPE definition said that they use it to teach medication safety. This is an important consideration given that (a) all of the respondents perceived considerable benefits in the use of IPE to teach medication safety and (b) that communication errors have been identified as the root cause of 70% of sentinel events occurring in health care settings (Joint Commission, 2004). One possible
reason for this is limited availability of appropriate teaching and learning resources. This is supported by the fact that all the respondents indicated that multi-media IPE resources such as DVDs, websites and online scenarios would benefit them in teaching medication safety.

For those who use IPE to teach medication safety the majority of the respondents reported that medication error, drug calculations and prescribing and dispensing were the main focus of the experiences. This is consistent with evidence from literature indicating that traditionally, the teaching of safe medication practices to health professional students has mainly focused on increasing their knowledge about medications and skills in medication calculations (Bayne & Bindler, 1997; Maxwell & Walley, 2003; O’Shea, 1999; Ross & Loke, 2009). However, evidence indicates that attention to increasing these skills without consideration of the broader issues that impact safe medication practices, has not translated to improved outcomes such as a reduction in medication errors (Armitage & Knapman, 2003; Ross & Loke, 2009). Interestingly, the participants identified teamwork and interprofessional communication as important foci in IPE medication safety resources. This result reinforces the hypothesis that the lack of focus on these elements in current IPE efforts may be the result of a lack of appropriate resources, or a lack of confidence in using innovative approaches.

The scope and level of coherence and coordination of IPE in Australia and New Zealand falls short of what has been achieved in a number of other countries. In Canada and the United Kingdom for example, there exists a clear policy direction and substantial government funding to incorporate IPE into health professional education.

A recent report produced by an expert panel convened by the Interprofessional Education Collaborative (2011) in the USA identified core competencies aimed at
promoting shared learning among students from two or more health professions. Some authors have suggested that the lack of clear policy to guide the incorporation of IPE into Australian health curricula as one of the major barriers to successful implementation of IPE (Gilbert, 2005). An important finding from this study that challenges this premise is that the majority of participants did not select the lack of policy or legislative requirements as a substantive barrier to IPE activities. Instead, the participants identified timetabling restrictions, lack of appropriate teaching and learning resources, and funding limitations as the main barriers to implementing IPE. These are consistent with those reported in similar surveys in the US and Canada (Blue, Zoller, Stratton, Elam, & Gilbert, 2010; Curran, Deacon, & Fleet, 2005; Gardner, Chamberlin, Heestand, & Stowe, 2002). All of these factors need to be considered when planning IPE experiences.

There is continued debate regarding the most appropriate timing for the introduction of IPE experiences. Some studies have reported that IPE should be included in the early years of university studies (Cameron et al., 2009; Hylin, Nyholm, Mattiasson, & Ponzer, 2007). One of the major reasons cited for this is that early exposure to IPE can help students to appreciate and comprehend the structure and system in which they will work as professionals after completing their studies. Others however, have argued that IPE experiences should be introduced towards the end of their undergraduate programs after students have an understanding of their individual professional identity and scope of practice (Anderson, Thorpe, Heney, & Petersen, 2009). By contrast, Curran, Sharpe, Flynn, and Button (2010) propose exposing students to elements of IPE early and continuously throughout their undergraduate education. The results of the current study indicate that in Australia and New Zealand, the majority of IPE activities occur during middle years of enrolment. This issue warrants further investigation.
A recent literature review by Thannhauser, Russell-Mayhew, and Scott (2010) identified a total of 23 instruments used to evaluate outcomes in IPE studies. The results from this cross sectional survey indicate that 65% of respondents utilised their own instruments to evaluate IPE outcomes. This result is supported by literature suggesting that researchers often develop their own instruments to evaluate the effectiveness of IPE interventions (Cragg, Hirsh, Jelley, & Barnes, 2010). However, many of these instruments lack sufficient information about their psychometric properties and details pertaining to validity and reliability. This presents opportunities to develop and psychometrically test instruments that can be used to comprehensively evaluate IPE outcomes related to medication safety and in particular, whether the learning outcomes from IPE translate to clinical performance.

The IPE approaches implemented in the majority of cases are campus or classroom based. This may be considered the most appropriate method to ensure delivery of IPE to large cohorts of students. However, the lack of physical proximity of the different schools and availability of appropriate space can also pose logistic problems. In one study the researchers utilised an online IPE module with students who were exposed to the online resources expressing more positive attitudes towards IPE post intervention (Becker & Godwin, 2005). The use of online approaches to offset timetabling and geographical limitations could also be extended. Such innovative approaches have the potential to allow health professional students to learn about and from other disciplines even when they do not have the opportunity to learn with them.

**Limitations of the study**

Certain limitations inherent in design and conduct of surveys must be taken into account when judging the strength of conclusions drawn. The sample employed in this study consisted of Australian and New Zealand Universities only and the results...
therefore may not be generalizable more broadly. The primary source of survey error is nonresponse error and this occurs when there are differences between respondents and nonrespondents on the variables of interest (Groves & Couper, 1998). The possibility of non-respondents being different from respondents is likely to be greater when the response rate is lower. In this study however, responses were obtained from 72% of Australian and New Zealand Universities, increasing confidence that the results provide a comprehensive picture of current IPE activities in this region. Further, many of the findings from the survey are supported by evidence from the internationally published literature, lending weight to the conclusions drawn from the results.

CONCLUSION

This study elucidates the extent to which IPE is currently used to teach medication safety in Australian nursing, pharmacy and medical programs. While 80% of the respondents indicated that they currently offer IPE experiences, only 24% of these experiences fit the definition of IPE as learning with, from and about other professions. Innovative approaches such as multimedia resources and e-learning activities are essential to overcoming some of the very real barriers to the use of IPE and hold great potential for the integration of IPE into the teaching of medication safety.

Acknowledgement

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Declaration of interest

The authors declare no conflict of interest. The authors alone are responsible for the writing and content of the paper.
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CHAPTER 4: Development and testing of the Theory of Planned Behaviour Medication Safety Questionnaire

4.1 Publication relevance to thesis

The systematic review presented in publication one (Lapkin, Levett-Jones, & Gilligan, 2013) found that to date the effectiveness of interprofessional education (IPE) approaches remains uncertain. This however, is likely to be a product of a lack of rigorous evaluation, rather than evidence of ineffectiveness, as identified in both the systematic review and cross-sectional survey (publication two) (Lapkin, Levett-Jones, & Gilligan, 2012). The small number of studies included in the systematic review, and the lack of evaluation associated with IPE efforts reported in the cross-sectional survey, highlight the lack of rigorous evaluation of learning outcomes associated with IPE efforts. The area of IPE is not unique in experiencing difficulties in evaluating learning outcomes and determining changes in practice or clinical behaviour as a result of educational efforts. This challenge has long plagued educators and educational researchers.

Sixty-five per cent of participants in the cross-sectional survey indicated that they had developed their own instruments in order to evaluate IPE offerings. Evidence from the literature indicates that the majority of such instruments have not been psychometrically tested and evidence of validity and reliability is therefore limited or non-
existent (Anderson, Thorpe, Heney, & Petersen, 2009; Cox et al., 2009; Hylin, Nyholm, Mattiasson, & Ponzer, 2007). Other participants reported using validated instruments such as the Readiness for Interprofessional Learning Scale (RILP) and the Interdisciplinary Education Perception Scale (IEPS). However, results of psychometric analysis of the original versions of these instruments have been inconsistent (McFadyen, Maclaren, & Webster, 2007; McFadyen et al., 2005). Some researchers have attempted to address such limitations by further developing and modifying these instruments in order to improve their validity and reliability or to meet their specific aims (Cameron et al., 2009; McFadyen et al., 2005; Reid, Bruce, Allstaff, & McLernon, 2006).

Instruments such as IEPS and RIPLS as well as other instruments currently used for evaluating IPE outcomes, tend to focus on participants' satisfaction, attitudes and knowledge acquisition. These outcomes correspond to levels one and two of the modified Kirkpatrick four-level model (Table 2) of evaluating educational outcomes (1967). This study attempts to address this gap in the IPE literature, at the same time as generating a resource for future, rigorous evaluation, by developing and testing the Theory of Planned Behaviour Medication Safety Questionnaire (TPB-MSQ). This is an instrument designed to measure behavioural change of health professional students, representing level three on Kirkpatrick's model. The TPB framework proposes that three predictor variables, namely those of attitudes, subjective norms, and perceived behavioural control, are the main determinants of behaviour. This approach offers a practical solution to the challenges of evaluating educational efforts in general, as it considers measures of behavioural intentions as a proxy for actual clinical behaviour.
Table 2 Kirkpatrick’s Model of Evaluation of Educational Outcomes

<table>
<thead>
<tr>
<th>Level</th>
<th>Description and Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Reaction</td>
<td>Learners’ views on the learning experience and its interprofessional nature</td>
</tr>
<tr>
<td>2a Modification of attitudes/perceptions</td>
<td>Changes in reciprocal attitudes or perceptions between participant groups. Changes in perception or attitude towards the value and/or use of team approaches to caring for a specific client group.</td>
</tr>
<tr>
<td>2b Acquisition of knowledge / skills</td>
<td>Including knowledge and skills linked to interprofessional collaboration.</td>
</tr>
<tr>
<td>3 Behavioural change</td>
<td>Identifies individuals’ transfer of interprofessional learning to their practice setting and changed professional practice.</td>
</tr>
<tr>
<td>4a Change in organisational practice</td>
<td>Wider changes in the organisation and delivery of care.</td>
</tr>
<tr>
<td>4b Benefits to patients / clients</td>
<td>Improvements in health or wellbeing of patients / clients</td>
</tr>
</tbody>
</table>

The development of the TPB-MSQ was based on Ajzen’s (2002) guidelines as well as Francis and colleagues’ (2004) instructions for TPB questionnaire development, and the essential elements of questionnaire design and development suggested by Streiner and Norman (1995). Consistent with this approach, 12 focus groups were held comprising of a mix of recent graduates from the nursing, pharmacy and medical fields from three Australian states. Subjects were recruited in order to elicit their beliefs regarding undergraduate IPE experiences (data presented in separate publications by colleagues that are not associated with this thesis). The findings from the focus groups and from review of medication safety literature informed the development of a draft TPB-MSQ questionnaire. The questionnaire was subsequently reviewed for content accuracy, clinical relevance, and authenticity by an expert panel of health professionals prior to being tested with a convenience sample of nursing, medical and pharmacy students.

The paper presented in this chapter reports on the development and testing of the TPB-MSQ and was completed in collaboration with the research supervisors and is currently under review:

Lapkin, S., Levett-Jones, T., & Gilligan, C. (2013). Development and testing of the
Theory of Planned Behaviour Medication Safety Questionnaire. (Manuscript submitted for publication to the *Nurse Education Today* journal)

Other documents associated with this manuscript are attached as:

Appendix J: Ethics approval

Appendix K: Text of invitation email to Heads of Schools

Appendix L: Information Statement for the Research Project

4.2 References


effectiveness of interprofessional education in health professional programs. 

*Nurse Education Today, 33*(2), 90-102.


The following is the manuscript which has been submitted, and is under review for publication in the *Nurse Education Today* journal. The manuscript complies with the journal's requirements but is not an accepted version.

**Title: Development and testing of the Theory of Planned Behaviour Medication Safety Questionnaire**

**ABSTRACT**

**Aim:** This paper presents a study that aimed to develop and test a questionnaire, based on the Theory of Planned Behaviour to measure the behavioural intentions of health professional students in relation to medication safety.

**Methods:** A stepwise approach using both qualitative and quantitative methods was used to construct the questionnaire. A web-based version of the questionnaire was tested with a convenience sample of 65 nursing, medical and pharmacy students; the results were analysed using multiple regression.

**Results:** Data analysis indicated that attitudes are the most significant predictor of health professional student’s intention to practice in a way that enhances medication safety. The three predictor variables of the Theory of Planned Behaviour namely attitude, subjective norm, and perceived control accounted for between 30-46% of the variance in behavioural intention.

**Conclusion:** The Theory of Planned Behaviour Medication Safety Questionnaire is a valid and reliable instrument for explaining and predicting health professional students’ behavioural intentions in relation to medication safety.

**Keywords:** attitudes; interprofessional education; health professional students; medication safety; Theory of Planned Behaviour
INTRODUCTION
Medication safety is a component of a broader global strategy to improve patient safety and quality of care and is now a key focus of national and international organisations. The World Alliance for Patient Safety (2008), which represents health care agencies, policy-makers, patient advocacy groups and the World Health Organization, recognises medication safety as an urgent and major challenge for interprofessional co-operation in the global context. Despite the various activities to address the problem, the prevalence of adverse patient outcomes associated with medication incidents remains unacceptability high (Westbrook et al., 2010). As a result, international efforts to enhance medication safety have led to a range of attempts to reform health professional education. Considering the multidisciplinary nature of the medication process, it has been suggested that strategies such as interprofessional education (IPE) could help to appropriately prepare students for safe medication practices (Lapkin et al., 2013).

IPE is a collaborative approach that involves students from different professional groups learning from, with, and about each other (Center for the Advancement of Interprofessional Education, 2002). A successful interprofessional curriculum may improve communication and reduce negative stereotypes, thus helping to overcome barriers to collaboration and teamwork (Bridges et al., 2011). An expanding literature about IPE points to its increasing inclusion in university programs (Bridges, et al., 2011). Despite widespread support for IPE however, the effectiveness and impact of this pedagogical approach on health professional behaviour and patient outcomes remains uncertain (Bradley et al., 2009).

Contemporary systematic reviews of the impact of IPE report positive learner-focused outcomes usually linked to satisfaction with learning experiences, changes of perception/attitudes and/or improved knowledge or skills (Freeth et al., 2002; Hammick et al., 2007). These outcomes represent the lower levels (1-2) the Kirkpatrick’s (1967) four-level model
for evaluating educational outcomes (Table 1). However, evidence of the effectiveness of IPE experiences on outcomes that represent level 3-4 of Kirkpatrick’s model such as improved clinical practice and patient care, is lacking (Clifton et al., 2007; Lapkin, et al., 2013). It is these behavioural changes and improvements in patient outcomes which are often key objectives of educational initiatives, but that represent the greatest challenges to evaluation.

**Table 1 Kirkpatrick’s Model of Evaluation of educational outcomes**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description and Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Reaction</td>
<td>Learners’ views on the learning experience and its interprofessional nature</td>
</tr>
<tr>
<td>2a Modification of attitudes/perceptions</td>
<td>Changes in reciprocal attitudes or perceptions between participant groups. Changes in perception or attitude towards the value and/or use of team approaches to caring for a specific client group.</td>
</tr>
<tr>
<td>2b Acquisition of knowledge/skills</td>
<td>Including knowledge and skills linked to interprofessional collaboration</td>
</tr>
<tr>
<td>3 Behavioural change</td>
<td>Identifies individuals’ transfer of interprofessional learning to their practice setting and changed professional practice.</td>
</tr>
<tr>
<td>4a Change in organisational practice</td>
<td>Wider changes in the organisation and delivery of care.</td>
</tr>
<tr>
<td>4b Benefits to patients/clients</td>
<td>Improvements in health or well being of patients/clients</td>
</tr>
</tbody>
</table>


The dearth of empirical evidence for the effectiveness of IPE can be attributed in part, to a lack of rigorous evaluation of the implementation and effectiveness of IPE efforts and subsequent learning outcomes (Hammick, et al., 2007). A recent cross sectional survey of university based IPE experiences reported that 65% of IPE experiences were evaluated using a diverse range of instruments, although the majority lacked sufficient theoretical and psychometric development (Lapkin et al., 2012). Assessment of the impact of educational initiatives provides information about teaching effectiveness and whether students are achieving intended learning outcomes, and is one of the most important activities educators can undertake (Trottera, 2006).
The Theory of Planned Behaviour

Evaluation of the impact of IPE is fraught with conceptual and practical difficulties. Several authors have suggested that the use of social psychological, cognitive, behavioural and other empirically validated theories can help understand the process of learning involved in IPE experiences (Mann et al., 2012; Reeves and Goldman, 2011; Sargeant, 2009). One such theory that has the potential to improve understanding of the effectiveness of IPE approaches is the Theory of Planned Behaviour (TPB). This theory posits that behavioral intentions are the main determinants of behavior. Intentions are in turn determined independently by three domains; attitudes, subjective norms, and perceived behavioural control (Ajzen, 1991). The assumption behind TPB is that aggregating these variables provides a valid measure of underlying behavioural disposition (Ajzen, 1991). Although other variables may potentially affect behaviour, human action is most accurately predicted by the three basic determinants of attitudes, subjective norms, and perceived behavioural control (Ajzen, 1991).

The TPB methodology uses questions (response items) about behavioural beliefs to yield attitude ($A_b$), normative beliefs to yield subjective norm ($SN_b$), and control beliefs (or self-efficacy) to yield perceived behaviour control ($PBC_b$). The behavioural intentions score ($B_{I_b}$) is a weighted algebraic sum of these three components:

$$B_{I_b} = A_b + SN_b + PBC_b \quad (Ajzen, 1991)$$

The more favourable the attitude and subjective norm and the greater the perceived control, the stronger will be the person’s intention to perform the behaviour in question. Given a sufficient degree of actual control over the behaviour, people are expected to carry out their intentions when the opportunity arises. Behavioural intention is thus assumed to be the immediate antecedent of
behaviour and can act as a proxy to measuring actual behavioural (Ajzen, 1991).

The TPB has been emerged as one of the most robust social–psychological model that has been used extensively to identifying important predictors of to examine and predict human intentions and behaviour. A review of Medline and PsycINFO scholarly databases between 1985 and 2004 identified over 800 studies that used the TPB as the theoretical basis (Francis et al., 2004). A meta-analysis of 87 studies concluded that there is significant evidence that intention can be used to predict actual behaviour (Sheppard et al., 1988).

Recent research has focused on application of the TPB across behavioral and social domains including social and cognitive psychology (Chorlton et al., 2012), advertising, marketing, healthcare professionals training (Casper, 2007) and information technology (Aguilar-Luzon et al., 2012). While the measurement of health professional students’ actual clinical behaviour remains difficult, the TPB offers an opportunity to rigorously measure behavioural intentions as a proxy for actual changes in clinical behaviours. Thus, the aim of the present study was to design and test a Theory of Planned Behaviour-based questionnaire to evaluate behavioural intentions related to medication safety. This questionnaire will be subsequently used in a future study to examine the impact of web-based interprofessional learning modules on health professional student’s behavioural intentions in relation to medication safety and collaborative practice.

**METHODS**

**Questionnaire development**

A stepwise approach was used to develop the Theory of Planned Behaviour Medication Safety Questionnaire (TPB-MSQ). It involved both qualitative and quantitative methods based on guidelines for the construction of the TPB questionnaires developed by Francis, et al. (2004) and the essential elements of questionnaire design

**Stage I: Belief elicitation - focus group interviews**

A total of 12 focus group interviews were conducted with 68 recent health professional graduates from nursing (n=28), pharmacy (n= 23), and medicine (n= 17) to identify the beliefs and perceptions of IPE and medication safety. The questionnaire items for the predictor variables of TPB were developed based on data collected during this elicitation study and with reference to a wide body of literature.

**Stage II: Draft instrument development**

*Behavioural intentions*

The intention simulation method that uses written scenarios was adopted for this study. It is considered a valid proxy measure for actual behaviour as it closely approximates real clinical situations that require complex decision making (Francis, et al., 2004). Written scenarios are effective for eliciting attitudes and beliefs; evaluating recall and application of knowledge; and elucidating the decision-making process (Jones et al., 1990). Each of the scenarios developed were followed by a yes/no intention question and a question asking respondents to rate how difficult it was to make their decision using a 7 point-scale (strongly disagree strongly agree). The scenarios were based on the clinical experience of the researchers. Four scenarios were developed, addressing common medication safety issues related to managing errors, open disclosure, managing interruptions, and person-centred care.

*Attitudes*

It has been suggested that effective interprofessional collaboration and teamwork can be significantly influenced by the attitudes of healthcare professionals towards their own and other professional groups (Hind et al., 2003). A total of 20 items which assess the strength of attitudes in relation to medication safety and IPE were included.
Subjective norms

Subjective norms refer to perceptions about how others would judge a person for performing a specified behaviour (Casper, 2007). Given that IPE involves various health care professional groups, this component of the TPB is a particularly important consideration in the present evaluation. Subjective norm is a combination of normative beliefs and motivation to comply. Salient referents are people or groups whose beliefs or opinions regarding the behaviour of interest are important to the individual (Mathieson, 1991). Salient referents identified by the health professional graduates during the Stage I focus groups were other health professionals, patients and patient’s families. A total of 20 items asking respondents to rate the extent to which salient referents would approve or disprove of performing a particular behaviour were included to measure subjective norms.

Perceived behavioural control

The third predictor of intention is perceived behaviour control; this refers to the self assessment of both the capability or skill and the opportunity to perform the behaviour (Casper, 2007). Although a person may have a strong intention to perform a behaviour, actual performance may be limited by factors such as the availability of requisite resources, information, skills and opportunities to carry out an action (Ajzen, 1991; Trafimow et al., 2002). People who perceive that they have access to the necessary resources and have opportunities (or lack of obstacles) to perform the behaviour are likely to have a high degree of perceived behaviour control (Ajzen, 1991). A meta-analysis by Trafimow et al. (2002) indicates that the inclusion of perceived behaviour control increases the power to predict behaviour. Thus 15 items were included in the draft questionnaire to measure perceived behaviour control.
Stage III: Content validity

In order to maximise the content validity of the questionnaire an expert panel consisting of 14 researchers and interprofessional clinicians (nursing n=4; pharmacy n=5; medicine n=4 and education n=1) reviewed all of the scenarios and items. Each panel member was provided with a copy of the draft questionnaire, consisting of four scenarios and 68 items. They were asked to judge each scenario for clinical relevance and each item for item for accuracy, clarity, and ability to measure what was intended. A rating tool designed for this purpose was utilised to ensure consistent and focused feedback. As suggested by Berk (1990) the expert panel was also asked to make any necessary revisions to items that they considered unclear or ambiguous and to assess the entire instrument for comprehensiveness (Lynn, 1986).

The expert panel agreed on the overall relevance of 96% of the items. Appropriate changes were made to the scenarios and 12 items were deleted based on the feedback. The final TPB-MSQ was composed of four parallel, profession specific scenarios and 56 items related to: attitude (n=16); perceived behavioural control (n=14); subjective norms (n=12); behavioural intentions (n=4); decision difficulty (n=4); demographics (n=5). As recommended by Ajzen (1991) seven-point rating scales (strongly disagree to strongly agree) were used for the predictor components of the TPB. In order to minimize potential bias some of the items were reverse scored (Streiner and Norman, 1995).

Stage IV: Testing

Questionnaire administration procedure

Following ethics approval from the university’s Human Research Ethics Committee, undergraduate or graduate entry students enrolled in the second year or later in pharmacy, nursing and medicine programs were invited to participate via advertisements placed on the university’s learning management system (Blackboard™).
Participants were provided with an information statement which directed them to a secure website where they voluntarily completed the 15 minute online questionnaire. Completion and submission of the survey was taken as implied consent.

**Statistical analysis**

Statistical analysis was conducted using the Statistical Package for the Social Sciences statistical software package version 20.0 for Mac OS X (SPSS Inc., Chicago, IL, USA). A total of 19 questions that had negative endpoints were reverse scored to ensure that high scores consistently reflected positive target behaviours.

The internal consistency of the entire questionnaire and subscales of each of the predictor variables were assessed by Cronbach’s alpha coefficient (α). Internal consistency is an important part of the development of reliable scales (Pittman and Bakas, 2010), with acceptable results usually indicated by a Cronbach’s alpha of more than .70 (Bryman and Cramer, 1997; DeVillis, 2003). However, for TPB questionnaires Francis et al., (2004) suggest that an Cronbach’s alpha greater than .60 is appropriate. This view is supported by Kline (1999) who notes that for psychological constructs Cronbach’s alpha values of below .70 can still indicate a reliable scale.

Bivariate Pearson’s correlations were also performed to explore associations between intention, attitude, subjective norm and perceived behaviour control variables for each clinical scenario. Correlation coefficient values of ± .1, ±.3, and ± .5 are considered to be small, medium, and large effect size respectively (Lau and Kuk, 2011). Multiple linear regression was conducted to further explore the association between these variables. In all analyses the dependent variable was the behavioural intention and the independent variables were attitude, perceived behavioural control and subjective norm. A p-value of less than .05 was considered statistically significant.
RESULTS

Participant characteristics

Responses were obtained from 65 participants as follows: nursing 41 (63%), medicine 14 (22%) and pharmacy 10 (15%). A majority of participants were female (80%) and 21% reported that they had previously been exposed to IPE experiences.

Reliability analysis

The Cronbach’s alpha resulting from the removal of an item was used to identify items for removal to improve internal consistency. For the 16 items measuring attitude, omitting one item “Medication incidents are related to human factors and are therefore difficult to prevent” increased the Cronbach’s alpha from .469 to .602. This item was therefore omitted from the scale resulting in a total of 15 attitude items.

The Cronbach’s alpha for the 12 subjective norm items was .580. Analysis indicated that no item would significantly increase this value if omitted so all 12 subjective norm items were retained. Similarly, the Cronbach’s alpha for the 14 perceived behaviour control items was .761 and all were retained. The Cronbach’s alpha for the entire questionnaire was .844. Sample items and other descriptive statistics are shown in Table 2.
Table 2: Direct measures of the Theory of Planned Behaviour

<table>
<thead>
<tr>
<th>TPB construct</th>
<th>Number of items</th>
<th>Sample item</th>
<th>Cronbach’s alpha (α)</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude</td>
<td>15</td>
<td>Reviewing the factors that contributed to this medication incident is the responsibility of a senior member of staff</td>
<td>.602</td>
<td>5.36</td>
</tr>
<tr>
<td>Subjective norm</td>
<td>12</td>
<td>My colleagues would expect me to take the initiative for reviewing the factors that contributed to this medication incident</td>
<td>.580</td>
<td>5.52</td>
</tr>
<tr>
<td>Perceived behaviour control</td>
<td>14</td>
<td>It is my role to inform patients or a member of their family if a medication incident occurs</td>
<td>.761</td>
<td>5.19</td>
</tr>
</tbody>
</table>

Relationships between predictors

Correlation analyses were conducted to explore the relationship between intention and each of the measured variables. The most significant correlation with intention was attitude, \( r = .567, p < .0001 \) followed by perceived behaviour control with a weak positive relationship, \( r = .343, p < .01 \). There was a weak negative relationship between subjective norm and intention, however this was not statistically significant, \( r = -.067, p= .613 \). Attitude was also positively correlated with the other two-predicator variables: perceived behavioural control \( r = .366, p < .01 \) and subjective norm \( r = .372, p < .01 \). In addition, there was moderate positive correlation between perceived behavioural control and subjective norm, \( r = .445, p < .0001 \).

Explaining intention

Overall scores for attitude, subjective norms, and perceived behavioural control were obtained by calculating the mean of the individual items used to measure these three variables, each rated on 7-point unipolar scales ranging from 1 to 7. For intentions the total number of “yes” answers was calculated for each scenario.

Multiple regression analyses were conducted using these composite variables, to determine which of the three TPB constructs exerted the greatest influence on intention to practice in a way that promotes medication safety. The composite
functions for each of the TBP constructs were used as independent variables with intention as the dependent variable. As in Table 3, it was found that attitude ($\beta = 0.614$, $p < 0.001$) and perceived behaviour control ($\beta = 0.312$, $p < 0.05$) are significantly and positively related to behavioural intention. However, subjective norm was significantly negatively related to behavioural intention at $p < 0.001$ level ($\beta = -0.434$).

**Table 3 Coefficients**

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>-1.449</td>
<td>.880</td>
<td>-1.646</td>
<td>.105</td>
</tr>
<tr>
<td></td>
<td>Attitude</td>
<td>.846</td>
<td>.163</td>
<td>.567</td>
<td>5.192</td>
</tr>
<tr>
<td>2</td>
<td>(Constant)</td>
<td>.441</td>
<td>1.050</td>
<td>.420</td>
<td>.676</td>
</tr>
<tr>
<td></td>
<td>Attitude</td>
<td>1.025</td>
<td>.165</td>
<td>.687</td>
<td>6.214</td>
</tr>
<tr>
<td></td>
<td>Subjective norm</td>
<td>-0.517</td>
<td>.177</td>
<td>-.323</td>
<td>-2.919</td>
</tr>
<tr>
<td>3</td>
<td>(Constant)</td>
<td>-.038</td>
<td>1.006</td>
<td>-.038</td>
<td>.970</td>
</tr>
<tr>
<td></td>
<td>Attitude</td>
<td>.917</td>
<td>.160</td>
<td>.614</td>
<td>5.712</td>
</tr>
<tr>
<td></td>
<td>Subjective norm</td>
<td>-.695</td>
<td>.179</td>
<td>-.434</td>
<td>-3.887</td>
</tr>
<tr>
<td></td>
<td>Behaviour control</td>
<td>.394</td>
<td>.141</td>
<td>.312</td>
<td>2.796</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Intention

The model explained between 30-46% of health professional student’s intention to practice in a way that enhances medication safety, with the attitude construct the being the most significant predictor (adjusted $R^2 = 0.309$) as shown in Table 4.
Table 4: Regression Model summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.567a</td>
<td>.321</td>
<td>.309</td>
<td>.84940</td>
</tr>
<tr>
<td>2</td>
<td>.641b</td>
<td>.411</td>
<td>.390</td>
<td>.79836</td>
</tr>
<tr>
<td>3</td>
<td>.696c</td>
<td>.484</td>
<td>.456</td>
<td>.75378</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Attitude
b. Predictors: (Constant), Attitude, Subjective norm
c. Predictors: (Constant), Attitude, Subjective norm, Perceived behaviour control

DISCUSSION

We have used a well-established process (DeVillis, 2003; Francis, et al., 2004; Hardesty and Bearden, 2004; Streiner and Norman, 1995) to design and test the TPB-MSQ. Statistical analysis provided strong support for the application of the Theory of Planned Behaviour to explain and predict health professional students' behavioural intentions to practice in a way that promotes medication safety. Attitude, subjective norm, and perceived control accounted for about 46% of the variance in students' intentions to practice in a way that enhances medication safety. This is a very strong prediction considering that a meta-analysis of 185 studies concluded that the TPB accounted for an average of 39% of the variance in behavioural intention (Armitage and Conner, 2001).

The attitude construct was the most significant predictor of intention to practice in a way that enhances medication safety (31%). This result is consistent with much of the published research based on the Theory of Planned Behaviour, in which a typical finding is that attitude towards the behaviour is the strongest correlate of intention (Parker et al., 1998; Tonglet et al., 2004). Attitude also exhibited strong and statistically significant correlations with perceived behaviour control. This suggests that having the appropriate skills, resources and opportunities to practice in a way that enhances medication safety contributes towards a positive attitude.
Although there is an underlying assumption that individuals tend to perform behaviours encouraged and accepted within their circle of influence, the subjective norm items that measured this construct had a statistically significant negative effect on behavioural intention. This finding is consistent with previous studies which have demonstrated that the subjective norm construct is a weaker predictor of behavioural intentions than attitudes and perceived behavioural control (Godin and Kok, 1996; Hagger et al., 2002).

**Limitations of the study**

The study findings corroborate previous research based on the TPB by suggesting that attitude positively influences behavioural intentions. However, there is a need to further examine the effects of the subjective norm component on behavioural intention as it does not entirely reflect the relationships proposed by the TPB. In this study we used only four specific clinical examples and associated behavioural intentions. It is possible that different scenarios, may elicit different results. In addition, the unequal response distribution from nursing, medical, and pharmacy students may have affected the statistical results, however, the distribution of professions was similar to ratios observed in many university enrollments and practice settings. Taken together, these limitations mean that interpretation of the results of this study should be performed with caution.

**Implications for further research**

The instrument developed through this study represents a useful tool for the evaluation of behavioural outcomes of educational efforts to promote medication safety. This tool provides an effective way to evaluate IPE outcomes related to behavioural change which represent level 3 on Kirkpatrick’s (1967) four-level model for evaluating educational outcomes. Our findings have important implications for the assessment of IPE, the development and implementation of strategies to enhance medication
safety, and for the future use of the TPB in the evaluation of educational interventions. The inherent usefulness of social cognition models such as the TPB is that they can be used to identify variables to target in interventions. Specifically, the results of the present study suggest that educational interventions may be most successful if they focus on the attitude, given this component of the model was the most important predictor of behavioral intention.

Pedagogical approaches must therefore aim to (1) reinforce the positive attitudes of health professional students who are already committed to safe medication practices and (2) change the attitudes of those who view safe medication practices and their own capacity for influence negatively. Research must also focus on subjective norms since it had a negative effect on students’ behavioural intention to practice in a way that enhances medication safety.

Lastly, it will be important to explore the impact of other variables external to the TPB such as gender, professional group and previous IPE experiences. Despite the limitations, the results of this study are useful for further research and to inform the development of strategies that may be applied to enhance safe medication practices and interprofessional practice.

**CONCLUSION**

This study provided evidence of reliability and validity of the predictive power of the TPB-MSQ. The findings suggest that attitudes are the major contributor to health professional students’ intention to practice in a way that enhances medication safety. This knowledge can inform the development of teaching and learning resources for health professional students aimed at promoting patient safety. We are currently undertaking a multi-site study to examine the impact of web-based learning modules on health professional students’ behavioural intentions in relation to medication safety.
and collaborative practice. Questionnaire development is an iterative process and future studies in different context and with difference student cohorts could add to the testing of the psychometric properties of the TPB-MSQ.

**Acknowledgement**

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**Declaration of interest**

The authors report no declarations of interest.
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http://www.caipe.org.uk/about-us/defining-ipe/


CHAPTER 5: The effectiveness of web-based interprofessional learning modules on health professional students’ behavioural intentions in relation to medication safety: A quasi-experimental study

5.1 Publication relevance to thesis

The university based face-to-face interprofessional education (IPE) experiences discussed in the introduction (Chapter 1) and systematic review (publication one) incorporated narrative pedagogy in the form of case studies and simulated scenario based learning as the main educational strategies. The approaches can be easily incorporated in IPE experiences providing the learners with different types of stimulations and ways of learning content. However, such IPE efforts are limited by pragmatic constraints inherent in university programs such scheduling and geographic barriers and large students’ cohorts. There is emerging interest in web-based IPE learning approaches as a way to offset some of these barriers. One of the nine studies included in the publication one used a web-based IPE module to overcome barriers of time, space and location (Becker & Godwin, 2005). The researchers reported that students completing the web-based modules reported improvements in interdisciplinary values, as evaluated by the Interdisciplinary Education Perception Scale (IEPS). Although these results suggest that web-based IPE approaches can achieve improvements in outcomes similar in value to face-to-face IPE experiences, designated evaluation of the effectiveness of web-based IPE experiences is yet to be
conducted (Grundgeiger & Sanderson, 2009). The fourth component of this thesis addressed this knowledge gap by using the Theory of Planned Behaviour Medication Safety Questionnaire (TPB-MSQ) (manuscript three) in order to investigate the effectiveness of a web-based IPE module upon a health professional students’ intention to behave in a way that promotes medication safety.

The web-based IPE module evaluated in this study is one of five developed as part of the Office of Learning and Teaching (OLT) funded project titled Interprofessional education: Enhancing the teaching of medication safety to nursing, pharmacy and medical students that is associated with this thesis. The full report of this project is available at this link http://www.olt.gov.au/resource-interprofessional-education-teaching-medication-safety. The module incorporated narrative pedagogy and simulated scenario based educational strategies as described in the manuscript attached as Appendix B (Additional publication associated with thesis).

Citation:

At the time of thesis submission this paper has been cited once.

The module was based on an actual clinical case described in a Coroner’s report, and was developed with input from key stakeholders including Nursing, Pharmacy and Medicine Academics, clinicians, students, and patient representatives. The case was designed to be clinically authentic and realistic as well as demonstrating key learning points in relation to communication and teamwork, and providing stimulus for critical thinking. The script of web-based IPE learning module is attached as Appendix N
The manuscript that presents the results of the quasi-experimental study was co-authored in collaboration with the research supervisors and is currently under review.

Citation:


The IPE module evaluated in this component of the thesis is available at:


5.2 References


The following is the manuscript which has been submitted, and is under review for publication in the *Focus on Health Professional Education: A Multi-disciplinary Journal*. The manuscript complies with the journal’s requirements but is not an accepted version.

**Title:** The effectiveness of web-based interprofessional learning modules on health professional students’ behavioural intentions in relation to medication safety: A quasi-experimental study

**ABSTRACT**

**Background:** Safe medication practices are a key focus of the global strategy to improve patient safety. Emerging evidence demonstrates that learning experiences focusing on developing collaborative skills such as mutual understanding of others’ roles, teamwork and interprofessional communication can enhance medication safety. However, interprofessional education for undergraduate students is limited by factors such timetabling restrictions and curricular constraints. Web-based approaches provide the opportunity to overcome these barriers. However, currently there is little empirical evidence for the effectiveness of web-based approaches in changing the behaviour of health professional students in relation to medication safety and collaborative practice.

**Aim:** To examine the impact of web-based interprofessional learning modules on health professional student’s behavioural intentions in relation to medication safety and team work.

**Methods:** A quasi-experimental approach was employed to evaluate the effectiveness of the learning modules and 320 undergraduate health professions
students were recruited. Students were allocated to either an experimental (n= 155) or control group (n= 165). Participants in the experimental group completed a multimedia web-based learning module. The Theory of Planned Behaviour Medication Safety Questionnaire was used to compare behavioural intentions, attitudes, subjective norms and perceived behavioural control in relation to medication safety between the control and experimental groups.

**Results:** Participants in the experimental group demonstrated significantly greater intention to practice in a way that enhances medication safety and collaborative practice than those in the control group, as evidenced by higher scores on all outcomes: behavioural intention (p < 0.001); attitude (p < 0.001); perceived behavioural control (p = 0.107); and subjective norm (p = 0.115).

**Conclusion:** The web-based interprofessional learning modules were an effective learning strategy for developing the behavioural intentions and attitudes inherent in safe medication practices.

**Keywords:** attitudes, interprofessional education, health professional students, medication safety, Theory of Planned Behaviour
BACKGROUND

Safe medication practices are a key focus of the global strategy to improve patient safety (Sears, Ross-White, & Godfrey, 2012; World Health Organization, 2011). While most medications are administered safely, evidence suggests that as a result of medication errors only between 4% and 21% of patients achieved the optimum therapeutic benefit (Garfield, Barber, Walley, Willson, & Eliasson, 2009). Despite the various efforts to address the problem the prevalence of the medications incidents is unacceptability high. Medication related incidents remain the second most common type of incident reported in Australian hospitals (De Winter et al., 2010) with reports indicating error rates of up to 18% (Johnson, Tran, & Young, 2011). In the Australian public health system alone, medication adverse events cost approximately $6 billion dollars per year and inappropriate use of medicines $380 million (National Health and Hospitals Reform Commission, 2008). Such figures are not unique to Australia, with research undertaken by the National Health Service in the UK (Smith, 2004) and the Institute of Medicine (2007) in the US reporting similar figures. However, it is likely that the available data underestimates the magnitude of the medication errors due to the fact that many incidents are never discovered, acknowledged or reported.

Emerging evidence suggests that interprofessional communication and collaborative skills such as mutual understanding of others’ roles and ability to appreciate one another’s skills and contributions, can enhance medication safety practices (Courtenay, 2012; Taylor, Yuen, Hunt, & Emond, 2012). This is not surprising considering that safe, timely, and efficient use of medicines is an interdependent process requiring effective interprofessional collaboration between all members of the medication team (Madegowda, Hill, & Anderson, 2007).

Ideally, communication and collaboration skills are best learned when students from various professions undertake structured and facilitated interprofessional education
(IPE) experiences during clinical placements (Anderson & Thorpe, 2010; Eccles et al., 2006; Godin, Bélanger-Gravel, Eccles, & Grimshaw, 2008; Ward, 2012). However, opportunities for health professional students to experience collaborative learning in a systematic and consistent manner are limited by the constraints imposed by a lack of clinical placement availability, timetabling of placements across programs, and large numbers of students (Levett-Jones & Bourgeois, 2011). As a result, undergraduate education is currently delivered mainly in an on-campus discipline specific mode providing limited opportunities for students to appreciate the roles and responsibilities of other health professionals (Ateah et al., 2011). This can in turn can lead to the development of profession-specific stereotypes that might not necessarily be a reflection of the realities of contemporary medication practices.

Improvements in outcomes related to collaborative practice have been demonstrated through IPE experiences involving face-to-face methods such as case studies, workshops and seminar formats (Ateah et al., 2011; MacDonnell, Rege, Misto, Dollase, & George, 2012; Wellmon, Gilin, Knauss, & Inman Linn, 2012). However, the widescale integration of these approaches is constrained by the pragmatic constraints inherent in university programs such as timetabling restrictions, rigid curricular, balancing of students numbers and lack of physical space (Lapkin, Levett-Jones & Gilligan, 2012). These challenges necessitate the development of alternative and innovative learning approaches in order to prepare students for their future roles in the medication team (National Medicines Safety and Quality Scoping Study Steering Committee, 2008; World Health Organization, 2011).

Emerging evidence suggests that web-based IPE experiences can contribute to an improved understanding of professional roles and responsibilities, enhancement of students’ attitudes towards each other, enhanced interprofessional communication, and improved preparation for interprofessional team work (Atack, Parker, Rocchi,
Maher, & Dryden, 2009; McKee, Goodridge, Remillard, & D’Eon, 2010). Although these studies provide some evidence of attitudinal changes after online IPE interventions, they had various methodological limitations such as small sample sizes and one group design with no control groups. It is also unclear if the reported improvements in outcomes can translate to changes in clinical behaviour. Such issues make it difficult to draw accurate conclusions regarding the effectiveness of these online IPE experiences.

Although the measurement of changes in actual clinical behaviour remains difficult, various authors have suggested that use of social psychology, cognitive, behavioural and other empirically validated theories can help understand the process of learning involved in IPE experiences (Mann et al., 2012; Reeves & Goldman, 2011; Sargeant, 2009). The Theory of Planned Behaviour (TPB), for example, is one of the most widely used frameworks for understanding human behaviour across behavioral and social domains, including social and cognitive psychology, advertising, marketing, healthcare, and communications (Alt & Lieberman, 2010). The number of citations of TBP per year in scholarly databases has increased from 22 in 1985 to 4550 in 2010 (Ajzen, 2011). The theory posits that behavioral intentions are the main determinants of behavior. Intentions are in turn determined independently by three domains; attitudes, subjective norms, and perceived behavioural control (Ajzen, 1991). Attitudes are the positive or negative evaluations held by an individual about performing particular a target behaviour (Ajzen & Fishbein, 1980). Subjective norms refer to perceptions about how others would judge a person for performing the behaviour (Casper, 2007). Perceived behavioural control refers to one’s perceived ease of performing a behaviour (Ajzen, 2002).

The assumption behind TPB is that aggregating these variables provides a valid measure of underlying behavioural disposition (Ajzen, 1991). Evidence from two
systematic reviews indicates that measures of behavioural intention are a valid proxy measure for behaviour (Eccles et al., 2006; Godin et al., 2008). Examples of how the TPB has been used in health care include: evaluating mental health practitioner’s intentions to implement new techniques (Casper, 2007); predicting and explaining university student’s class attendance (White, O’Connor, & Hamilton, 2011); and evaluating health professional student’s behavioural intentions in relation to infection prevention and control precautions while on clinical placements (Ward, 2012).

The study profiled in the current paper forms one component of a funded teaching and learning project, which sought to develop web-based multimedia resources that were designed to engage students with interactive and authentic ‘patient journeys’ and enhance their interprofessional skills related to medication practices. This paper presents the results of quasi-experimental study that evaluated the effectiveness of the web-based resources in influencing students’ intentions to behave in a way that promotes medication safety and collaborative practice using a questionnaire that was based on the TPB framework. We hypothesized that students who viewed the module would demonstrate greater intention to practice in a way than enhances medication safety and collaborative practice than those in the control group.

**METHOD**

**Study Design**

A quasi-experimental approach was employed to enable comparison between the control and experimental groups. Nursing, pharmacy and medical students in their second year of enrolment or later in Australian and New Zealand universities were recruited. The participating universities were divided into two groups based on their geographical location. Heads of schools of targeted universities were sent invitation emails with an information statement and a link directing participants to a
secure survey website. Reminder messages were sent after two weeks to those who did not respond to the initial invitation, and one further reminder was sent three weeks following that. Similar approaches have been shown to increase response rates by between 4% and 10% in mail based surveys (Scott & Edwards, 2006). Confidentiality and anonymity of data collected was maintained throughout all phases of study. The study was approved by the university ethics committee.

**Intervention**

Participants in the experimental group were asked to work through one of the web-based multimedia medication safety IPE learning modules developed for the broader project. To ensure equity students in the control groups were given access to the module once data collection was complete. The IPE module was adapted from the coroner’s report of an inquest in which a serious clinical error occurred. It depicted a 65 year-old male who was brought to the emergency department following a motor vehicle accident. The patient was taken to theatre and underwent internal fixation of a fractured femur. Despite guidelines to the contrary, pre-operative orders did not include chemical or mechanical venous thromboembolism (VTE) prophylaxis. Although circulation observations and pneumatic calf compression were performed during surgery no orders were given to continue this post-operatively as per evidence-based VTE guidelines (National Health and Medical Research Council (NHMRC), 2009).

A combination of digital video, audio, and text was used for the module in order to provide participants with insights into how a series of communication errors that occurred between the health care professionals led to a series clinical error. Demonstrations of clinical behaviours were followed by critical thinking questions asking students to consider how improvements in teamwork and clinical practice could promote medication safety (Levett-Jones, Gilligan, Lapkin & Hoffman, 2012). In this way,
the modules highlighted the inextricable link between medication safety, communication and collaborative practice. Students were also provided with supporting documents including: VTE prevention guidelines, risk assessment tools, and the coroner’s report on which the module was based. A panel comprised of expert clinicians and academics ensured content validity and clinical authenticity of all modules. The modules were designed to demonstrate elements of professional communication based on a modified version of the Oxford Non-Technical Skills (NOTECHS) framework (Levett-Jones, et al., 2012).

Data Collection
Participants’ behavioural intentions in relation to medication safety were measured using the Theory of Planned Behaviour Medication Safety Questionnaire (TPB-MSQ). Those in the experimental group completed the TPB-MSQ after completing the web-based IPE module, while the control group participants completed the same questionnaire without having access to the module. The development of the TPB-MSQ was informed by guidelines for the construction of the TPB questionnaires developed by Francis, et al. (2004) and the essential elements of questionnaire design and development suggested by Streiner and Norman (1995). These included elicitation focus group interviews with 68 recent health professional graduates, and checking of face and content validity of the questionnaire by an expert panel.

The TPB-MSQ consists of four scenarios and 41 items. Four items measured behavioural intentions; 15 measured attitudes; 14 measured perceived behavioural control; and 12 measured subjective norms in relation to medication safety and collaborative practice. The four scenarios in the questionnaire focused on behaviours related to: (1) managing medication errors, (2) open disclosure, (3) managing interruptions during prescribing and administering, and (4) person-centred care. Initial testing of the entire TPB-MSQ
with a sub-sample of nursing, medicine and pharmacy undergraduate students revealed a Cronbach's alpha of 0.854. The reliability of the subscales within the TPB-MSQ demonstrated a Cronbach's alpha coefficients of 0.620 for attitude, 0.761, for perceived behaviour control, and 0.580 for subjective norm.

The items were scored using 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree) with higher scores indicating a stronger intention to perform the target behaviour. Overall scores for attitude, subjective norms, and perceived behavioural control were obtained by calculating the mean of the individual items used to measure these three variables, each rated on 7-point unipolar scales ranging from 1 to 7. For intentions the total number of ‘yes’ answers was calculated for each scenario.

**Data analysis**

Statistical analysis was conducted using the Statistical Package for the Social Sciences statistical software package version 20.0 for Mac OS X (SPSS Inc., Chicago, IL, USA). Demographic data relating to gender and previous IPE experience were analysed using the chi-square test. Independent t-tests were used to compare overall scores for intention, attitude, subjective norms, and perceived behavioural between the control and experimental groups. A p-value of less than 0.05 was considered statistically significant for the outcome variables.

**RESULTS**

A total of 320 undergraduate health professional students' from 11 universities participated in the study. Most were from nursing (89%; n= 284), with smaller numbers from medicine (6%; n=16) and pharmacy (5%; n=15). Participants' demographic characteristics are summarised in Table 1. No significant differences existed in regarding gender and previous IPE experience between the groups at baseline.
Table 1: Demographics of the participants (N= 320)

<table>
<thead>
<tr>
<th>Demographic Characteristic</th>
<th>Control (n=165)</th>
<th>Experimental (n=155)</th>
<th>Difference between groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>14</td>
<td>20</td>
<td>Chi-square (1) = 0.98, ( p = 0.794 )</td>
</tr>
<tr>
<td>Female</td>
<td>96</td>
<td>122</td>
<td></td>
</tr>
<tr>
<td>Previous IPE Experience</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>86</td>
<td>104</td>
<td>Chi-square (1) = 0.567, ( p = 0.451 )</td>
</tr>
<tr>
<td>Yes</td>
<td>23</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

Participants in the experimental group reported a stronger intention to practice in a way that enhances medication safety as demonstrated by statistically significant intervention effects on the measures of intention \( [t (290) = -4.723, p = 0.000] \) and attitude \( [t (290) = -4.203, p = 0.000] \) (Table 2). The results also indicate that students in the experimental group had higher mean scores in perceived behavioural control \( [t (290) = -1.616, \ p=0.107] \) and subjective norm \( [t (290) = -1.579, \ p = 0.115] \), although these differences were not statistically significant. Gender and previous interprofessional education experiences did not have significant effects on any outcomes.

Table 2: Effects of module on TPB variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control (N= 144) (Mean ± SD)</th>
<th>Experimental (N= 148) (Mean ± SD)</th>
<th>( t )-test for equality of means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( t )</td>
<td>df</td>
<td>Sig.(2-tailed)</td>
</tr>
<tr>
<td>Intention</td>
<td>2.9306± 1.15057</td>
<td>3.4730 ± 0.76883</td>
<td>-4.723 290 0.000</td>
</tr>
<tr>
<td>Attitude</td>
<td>5.2702 ± 61045</td>
<td>5.5472 ± .51278</td>
<td>-4.203 290 0.000</td>
</tr>
<tr>
<td>Perceived behavioural control</td>
<td>5.1150 ± .73427</td>
<td>5.2478 ± .66959</td>
<td>-1.616 290 0.107 (NS)</td>
</tr>
<tr>
<td>Subjective norm</td>
<td>5.3619 ± .63869</td>
<td>5.4788 ± .62624</td>
<td>-1.579 290 0.115 (NS)</td>
</tr>
</tbody>
</table>
DISCUSSION

The TPB-MSQ was designed to evaluate underlying behavioural, normative, and control beliefs that are known to impact on behavioural intentions related to medication safety and collaborative practice. The findings demonstrate that the web-based interprofessional learning module successfully impacted upon participant’s behavioural intentions with participants in the experimental group having a stronger intention to behave in a way that enhances medication safety after undertaking the module.

The higher mean behavioural intention scores for the students in the experimental group imply that these students were more likely to practice in a way that enhances medication safety than those in the control group. The experimental group participants also demonstrated positive attitudes towards the target behaviour as demonstrated by higher mean attitude scores after exposure to the learning module. Participants who completed the module had higher subjective norm scores reflecting greater social pressure to practice in a way that enhances medication safety from other health professionals, patients and patient’s families. Lastly, the higher mean perceived behavioural control scores for participants in the experimental group indicated that, overall, these participants perceived that they have the capability and skills required for practicing in a way that enhances medication safety after undertaking the module.

The results of this study are consistent with reported improvement in students’ attitudes towards interprofessional collaboration after exposure to IPE experiences (Barr, 2009; Lapkin, Levett-Jones, & Gilligan, 2011). However, the present study has gone somewhat further than the majority of studies that mainly evaluated student’s attitudes towards interprofessional collaboration. The TPB-MSQ was designed to evaluate the impact of educational interventions on the behaviour of health professional students. According to the TPB, the more favourable the attitude and the subjective norm and the greater the
perceived control, the stronger should the person’s intention to perform the behaviour in question. The results therefore provide evidence of positive behavioural intentions in relation to medication safety and collaborative practice after exposure to a web-based interprofessional-learning module.

**Implications for education**

This study has demonstrated that positive changes in behavioural intention can be obtained when using web-based IPE experiences. Web-based experiences provide new platforms for teaching and learning through interactive processes that can overcome many of the barriers to face-to-face IPE. They also have the potential to be delivered asynchronously to large student numbers at different locations thus presenting a cost-effective intervention (West, 2012). Web-based interventions also provide an opportunity for data collection to occur as part of the educational process. Such self-report approaches are convenient, economical, simple to administer and can reach a significant number of participants. More importantly, web based IPE can provide health professional students with opportunities to learn from and about each other even when they do not have the opportunity to learn with students from other health professions.

**Implications for research**

While we evaluated the effectiveness of web-based interprofessional learning modules by assessing behavioural intentions immediately following the intervention, a longitudinal study examining the relationship between the variables over time would be valuable. By conducting such a study, researchers could attain rich and meaningful data and further validate the utility of the TPB in examining health professional student’s behavioural intentions in relation to medication safety and collaborative practice.
Limitations

There are limitations in this research that warrant further discussion. Firstly, a convenience sampling method was used and the majority of the participants were nursing students. Therefore, the ability to generalise to other health professionals involved in the medication process is limited. Another limitation is the potential for selection bias associated with the use of convenience samples. In addition, completion of the learning modules and questionnaire was voluntary and it is possible that the opinions reported may not be representative of all health professional students. However, this research attempted to minimize selection bias by recruiting participants from multiple universities and different professions. Lastly, the study findings may also be limited by the use of self-reports, though this was minimized through the anonymity of responses.

Conclusion

Despite the limitations outlined above, the study results have demonstrated that the innovative and cost effective web-based modules developed as an intervention did achieve significant changes in health professional student’s intention to practice in a way that enhances medication safety by increasing behavioural intentions, attitudes, behavioural control, and perceived control belief. The TPB posits that intention, as the immediate antecedent of behavior, can act as a proxy to measuring actual behaviour. Our study therefore, provides evidence that an online module is effective in preparing health professional students for safe medication practices and working collaboratively with other healthcare professionals in the future.

Acknowledgement

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Workplace Relations is gratefully acknowledged.

**Conflict of interest**

The authors declare no conflict of interest.
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learning resources. *Nurse Education Today, 32*(8), 934-938.


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CHAPTER 6: Discussion and Conclusions

6.1 Introduction

Education is an essential component of the global effort to promote medication safety. Strategies aimed at improving graduates’ ability to practice in a way that promotes medication safety have been identified as a key component in this area (World Health Organization, 2011). Emerging evidence indicates that health professional students who learn together are better prepared to work collaboratively with other professions (Ateah et al., 2011; Patrician et al., 2012). Consequently, interprofessional education (IPE) is being acknowledged both nationally (Bennet et al., 2011; Dunston et al., 2010; Garling, 2008) and internationally (Carpenter & Dickinson, 2008; Schmitt, Gilbert, Brandt, & Weinstein, 2013; World Health Organization, 2010) as essential for preparing health professional students for future collaborative practice.

Research into this area is limited and many gaps exist. Despite the acknowledged potential for IPE to improve medication safety, prior to the research presented in this thesis there existed only:

1) limited level one evidence of the effectiveness of university based IPE experiences;
2) no detailed description of IPE activities within Australian and New Zealand universities, including how IPE is used to teach medication safety to health professions students; and

3) little empirical evidence of the effectiveness of web-based IPE resources as an alternative to face-to-face learning experiences or of the impact of such resources on health professional students’ intentions to behave in a way that enhances medication safety and collaborative practice.

This final chapter of the thesis summarises the key results of the research and demonstrates how the original research aims were achieved. The thesis concludes with a discussion of the implications of the research and directions for further research.

6.2 Key results

6.2.1 The effectiveness of university based IPE experiences

The first aim of the research was to examine the effectiveness of university based IPE experiences. The results of the systematic review demonstrate that university based IPE experiences have the potential to enhance students’ attitudes and perceptions of interprofessional collaboration, as well as clinical decision-making (publication one). However, most literature on this topic is exploratory and descriptive in nature. Even within the nine studies that were considered to be of sufficient methodological quality to be included in the systematic review, the educational outcomes were generally of a ‘low level’, that is, levels 1 and 2 (attitudes and perceptions) of the Kirkpatrick’s four-level model for assessing educational outcomes (1967). None of the studies included in the systematic review evaluated outcomes associated with behavioural changes. This reflects a lack of evidence for the capacity of IPE to support the translation of knowledge, skills and attitudes into clinical behaviour change and to ultimately improve patient outcomes. These results point to a compelling need for rigorous
evaluation of outcomes in order to accurately determine the effectiveness of IPE approaches in terms of improvements in clinical performance and patient safety.

6.2.2 Current status of IPE in Australian and New Zealand universities

The second aim of the research was to scope the extent to which IPE is used to teach medication safety in Australian and New Zealand based nursing, pharmacy and medical programs, and to clarify the nature of the barriers and facilitators to IPE curricula integration (publication two). Responses were received from 31 of the 43 (72%) target universities representing nursing, medicine, pharmacy, midwifery, physiotherapy, health and medical science, indigenous health, paramedics, human movement, dietetics, health information management, laboratory medicine, occupational therapy, psychology, social work, speech pathology and clinical psychology programs.

Based on the participants’ responses it is clear that there is very little formal IPE occurring within health professional programs in Australian and New Zealand universities. Most of the IPE that is offered tends to be sporadic, localized and opportunistic with lack of evidence of sustainability. The results also highlight that the level of coherence, coordination and high level support of IPE in Australian and New Zealand universities falls short of that achieved in countries such as Canada (Sommerfeldt, Barton, Stayko, Patterson, & Pimlott, 2011), the United Kingdom (Murray-Davis, Marshall, & Gordon, 2012) and the US (American Association of Colleges of Nursing et al., 2011). These countries have explicit policy recommendations that are complemented by substantial government funding for the mandatory inclusion of IPE experiences for all health professions students. Consistent with other IPE literature, the cross sectional survey identified
timetabling restrictions, lack of appropriate teaching and learning resources as well as funding limitations as the main barriers to the implementation of IPE experiences. Not surprisingly, participants also suggested that web-based IPE resources would be an effective way to overcome some of these barriers and to facilitate enhanced teaching about medication safety.

The survey results are important as they collectively provide a research based profile of IPE activities in universities in the region and identify priorities for future directions, particularly in relation to the teaching of medication safety. Firstly, there is a need for structured, collaborative efforts within university programs to ensure that all students have opportunities for IPE to foster the development of communication and teamwork skills required to enhance safe medication practices and ultimately improve patient outcomes. Secondly, there is a need to address such longstanding barriers to IPE as course design, scheduling, limited resources, large student numbers, negative staff attitudes, and issues of geography encountered when learners study at multiple campuses and clinical sites. The potential for web-based IPE resources to overcome some of these barriers, as well as the need for sustainable and adequate funding to facilitate curriculum development and evidence based research in regards to university based IPE experiences, requires exploration.

6.2.3 Evaluation of IPE outcomes

The third research aim was to develop and test the Theory of Planned Behaviour Medication Safety Questionnaire (TPB-MSQ) (manuscript three). As is the case with many educational efforts, evaluation of IPE related learning outcomes and experiences is fraught with conceptual and practical difficulties (Thannhauser, Russell-Mayhew, & Scott, 2010). Results from the cross-sectional survey support this notion with the majority of participants who currently offer IPE experiences indicating that they
use their own instruments to evaluate learning outcomes, often with little evidence of psychometric properties such as validity and reliability. Furthermore, evaluation of IPE experiences in Australian and New Zealand universities are mostly limited to outcomes such as attitudes and knowledge acquisition, rather than actual skills or clinical behaviour change (publication two).

Further evidence of the lack of validated instruments for evaluating IPE outcomes has been provided by the results of the systematic review (publication one). Outcomes from university based IPE studies mainly concentrated at levels 1 and 2a (acquisition of knowledge and skills, and changes in attitudes towards collaborative practice/IPE) of the Kirkpatrick’s model (1967). None of the included RCTs evaluated measures of behavioural change associated with IPE experiences in general, or with safe medication practices in particular. It is these behavioural changes that are often key objectives of educational initiatives, but represent the greatest challenges to evaluation. This result further highlights the need for more rigorous evaluation of IPE experiences.

The research presented in this thesis has gone some way towards addressing this gap by developing and testing the Theory of Planned Behaviour Medication Safety Questionnaire (TPB MSQ) (manuscript three). The Theory of Planned Behaviour posits that behavioural intention can act as a proxy for actual behaviour change and thus the TPB-MSQ was designed to measure the behavioural intentions of health professional students’ in relation to medication safety. The TBP-MSQ demonstrated that attitudes, subjective norms, and perceived behavioural control can effectively predict 46% of the variation in behavioural intention to practice in a way that enhances medication safety. The TPB-MSQ therefore has the potential to overcome many of the pragmatic and methodological barriers to rigorous evaluation of educational efforts and offers a
useful resource for future researchers and educators.

6.2.4 Effectiveness of web-based IPE experiences

The fourth research aim involved examining the impact of a web-based IPE module on nursing, pharmacy and medical study (manuscript four). The IPE experiences described in the systematic review failed to use theoretical frameworks to enable the effectiveness of the interventions to be adequately evaluated (Cooper et al., 2004). This study is novel, as it is the first to use a theoretical framework in order to rigorously assess the effectiveness of web-based IPE experiences. In addition, scheduling and geographic barriers are commonly cited as significant impediments to many universities wanting to implement IPE. The web-based module investigated in this thesis has the potential to overcome these limitations.

The web-based module was successfully delivered to a range of health professional students across 11 geographically dispersed universities. Students in the experimental group who viewed the web-based IPE module demonstrated significantly greater intention to practice in a way that enhances medication safety and collaborative practice than those in the control group. Higher scores on the TPB-MSQ demonstrated this. These results are particularly important as web-based approaches can offset many of the barriers associated with face-to face IPE experiences. The inclusion of a control group in the quasi-experimental design provides greater certainty regarding the effectiveness of web-based IPE experiences.

6.3 Conclusion

This thesis adds significantly to the body of knowledge related to IPE and
medication safety and includes some of the first research conducted that investigates the impact of IPE using advanced levels of Kirkpatrick’s Model of Evaluation of educational outcomes, as well as the Theory of Planned Behaviour (TPB). Using these models, the thesis contributes to an overall understanding of the use of web-based IPE modules as an intervention to achieve significant changes in health professional students’ intention to practice in a way that enhances medication safety. This thesis identifies priorities for future directions, particularly in relation to the teaching of medication safety. Specific strengths and limitations and implications for practice and further research related to the individual research aims, and overall study design were addressed in the published papers presented in the preceding chapters. However, the overall implications for practice and further research are collectively outlined below.

6.3.1 Implications for practice

The results of this study highlight the need for a coordinated approach to IPE in Australian and New Zealand Universities. Examples from countries such as the UK and Canada provide evidence that coordinated approaches are indeed possible and sustainable. Furthermore, the results demonstrate the potential for web-based IPE approaches to promote patient safety through enhancing safe medication practices of future health professionals. More specifically, web based IPE can provide health professional students with opportunities to learn from and about each other even when they do not have the opportunity to learn with students from other health professions.

The Theory of Planned Behaviour - Medication Safety Questionnaire (TPB-MSQ), which examined the antecedents of clinical behaviour of health professional students, demonstrated improvements in students’ intention to practice in a way that enhances medication safety and collaborative practice after completion of the web-based IPE
module. This instrument has potential for adaption and use in evaluating a range of educational efforts.

The TPB-MSQ represents a useful tool for the evaluation of behavioural outcomes of educational efforts to promote medication safety. Behavioural change represents level 3 on Kirkpatrick’s (1967) four-level model for evaluating educational outcomes. The results of this study suggest that educational interventions may be most successful if they focus on the attitude, given this component of the TPB model was the most important predictor of behavioural intention. Pedagogical approaches must therefore aim to: (1) reinforce the positive attitudes of health professional students who are already committed to safe medication practices; and (2) change the attitudes of those who view safe medication practices and their own capacity for influence negatively.

6.3.2 Implications for further research

The body of research presented in this thesis has several implications for researchers and educators with an interest in improving the preparation of health professional students. The premise that positive change in behavioural intention will result in improved clinical behaviour in relation to medication safety was supported by this study. However, variables external to the TPB such as gender, professional group and situational awareness that are known to impact on behaviour were not accounted for in this study. Direct observation of participant’s clinical behaviour, although more complex, and expensive would more fully explore the transferability of IPE outcomes to clinical practice. Longitudinal studies with larger samples, examining the relationship between behavioural intention and actual clinical behaviour would therefore be valuable in extending this work and substantiating the effectiveness of web-based IPE experiences.
Further investigation needs to also compare behavioural outcomes between web-based and face-to-face IPE experiences. Such comparison will further evaluate the effectiveness of IPE and help to identify the most appropriate contexts for web-based approaches to occur. Finally, while the recommendations are for systematic reviews of literature to be updated after at least a five year period, the increase in the research activity in the area of IPE highlights the need for bi-annual updates of the systematic review (publication one). The scope for the review should thoroughly evaluate the effectiveness of web-based IPE experiences as well as assessment of factors such as cost-effectiveness and medication related clinical outcomes such as length of stay and medication incidents. While the highlighted issues are beyond the scope of this PhD thesis, they represent important areas for future work.
6.4 References


Murray-Davis, B., Marshall, M., & Gordon, F. (2012). From school to work: Promoting the application of pre-qualification interprofessional education in the clinical


Appendix A: Conference Abstracts

THE EFFECTIVENESS OF WEB-BASED INTERPROFESSIONAL LEARNING RESOURCES ON HEALTH PROFESSIONAL STUDENTS' BEHAVIOURAL INTENTIONS IN RELATION TO MEDICATION SAFETY - A QUASI-EXPERIMENTAL STUDY

Samuel Lapkin

Senior Research Fellow, The Centre for Applied Nursing Research

Background
Emerging evidence demonstrates that learning experiences focusing on developing collaborative skills such as mutual understanding of others' roles, teamwork, and communication can enhance medication safe practice among interprofessional medication teams. Interprofessional education experiences for undergraduate health professional students are limited by factors such as timetabling restrictions, rigid curricular balancing of students numbers, and lack of physical space. Web-based approaches can potentially overcome these barriers and provide opportunities for students to engage in interprofessional learning experiences. At present, there is very little evidence for the effectiveness of web-based approaches in changing the behaviour of health professional students in relation to medication safety and collaborative practice.

Objective
To examine the impact of web-based interprofessional learning modules on health professional students' behavioural intentions in relation to medication safety and collaborative practice.

Methods
A quasi-experimental approach was employed to evaluate the effectiveness of the learning modules with 320 undergraduate health professions students. Students were allocated to either experimental (n= 155) or control group (n= 165), with participants in the experimental group asked to work through an online multimedia-learning module. The Theory of Planned Behaviour Medication Safety Questionnaire was used to compare behavioural intentions, attitudes, subjective norms and perceived behavioural control in relation to medication safety between the control and experimental groups.

Results
Participants in the experimental group demonstrated significantly greater intention to practice in a way that enhances medication safety and collaborative practice than those in the control group as evidenced by higher scores on all outcomes: behavioural intention ($p = 0.000$); attitude ($p = 0.000$); perceived behavioural control ($p = 0.107$); and subjective norm ($p = 0.115$).

Conclusion
Effective teaching of safe medication practices can be achieved through the use of web-based interprofessional learning modules.
A CROSS SECTIONAL SURVEY OF INTERPROFESSIONAL EDUCATION IN AUSTRALIAN AND NEW ZEALAND HEALTH PROFESSIONS PROGRAMS

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¹School of Nursing and Midwifery, The University of Newcastle

Background: Despite general acknowledgment its benefits, the current state of interprofessional education in Australian and New Zealand universities is largely unexamined. There is also little known about the use of interprofessional education in teaching medication safety to nursing, pharmacy and medical students.

Objective: A cross-sectional survey was designed to scope the extent to which interprofessional education is used in Australian and New Zealand nursing, pharmacy and medical programs. Details of the type of interprofessional approaches used, the barriers to integration, and application to medication safety were also explored.

Method: A web-based cross-sectional survey was used to gather information from Australian and New Zealand universities offering nursing, pharmacy or medical programs. The quantitative survey data were analysed using frequency summaries and qualitative data were examined using content analysis.

Results: Responses were received from 33 of the 43 (77%) target universities. Eighty percent of the participants indicated that they currently offer interprofessional education experiences, but only 24% of these experiences met the accepted definition of interprofessional education. Interprofessional education occurs when learners from two or more professional groups learn about, from and with each other. Of the participants who offered interprofessional education only 50% used it to teach medication safety. Timetabling restrictions and lack appropriate teaching and learning resources were identified as the main barriers. All participants reported that staff development, multi-media resources and e-learning options for teaching medication safety would be beneficial to interprofessional education initiatives.

Conclusion: Although interprofessional education has been identified as integral to the preparation of future health professionals there are pragmatic constraints that impede implementation. Creative and innovative approaches will be needed to overcome the barriers and facilitate uptake of quality interprofessional education more broadly. Web-based and e-learning options promise a possible way forward, particularly in the teaching of medication safety to nursing, pharmacy and medical students.
MEASURING HEALTH PROFESSIONAL STUDENTS INTENTION TO BEHAVE IN A WAY THAT PROMOTES MEDICATION SAFETY USING THE THEORY OF PLANNED BEHAVIOUR

Samuel Lapkin¹, Tracy Levett-Jones¹, Conor Gilligan¹
¹School of Nursing and Midwifery, The University of Newcastle

Background - Evaluation of the effectiveness of teaching approaches and assessment of the impact of education initiatives on students' behaviour has long been a challenge in educational research. The difficulty associated with rigorous evaluation has also plagued efforts to evaluate interprofessional education (IPE) initiatives. Despite widespread support for IPE, the effectiveness of IPE approaches remains uncertain. Existing evaluation instruments lack evidence of sufficient theoretical and psychometric development, and largely focus on attitudes toward interprofessional education and practice. This study uses an innovative approach to evaluate IPE outcomes using a questionnaire based on the Theory of Planned Behaviour (TPB). TPB methodology uses domains of attitudes, subjective norms, and perceived behavioural control to predict intention to perform a targeted behaviour. Behavioural intention can act as a proxy to measure actual behavioural outcomes, offering far greater generalizability and opportunities for interpretation than outcomes focused on attitudes alone.

Objective - The objective of this study is to develop and test a TPB-based questionnaire to measure the behavioural intentions of health professional students in relation to interprofessional practice and medication safety.

Methods - Focus group interviews were conducted with recent health professional graduates to identify the modal salient beliefs underlying their motivations to interprofessional practice and medication safety. Based on the identified factors, a draft instrument was developed, incorporating all the key theoretical constructs and both direct and belief-based measures. It was assessed for clarity and relevance by an expert panel of researchers and clinicians from nursing, pharmacy, medicine, and education disciplines. A web-based version of the questionnaire is being pilot-tested with nursing, medicine and pharmacy students from the University of Newcastle.

Results - This is an ongoing study. The results of pilot-testing and validation of the questionnaire and an understanding of its potential for widespread utility will be available by mid-2012. This presentation will report on the TPB approach and the results of this validation.
THE EFFECTIVENESS OF INTERPROFESSIONAL EDUCATION IN UNIVERSITY-BASED HEALTH PROFESSIONAL PROGRAMS: A SYSTEMATIC REVIEW

Samuel Lapkin¹, Tracy Levett-Jones¹, Conor Gilligan¹
¹School of Nursing and Midwifery, The University of Newcastle

Background: A key responsibility of universities is to prepare health professional graduates for their roles as effective members of the health care team. Currently, most university-based health professional education is delivered in a traditional, discipline specific way. This approach is limited in its ability to equip graduates with the necessary knowledge, skills and attitudes for effective interprofessional collaboration and for working as part of a complex health care team. Interprofessional education is widely seen as a way to improve communication between health professionals, ultimately leading to improved patient outcomes. However, much of the evidence in support of this premise tends to be more anecdotal than empirical.

Objective: The objective of this systematic review was to identify the best available evidence for the effectiveness of university-based interprofessional education.

Methods: A three-stage comprehensive search strategy was utilized to search across ten electronic databases. English language studies published between January 2000 and February 2011 were included. Two independent reviewers assessed the methodological quality of each study selected for retrieval using standardised Joanna Briggs Institute critical appraisal tools.

Results: Nine published studies consisting of three randomised controlled trials, five controlled before and after studies and one controlled longitudinal study were included in the review. Outcome measures included objectively measured or self-reported educational outcomes and or professional competencies related to interprofessional education as assessed by validated instruments such as the Readiness for Interprofessional Learning Scale and the Interdisciplinary Education Perception Scale. Four studies reported significant improvements in attitudes and perceptions of interprofessional education. In addition, five studies reported a mixed set of outcomes related to interprofessional education interventions.

Conclusions: Students attitudes and perceptions towards interprofessional collaboration and clinical decision making can be potentially enhanced through interprofessional education. However, larger more robust experimental studies explicitly focused on interprofessional education with rigorous randomisation procedures and allocation concealment would improve the evidence base of interprofessional education.
Appendix B: Additional publications associated with thesis

Systematic Review Protocol

Title: The effectiveness of interprofessional education in university based health professional programs: A systematic review

Centre Conducting Review:

*University of Newcastle Evidence Synthesis Group: a collaborative centre of the Joanna Briggs Institute*

Reviewers:

Samuel Lapkin (PhD Candidate), RN, BN (Hons)\(^1\)

Ass/Prof. Tracy Levett-Jones, RN, PhD, MEd & Work, BN, DipAppSc (Nursing)\(^1\)

Dr Helen Bellchambers, RN, PhD, RM, BN, MNurs, Grad cert (Geront)\(^1\)

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Commencement date: October 2010

Expected completion date: June 2011
Background

A key function of universities is to prepare graduates for life-long learning in a highly mobile and competitive workforce. Employers in the health sector seek nursing, medicine and pharmacy graduates who have acquired well developed interprofessional learning and practice capabilities to enable them to work both collaboratively and autonomously in complex clinical environments. Such environments require the ability to work as part of a multidisciplinary clinical team and demand effective teamwork and communication skills. Currently, most university-based health professional education is delivered in the traditional discipline specific mode. This approach is limited in its ability to equip graduates with the necessary knowledge, skills or attitudes for effective interprofessional collaboration required for working as part of a complex health care team.\(^1\) An educational approach such as interprofessional education (IPE) is required where learners from two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes.\(^2\)

In the education literature there is little distinction between the terms interprofessional, interdisciplinary, multiprofessional, and multidisciplinary. The prefix ‘multi’ suggests many groups, while ‘inter’ implies some sort of interaction in group.\(^3\) In a multidisciplinary health care team, individual health professionals make autonomous or separate decisions.\(^4\) In contrast, an interprofessional team comprises different professions with specialised knowledge, skills and abilities; each contributing to a common goal which cannot be achieved when one individual profession acts alone.\(^2\) In the clinical arena, this model is also referred to as interprofessional collaboration.

Interprofessional collaboration occurs when healthcare health providers, patients and their families work together in the provision of coordinated and integrated care to enable optimal health outcomes.\(^2\) An interprofessional team that collaborates effectively is characterised by its knowledge and understanding of each others’ roles and the team’s ability to appreciate and value the unique contribution made by each profession to patient care.\(^5\) In this practice model, joint decision making is valued and each profession is empowered to assume leadership on patient care issues appropriate to their expertise.\(^6\) Practice-based interventions that are interprofessionally collaborative such as rounds, meetings and externally facilitated audits have been shown to improve patient outcomes including improvement in safe medication practices and decreased length of hospital stay.\(^7\)
The fundamental premise of IPE is that if health professional students learn together they will be better prepared for interprofessional collaboration, teamwork, ultimately leading to improved health outcomes.\textsuperscript{8} Research indicates that information sharing, determining professional responsibilities, consensus building and setting common patient goals are components of effective communication skills that can be enhanced through IPE.\textsuperscript{9} Improvement in health professionals’ interpersonal and communication skills are associated with improved patient health outcomes.\textsuperscript{10, 11}

Definitions of IPE in the literature are varied and ubiquitous. The following definition by the American Association of Colleges of Pharmacy Interprofessional Education Task Force has been adopted for this review:

\textit{Interprofessional education involves educators and learners from two or more health professions and their foundational disciplines who jointly create and foster a collaborative learning environment. The goal of these efforts is to develop knowledge, skills and attitudes that result in interprofessional team behaviours and competence.\textsuperscript{12-14}}

In Australia, submissions by the Committee of Deans of Australian Medical Schools to the Australian Productivity Commission Review of the Health Workforce highlighted the potential importance of IPE by stating that: “… there is now a growing recognition that medical education needs to be contextualised within the needs of the health workplace and coordinated across the education/training/practice continuum.”\textsuperscript{15(p6)} Interprofessional teaching and learning was also a key element of health care reform promised by the Australian Federal Government in 2007.\textsuperscript{16} In addition, several recent government policy documents and independent reports have specifically advocated for inclusion of IPE in clinical education and training. The 2008 publication by the Department of Health and Ageing (DOHA) titled \textit{Towards a National Primary Health Care Strategy}, contained references to “multidisciplinary teams” and “interdisciplinary learning”.\textsuperscript{17} One recommendation was “the current and future primary health care workforce is provided with high quality education (undergraduate, postgraduate and vocational) and clinical training opportunities that support interdisciplinary learning”.\textsuperscript{18(p40)} In the same year, Garling’s\textsuperscript{1} \textit{Special Commission of Inquiry into Acute Care Services in NSW Public Hospitals} made clear recommendations supporting IPE approaches, stating that education and training should be undertaken in a manner that emphasises interdisciplinary team based patient centred care.
In the United States, the Institute of Medicine (IOM) published the report *Crossing the Quality Chasm: A New Health System for the 21st Century*. One of the major recommendations of this report is that "health professionals should be educated to deliver patient-centered care as members of an interdisciplinary team". In Canada IPE is being integrated into health professional education curricula while the United Kingdom has mandated the integration of IPE into pre-qualifying curricula. The Organization for Economic Co-operation and Development (OECD) and the World Federation of Medical Education (WFME) are examples of international organisations that have embraced strategies that facilitate IPE. More significantly, the recently published World Health Organization *Framework for Action on Interprofessional Education and Collaborative Practice* has led to an interest in IPE at the global level.

Despite this belief in IPE as a key area of health professional development, there remains a lack of systematic evidence of its effectiveness. Reviewers have argued that the concept of IPE remains unclear and that there are multiple definitions and objectives. Furthermore, the development and delivery of a curriculum that integrates IPE methods requires significant resources therefore, its adoption should be based on evidence of effectiveness.

**Existing reviews of IPE**

In order to prevent duplication of research, a search of the Cochrane Library, Joanna Briggs Institute Library of Systematic Reviews, MEDLINE and DARE databases was undertaken to establish whether or not a recent review on IPE exists. This search identified the following systematic reviews focusing predominantly on IPE:

- Zwarenstein, et al.
- Freeth, Hammick, Koppel, Reeves and Barr
- Clifton, Dale and Bradshaw
- Hammick, Freeth, Koppel, Reeves and Barr
- Reeves, et al.

One of the earliest systematic reviews was conducted by the United Kingdom Centre for the Advancement of Interprofessional Education (CAIPE) in 2002. It included 217 evaluations of IPE studies thirty percent of which included pre-registration students, however the research setting was often a health care facility rather than a university. The majority of the studies focused on continuing professional development at post-registration levels and were undertaken within the workplace or an employment training facilities. The systematic review
included nursing, medicine, social workers, pharmacist, physiotherapist and other allied health care professionals. Of note, this review was only based on studies published in Medline, CINAHL and the British Education Index and did not include other electronic databases or grey literature.

The reviewers reported outcomes of IPE into six categories: learners’ reactions, changes in attitude or perception, changes in knowledge or skill, behavioural changes, changes in the organisation or delivery of care, benefit to patients or clients. Although some studies reported positive outcomes, the majority reported mixed results. The authors also report that the majority of the studies included in the review were variants of before-and-after studies and longitudinal studies. Such studies do not demonstrate cause and effect and therefore cannot address effectiveness of IPE interventions.

In 2006, the United Kingdom Royal College of Nursing commissioned a literature review of published studies to determine the impact and effectiveness of IPE for primary care professionals. This review included 20 studies published between 2000 and 2006 that contained some form of evaluation of the effectiveness of IPE in undergraduate courses, university-based modules and work-based team development programmes. The professions involved in IPE were nursing, medicine, dietetics, pharmacy and social work.

Evidence suggests some positive findings related to undergraduate pre-registration IPE including; improvement in attitude and perceptions of the contribution of other health care professions; and an increase in knowledge and understanding of the contribution of other health care professionals to patient care. Two of the included studies reported some negative findings such as resistance to IPE. The authors also highlighted limitations in the study methodologies such as: a lack of control groups; validated instruments were not always used; small samples sizes.

Another evidence synthesis was undertaken by Hammick et al using selected bibliographic databases and journals published between 1981 and 2005; the review did not include any grey literature. The review included 21 studies, 15 of which evaluated IPE delivered to undergraduate health professional students, predominantly from medicine, nursing and physiotherapy. Other professions included in the studies were pharmacy, occupational therapy, dentistry, social work and midwifery.

Due to the different study methodologies and outcome measures, meta-analysis was not
possible in this review so the results were presented in a narrative form. The authors provided analysis of IPE outcomes for learner reactions, knowledge, skills, attitudes, behaviour and client care. Collectively, the study results indicated a positive change in students’ perceptions in knowledge, skills, perceptions and attitudes. Two studies reported that IPE education programs increased the volume of patients seen, and the comprehensiveness of patient care.

The most comprehensive appraisal of the effectiveness of IPE on professional practice and health outcomes was conducted as a Cochrane review. The review considered either randomised controlled trails, controlled before and after studies, or interrupted time-series studies. This review considered 1042 studies but none met the criteria for Cochrane review. The authors concluded that there was no published evidence that IPE promotes interprofessional collaboration, or improves client relevant outcomes.

In 2008, an update of the 2000 review identified six studies that compared the effectiveness of IPE with other teaching and learning approaches. The participants in the included studies were mainly qualified medical doctors and nurses and other allied health workers such as psychiatrists, medical assistants and therapist. The authors reported mixed results related to patient safety, with two of the six studies indicating no improvements in other outcomes. Four of these studies found that IPE improved the working culture in an emergency department, improved patient satisfaction; decreased errors in the emergency department; improved the management of the care delivered to domestic violence victims; and improved the knowledge and skills of professionals providing care to mental health patients. The authors concluded that due to the small number of studies and the heterogeneity of IPE approaches used, general conclusions could not be drawn.

Methodological shortcomings
The reviews discussed here provide some understanding of the impact of IPE on health outcomes. Although some studies reported positive outcomes, the majority reported mixed results. Some of the reviews only included published studies sourced from electronic databases without exploring other unpublished and grey literature. Such review methodologies can lead to publication bias as relevant unpublished studies might have been excluded from the analysis.
The majority of the studies included in the reviews did not use rigorous research designs and validated measurement instruments which make it difficult to draw accurate conclusions regarding the effectiveness of IPE interventions. Such studies do not demonstrate cause and effect and therefore cannot address effectiveness of IPE interventions. There is therefore a paucity of evidence specific to the effectiveness of IPE for university based health professions.

While there is a slowly emerging body of evidence, the impact of IPE and multidisciplinary approaches to patient care remains uncertain. It is important to note that a lack of sufficient evidence of the effectiveness of IPE does not equate to the ineffectiveness of IPE. Rather, this presents an opportunity for searching, synthesising and summarising the available primary studies in order to determine the effectiveness of IPE in university based health professions education. None of the systematic review explored specifically addressed the effectiveness of IPE in university or tertiary based health professional education. The proposed review will therefore fill this gap by considering the effectiveness of IPE in university or tertiary based settings. For the purposes of this review “effectiveness is the extent to which an intervention, when used appropriately, achieves the intended effect”.

**Review question/objective**

**Objective**
The aim of this review is to appraise and synthesise the best available evidence on the effectiveness of university based IPE interventions as compared to uniprofessional educational interventions.

**Review Question**
This review will systematically examine the evidence to answer the following question: What is the effectiveness of IPE in university based health professional programs?

**Inclusion criteria**

**Types of participants**
The review will consider studies that include students of two or more undergraduate and post graduate health professions engaged in IPE regardless of gender, age and disciplines.
Types of intervention(s)/phenomena of interest
The review will consider studies that include any university based pedagogical approaches to IPE.

Types of outcome
Any objectively measured or self-reported educational outcomes and/or professional competencies related to IPE assessed by validated instruments such as the Readiness for Interprofessional Learning Scale (RIPLS) and the Interdisciplinary Education Perception Scale (IEPS) will be included in the review.

Type of studies
Although properly designed randomized controlled trials (RCTs) are considered the gold standard to use for evidence of effectiveness, such methods are not always feasible and practical in all settings. The systematic review will therefore primarily consider (RCTs). However, in the absence of RCTs, other research designs, such as non-randomised controlled trials and before and after studies, will be considered. This approach will enable the identification of current best evidence regarding the effectiveness of IPE in health professional programs.

Search Strategy
Methods of review
The search strategy aims to find both published and unpublished studies, limited to the English language. A three-step search strategy will be utilised in this review. Initially a limited scoping search of MEDLINE and Proquest databases will be undertaken followed by an analysis of the text words contained in the title and abstract, and of the index terms used to describe each article retrieved. Initial terms to be used are:

- Collaborative learning
- Competencies
- Curriculum
- Health professions education
- Practice
- Student
- Teaching

Each of these terms will be searched preceded by the terms interprofessional, interdisciplinary, multiprofessional, and multidisciplinary.
The second step will involve searching electronic databases using several combinations and permutations of key words and index terms identified by the initial literature scoping. All the electronic databases will be searched from their inception dates to current. Using a defined search and retrieval method, the databases to be searched are:

1. AMED
2. CINAHL
3. Cochrane Database
4. Dissertation and Theses
5. EMBASE
6. ERIC
7. Journals@Ovid
8. MEDLINE
9. ProQuest Nursing Journals
10. PsycINFO

The following will be hand searched to find any additional articles:

- *Journal of Interprofessional Care*
- Mednar
- Directory of open access journals
- ProQuest - ProQuest Dissertations & Theses Database
- Conference Proceedings

Lastly, reference lists of all included literature will be searched for any additional relevant studies. The bibliographical software package Endnote™ will be utilised to manage all references as it facilitates the importation of references from electronic databases as well as the linkage of references into the Joanna Briggs Institute (JBI) Comprehensive Review Management System (CReMS™) for assessment of methodological quality using the JBI critical appraisal tools. These guidelines have been developed to minimise bias and establish validity of the findings.

**Critical Appraisal**

Papers selected for retrieval will be assessed for methodological validity by two independent reviewers prior to inclusion in the review. For this process, the reviewers will use the critical appraisal instrument from the Joanna Briggs Institute, known as the Meta Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI) (Appendix I). Where agreement is not reached between the reviewers, a third reviewer will be consulted.
Data Extraction

Data will be extracted from the papers included in the review using the standardised data extraction tool from JBI-MAStARI (Appendix II). The extracted data will include specific details about the interventions, populations, study methods and outcomes of significance to the aim of the review.

Data Synthesis

Quantitative papers will, wherever possible, be pooled in statistical meta-analysis using the JBI-MAStARI instrument. All results will be subject to double data entry to minimise errors. Odds ratio (for categorical data) and weighted mean differences (for continuous data) and their 95% confidence intervals will be calculated for analysis. Heterogeneity will be assessed using the standard Chi-square. Where statistical pooling is not possible the findings will be presented in narrative summary form.

Acknowledgements:

Support for this project has been provided by the Australian Learning and Teaching Council (ALTC) Ltd, an initiative of the Australian Government Department of Education, Employment and Workplace Relations. The views expressed in this paper do not necessarily reflect the views of the ALTC.

Conflicts of interest

Nil
References


31 McFadyen AK, Webster VS, Maclaren WM, O'Neill MA. Interprofessional attitudes and perceptions: Results from a longitudinal controlled trial of pre-registration health and social care students in Scotland. Journal of Interprofessional Care. 2010;24(5):549-64.
Appendix I: Joanna Briggs Institute Critical Appraisal Tools  
Critical Appraisal of Experimental studies

Reviewer _______________________________________ Date __________
Author_____________________ Year ____________Record Number ________

1) Was the assignment to treatment groups truly random?  
   yes □ no □ not clear □ NA □

2) Were participants blinded to treatment allocation?  
   yes □ no □ not clear □ NA □

3) Was allocation to treatment group concealed from the allocator?  
   yes □ no □ not clear □ NA □

4) Were the outcomes of people who withdrew described and included in the analysis?  
   yes □ no □ not clear □ NA □

5) Were those assessing the outcomes blind to the treatment allocation?  
   yes □ no □ not clear □ NA □

6) Were control and treatment groups comparable at entry?  
   yes □ no □ not clear □ NA □

7) Were groups treated identically other than for the named interventions?  
   yes □ no □ not clear □ NA □

8) Were outcomes measured in the same way for all groups?  
   yes □ no □ not clear □ NA □

9) Were outcomes measured in a reliable way?  
   yes □ no □ not clear □ NA □

10) Was appropriate statistical analysis used?  
    yes □ no □ not clear □ NA □

Overall appraisal: Include □ Exclude □ Seek further info □

Comments (including reasons for Exclusion)
_____________________________________________________________________
_____________________________________________________________________
JBI Critical Appraisal Checklist for Comparable/Case Control

Reviewer ___________________ Date __________
Author _____________________ Year __________ Record Number ______

1. Is sample representative of patients in the population as a whole?  Yes No Unclear

2. Are the patients at a similar point in the course of their condition/illness?  Yes No Unclear

3. Has bias been minimised in relation to selection of cases and of controls?  Yes No Unclear

4. Are confounding factors identified and strategies to deal with them stated?  Yes No Unclear

5. Are outcomes assessed using objective criteria?  Yes No Unclear

6. Was follow up carried out over a sufficient time period?  Yes No Unclear

7. Were the outcomes of people who withdrew described and included in the analysis?  Yes No Unclear

8. Were outcomes measured in a reliable way?  Yes No Unclear

9. Was appropriate statistical analysis used?  Yes No Unclear

Overall appraisal:  Include Exclude Seek further info

Comments (Including reason for exclusion)

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Page 227 of 305
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<td>5. If comparisons are being made, was there sufficient descriptions of the groups?</td>
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Overall appraisal: Include [ ] Exclude [ ] Seek further info [ ]

Comments (Including reason for exclusion)

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Appendix II JBI Data Extraction for Experimental/non experimental studies

Data Extraction Form (Quantitative Data)

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Interventions

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Outcome Measures

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<th>Outcome Description</th>
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### Results

#### Dichotomous Data

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<th>Control Group</th>
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#### Continuous Data

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Authors Conclusion

__________________________________________________________

Reviewers Conclusion

__________________________________________________________
Interprofessional education for the quality use of medicines: Designing authentic multimedia learning resources

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SUMMARY

It is claimed that health care students who learn together will be better prepared for contemporary practice and more able to work collaboratively and communicate effectively. In Australia, although recognised as important for preparing nursing, pharmacy and medical students for their roles in the medication team, interprofessional education is seldom used for teaching medication safety. This is despite evidence indicating that inadequate communication between health care professionals is the primary issue in the majority of medication errors. It is suggested that the pragmatic constraints inherent in university timetables, curricula and contexts limit opportunities for health professional students to learn collaboratively. Thus, there is a need for innovative approaches that will allow nursing, medical and pharmacy students to learn about and from other disciplines even when they do not have the opportunity to learn with them.

This paper describes the development of authentic multimedia resources that allow for participative, interactive and engaging learning experiences based upon sound pedagogical principles. These resources provide opportunities for students to critically examine clinical scenarios where medication safety is, or has the potential to be compromised and to develop skills in interprofessional communication that will prepare them to manage these types of situations in clinical practice.

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Introduction

Traditionally most health professional education has been undertaken in a discipline specific manner (Australian Council for Safety and Quality in Health Care, 2005). However, this segregated approach is not appropriate for the preparation of contemporary health care workers. It is claimed that health care students who learn together will be better prepared to work collaboratively and more able to reduce risks to patients. One area of particular risk and of global concern is medication safety. In Australia, although recognised as important for preparing nursing, pharmacy and medical students for their roles in the medication team (Bellchambers and McMillan, 2007; World Health Organization, 2007), interprofessional education (IPE) is seldom used for teaching medication safety. This is despite evidence indicating that inadequate communication between health care professionals is the primary issue in the majority of medication errors (Leonard et al., 2004).

In this paper we outline the clinical, educational, theoretical and political drivers for IPE and discuss the use of IPE as a platform for teaching medication safety to health professional students. The development of authentic and innovative multimedia IPE resources is then discussed. Such resources provide opportunities for students to learn from and about each other even when they do not have the opportunity to learn with students from other health professions. The learning resources profiled in this paper form one component of a funded teaching and learning project that aimed to:

1. Scope the approaches currently used to teach and assess practices relevant to medication safety in Australia and New Zealand (Stage 1: cross-sectional survey).
2. Develop and implement a range of multimedia teaching and learning resources that engage students with interactive and authentic ‘patient journeys’ and enhance students’ interprofessional communication skills related to medication practices (Stage 2).
3. Examine the impact of the teaching and learning resources developed on students’ communication skills, knowledge, attitudes toward interdisciplinary collaboration, and satisfaction with the learning experience (Stage 3: quasi-experimental study).
4. Examine the feasibility of IPE when used for teaching medication safety (Stage 4: cost utility analysis).

The outcomes of project stages 1, 3 and 4 are reported separately.

This paper describes the development of authentic multimedia resources that allow for participative, interactive and engaging learning experiences based upon sound pedagogical principles. These resources provide opportunities for students to critically examine clinical scenarios where medication safety is, or has the potential to be compromised and to develop skills in interprofessional communication that will prepare them to manage these types of situations in clinical practice.

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This paper describes the development of authentic multimedia resources that allow for participative, interactive and engaging learning experiences based upon sound pedagogical principles. These resources provide opportunities for students to critically examine clinical scenarios where medication safety is, or has the potential to be compromised and to develop skills in interprofessional communication that will prepare them to manage these types of situations in clinical practice.

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Interprofessional education

The World Health Organization (WHO) recognizes IPE as an innovative but essential strategy for preparing a collaborative practice-ready health workforce (World Health Organization, 2010). "Interprofessional education occurs when two or more professions learn with, from and about each other to improve collaboration and the quality of care" (Center for the Advancement of Interprofessional Education (CAIPE), 2002). IPE is reported to enhance students’ ability to communicate effectively and work as part of an interdisciplinary team (World Health Organization, 2010). The Canadian Interprofessional Health Collaborative describes interprofessional collaboration as a phenomenon that occurs when learners/practitioners, patients/clients/families and communities develop and maintain interprofessional working relationships that enable optimal health outcomes (Canadian Interprofessional Health Collaborative (CHC), 2010). True interprofessional collaborative practice requires a consistent culture of collaboration between learning and practice that supports the development of interprofessional collaborative competencies (Canadian Interprofessional Health Collaborative (CHC), 2010). Culture takes time to develop however, so the earlier that a culture of collaboration is initiated, the more likely it is that health professionals will attain the necessary skills, knowledge, attitudes, and values to adopt a collaborative culture in their clinical practice. It would seem that in order to prepare learners (soon to be practitioners) for collaborative practice, IPE is a logical and essential step.

Ideally, IPE opportunities should be provided in ‘real’ healthcare contexts during the experiential learning that occurs when students undertake clinical placements. In reality though, there are barriers to this occurring in a systematic or consistent way. Clinical placements are unpredictable and dynamic, providing varied and sometimes chaotic learning experiences (Levetts-Jones and Bourgeois, 2011). Additionally, opportunities for students to work as part of an interdisciplinary team are often frustrated by the constraints imposed by placement availability and differences in the sizes of student cohorts (Levetts-Jones and Bourgeois, 2007). The pragmatic limitations inherent in university curricula and contexts also impact upon opportunities for health professional students to learn collaboratively. Not all universities offer concurrent nursing, pharmacy and medicine programmes, and even when they do, timetabling restrictions, resource implications and large student cohorts can act as barriers to IPE.

Despite the recognised barriers, both the Canadian and UK governments have allocated substantial funding, and have adopted a clear policy direction to incorporate IPE into health professional education. The Health Council of Canada has included a recommendation that each university health science programme offers an IPE component (Randali et al., 2011). In the UK, calls to implement IPE came after the Bristol Royal Infirmary inquiry attributed a significant percentage of preventable errors to poor interprofessional collaboration (Bristol Royal Infirmary Inquiry, 2001). IPE is now a mandatory requirement in the UK for pre-registration training in health and social care (Department of Health and Quality Assurance Agency, 2006). In the United States, the Institute of Medicine published the report Health Professions Education: A Bridge to Quality. One of the major recommendations of this report was that “all health professionals should be educated to deliver patient-centred care as members of an interdisciplinary team” (Institute of Medicine Committee on the Health Professions Education Summit, 2003, p. 45). In Australia there is no clear policy to guide the incorporation of IPE into health curricula. This has been identified as a major barrier to its successful implementation (Thistlethwaite, 2007). This situation persists, despite the fact that several government and independent reports have specifically advocated for the inclusion of IPE in health professional education programmes.

Interprofessional communication and medication safety

Medication errors are one of the most common types of adverse events reported in health care. In Australia up to 30% of hospital patients will experience an adverse drug event (Classen et al., 2005) costing almost six billion dollars per year (National Health and Hospitals Reform Commission, 2008). These statistics are not dissimilar to many other developed countries with conservative estimates of adverse drug events between 10 and 25% being reported in many countries (Dingham et al., 2009; Staussberg and Hasford, 2011). However, it is acknowledged that these figures are probably just the ‘tip of the iceberg’ with underreporting an issue. Medication errors and adverse patient outcomes result from multiple factors. They are related to knowledge and skill deficits, inadequate clinical reasoning skills (del Bueno, 2005), ineffective teamwork, and poor communication between health professionals and between health care consumers and health professionals (World Health Organization, 2007). However, while knowledge and skills related to medication safety are currently addressed in academic programmes, interprofessional communication has not been given the same attention. There is little evidence that education focused on increasing students’ knowledge about medications has translated into a reduction in medication errors (Ross and Loke, 2009). Similarly, attention to medication calculation skills without consideration of the broader context of safe medication practices has not resulted in improved outcomes (Armitage and Knappam, 2003).

Many medication related errors are potentially preventable through effective collaboration and communication (Dieleman et al., 2004). Deficiencies in communication between health professionals and recommendations for improvement are major findings in many health care quality improvement investigations (Office of Safety and Quality in Healthcare Department of Health (WA), 2008) with communication errors identified as the root cause of 70% of sentinel events in health care settings (Leonard, et al., 2004). Research also indicates that inadequate communication (verbal and written) between health care professionals and with health care consumers and/or family members is the primary issue in the majority of medication errors, adverse drug events, and near-misses (Bennjamin, 2003).

The National Medicines Safety and Quality Scoping Study Steering Committee (2008) advocates for the inclusion of safe medication practice in curricula for health professionals. In the Quality Use of Medicines (QUM) team the four primary stakeholder groups are those who prescribe, dispense, administer and consume (i.e. patients/clients). While each member of the team has unique responsibilities for ensuring medication safety, IPE increases the likelihood of effective communication, safe practice and improved patient outcomes.

IPE for QUM resources

To address the issues identified above we are developing a series of multimedia learning modules that are designed to help nursing, pharmacy and medical students learn about medication safety and prepare for interprofessional clinical practice. The resources take into account the barriers in bringing different health professional students together by providing a ‘virtual’ and ‘vicarious’ IPE experience. The multimedia resources provide opportunities for students to learn from and about each other even when they do not have the opportunity to learn with students from other health professions.

The resources give students a window into how health care professionals communicate and work collaboratively to promote QUM and ensure medication safety. Each module is based on an actual clinical situation; a number are re-entrants or adaptations of coronial inquests or other reports. The skills inherent in safe and effective medication and communication practices are illustrated with positive and negative examples. Although each module is distinct, the resources use a consistent pedagogical approach and are supported by
critical thinking questions designed to promote reflection and discussion. Each module is being developed collaboratively and reviewed for content accuracy, relevance and authenticity by an expert panel consisting of clinicians and educators.

The communication skills illustrated in the IPE for QUM modules are based on the Oxford NOTECHS (non-technical skills) scale (Anderson and Leflore, 2008). This Scale was originally used to describe the teamwork skills essential to aviation safety, and has since been adapted and used in healthcare settings (Mishra et al., 2009). It portrays both positive and negative communication behaviours. Table 1 presents the key teamwork and communication skills inherent in safe medication practices, structured to align with the Oxford NOTECHS scale. The framework provided in Table 1 can be used by educators as a prompt for reflection and discussion and/or as a way of assessing students' communications skills in relation to medication safety in virtual, simulated or actual clinical learning environments. The elements in the framework are specific, measurable, achievable, realistic and timely (SMART) (Levet-Jones and Bourgeois, 2011); and are designed to provide clarity to communication processes that are often vague and somewhat difficult to quantify.

IPE for QUM curriculum integration

It is recognised that curricula differ substantially across health professional programmes, with students learning about interprofessional communication and medication safety at different stages. For this reason the IPE for QUM modules have been flexibly designed so that educators can select the most appropriate resource to align with the particular learning objectives of their programme, course or unit. Although the IPE modules provide an ideal platform for students from two or more disciplines to learn together, they are also effective when used for teaching single disciplines as they illustrate the roles and responsibilities of all members of the medication team.

The modules can be used as an e-learning resource or as stimulus materials in face-to-face lectures or tutorials. Both modes of delivery have merit and have been positively evaluated by students. The modules can be used in a self-directed way but also promote vigorous dialogue and debate when used for class or group work. Use in a class situation, guided by a trained facilitator, can ensure that the key concepts are understood and that students develop a broad understanding of the issues rather than retain a profession-centric view. While students working independently do not have the opportunity for guidance or debate, summary points and key messages attached to each module are designed to correct any potential misunderstandings and highlight points that may have been missed.

The modules can be used in ways that vary in complexity. For example, at a basic level students can be guided to observe and discuss communication behaviours. As students progress they can have the opportunity to analyse communication factors, human, and system errors that lead to adverse drug events; and in this way develop a deeper understanding of the complexities of each topic and each medication area. Table 2 demonstrates this concept through application of Blooms’ taxonomy (Krathwohl, 2002). The level of complexity to which students explore each module can be decided based on student level and learning objectives. A module may be revisited at various stages during a health professional education programme, gradually increasing in complexity as students’ progress.

Critical thinking questions have been integrated throughout the modules and are designed to reinforce key concepts and extend understanding and application. It is anticipated that educators will develop supplementary questions that align with the specific learning objectives of their own course or unit.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Teamwork and communication skills inherent in safe medication practices (adapted from Anderson and Leflore, 2008).</th>
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</thead>
<tbody>
<tr>
<td>Domains</td>
<td>Elements</td>
</tr>
<tr>
<td>Person-centred care</td>
<td>Including patient/family in discussion</td>
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<td></td>
<td>Seeking and considering patient’s social and medical history</td>
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<td></td>
<td>Equipping patients with the skills to identify problems and</td>
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<td></td>
<td>to play an active role in their medication management</td>
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<td></td>
<td>Awareness of and respecting the roles of team members</td>
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<td>Supporting others</td>
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<td>Understanding needs of the team</td>
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<td>Managing conflict</td>
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<td></td>
<td>Asking for help</td>
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<td></td>
<td>Valuing others’ contribution</td>
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<tr>
<td></td>
<td>Sharing accountability and responsibility</td>
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<tr>
<td>Communication and interaction</td>
<td>Maintaining eye contact</td>
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<tr>
<td></td>
<td>Demonstrating open body language</td>
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<tr>
<td></td>
<td>Being polite and friendly</td>
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<td>Active listening</td>
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<td></td>
<td>Discussing together</td>
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<td></td>
<td>Asking questions</td>
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<td></td>
<td>Coordinating actions</td>
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<td></td>
<td>Expressing concerns freely</td>
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<td></td>
<td>Speaking up when unsure</td>
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<tr>
<td>Leadership and management</td>
<td>Communicating openly — including handover (ISBAR)</td>
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<tr>
<td></td>
<td>Taking the initiative</td>
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<tr>
<td></td>
<td>Maintaining clinical standards</td>
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<td></td>
<td>Delegating</td>
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<td></td>
<td>Demonstrating graded assertiveness</td>
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<tr>
<td>Problem solving and decision making</td>
<td>Creating a culture</td>
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<td></td>
<td>Collaboration problem solving</td>
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<td></td>
<td>Shared option generation</td>
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<td>Shared risk assessment</td>
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<td></td>
<td>Shared decision making</td>
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<td></td>
<td>Reviewing outcomes</td>
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<tr>
<td>Situational awareness</td>
<td>Noticing</td>
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<td>Anticipating—identifying future problems and discussing</td>
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<tr>
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<td>contingencies</td>
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<tr>
<td>Adherence to guidelines</td>
<td>Recognising the capabilities of others, cross-checking, and</td>
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<tr>
<td></td>
<td>contacting outside sources when necessary</td>
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<tr>
<td>Documentation</td>
<td>Being familiar and adhering to relevant guidelines, policies</td>
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<tr>
<td></td>
<td>and evidence-based resources</td>
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<td></td>
<td>Documenting clearly, accurately, contemporaneously and</td>
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<td></td>
<td>concisely</td>
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<td></td>
<td>Accessing and clarifying medical records</td>
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<table>
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<tr>
<th>Table 2</th>
<th>Application of the cognitive domain of Bloom’s Taxonomy to the assessment of communication skills and medication safety (Adapted from Krathwohl, 2002).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive skill</td>
<td>Example</td>
</tr>
<tr>
<td>Creation</td>
<td>Proposes a novel solution to prevent a medication error from recurring</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Develops an innovative communication strategy</td>
</tr>
<tr>
<td></td>
<td>Conducts or participates in a root cause analysis to identify the various</td>
</tr>
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<td></td>
<td>communication factors (human and system) that led to a medication error/adverse drug event</td>
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<td></td>
<td>Judges the merit of different approaches for enhancing interprofessional communication and teamwork</td>
</tr>
<tr>
<td>Analysis</td>
<td>Compares the effectiveness of different communication strategies or styles</td>
</tr>
<tr>
<td></td>
<td>Contrasts the outcomes of positive and negative medication scenarios</td>
</tr>
<tr>
<td>Application</td>
<td>Practices ISBAR in making a phone call</td>
</tr>
<tr>
<td></td>
<td>Provides examples of factors that contribute to medication errors</td>
</tr>
<tr>
<td></td>
<td>Demonstrates appropriate communication when taking a medication history</td>
</tr>
<tr>
<td>Understanding</td>
<td>Explains the roles and responsibilities of the members of the QUM team</td>
</tr>
<tr>
<td></td>
<td>Discusses the potential consequences of poor interprofessional communication</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Identifies the errors evident in a medication scenario</td>
</tr>
<tr>
<td></td>
<td>Lists elements of effective communication</td>
</tr>
<tr>
<td></td>
<td>Recalls the meaning of the acronym ISBAR</td>
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<td></td>
<td>Identifies the ‘5 Rights’</td>
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A note of caution

It is not unusual to adopt an overly simplistic and reductionist approach to adverse patient outcomes and in particular medication errors. Too often, errors are attributed to (and blamed on) the person who administered, prescribed or dispensed the medication without taking into account the multiple contextual and system-wide factors that create conditions in which medication errors can occur. Similarly, without appropriate guidance students may take a simplistic view of the medication errors they vicariously experience through the IPE for QUM modules.

We suggest that students are introduced to Reason’s ‘Swiss Cheese Model’ (Reason, 2000; Reason et al., 2001) before they analyse the medication incidents portrayed in the modules. In Reason’s model every step in a process has the potential for failure, to varying degrees. The ideal health care system is like a pile of Swiss cheese slices. Each hole is an opportunity for a process to fail, and each of the slices is a “defensive layer” in the process (Reason, 2000). A single error may allow a problem to pass through a hole but in the next layer the holes should be in different places and thus the problem should be caught.

For a medication error to occur, the holes need to align at each step in the process, bypassing or defeating all possible defences. If the layers are constructed with the holes aligned, an inherently flawed system has been created, and a problem at the beginning will be allowed to progress to adversely affect the outcome. Each slice of cheese represents an opportunity to stop an error. The more slices (defences) the better. The fewer the holes and the smaller the holes, the less likely it is that an error will occur (Reason, 2000). Fig. 1 provides an example of how inadequate communication can result in medication errors.

Conclusion

The fundamental premise of IPE is that if health professional students learn together they will be better prepared for interprofessional collaboration and teamwork, ultimately leading to improved health outcomes (Barr et al., 2005). This is particularly important in the teaching of medication safety. However, there are a number of pragmatic constraints inherent in university programmes that often make IPE difficult to execute. Even when IPE is a mandatory curriculum imperative, inadequate preparation of students can result in them feeling anxious about and resistant to IPE (Bright et al., 2004). The learning modules and supplementary resources described in this paper align with evidence-based pedagogical and error-reduction literature. Used on their own, either independently or guided by a trained facilitator, they provide a sound IPE foundation by introducing nursing, pharmacy and medical students to the types of medication situations they will encounter in clinical practice and the importance of interprofessional collaboration and communication. When used as supplementary resources for face-to-face IPE initiatives they provide effective preparation and/or stimulus resources to increase student engagement and improved learning outcomes.

The IPE for QUM resources described in this paper have been pilot tested as part of a multi-stage project funded by the Australian Learning and Teaching Council and this research is continuing. The first set of modules can be accessed at: http://www.ipeforqum.com.au. Additional modules will be added as the project progresses.

Acknowledgements

Support for this project has been provided by the Australian Learning and Teaching Council Ltd, an initiative of the Australian Government Department of Education, Employment and Workplace Relations. The views expressed in the project do not necessarily reflect the views of the Australian Learning and Teaching Council. We would like to acknowledge the input and support of the project team and reference group. A list of project team members is available on the project website: http://www.ipeforqum.com.au

References


![Fig. 1. Reason’s Swiss Cheese Model applied to medication safety and interprofessional communication (Adapted from Reason, 2000).](image-url)
Appendix C: Statements of contribution and collaboration for publications

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Statement of contribution and collaboration for Thesis Paper One


In the case of Paper One the nature and extent of contribution to the work was the following:

Samuel Lapkin contributed to the development of the systematic review protocol, selection of and critically appraisal of potentially includable papers, primary and overall data extraction from included papers and drafting of the manuscript. Professor Tracy Levet-Jones and Doctor Conor Gilligan contributed to the protocol and manuscript development within the capacity of their role as PhD supervisors. Professor Tracy Levet-Jones was also the secondary reviewer for the systematic review, and verified studies included in the review and data extraction.

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<th>Candidate’s Signature</th>
<th>Samuel Lapkin</th>
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Declaration by co-authors

The undersigned hereby certify that:

(1) the above declaration correctly reflects the nature and extent of the candidate’s contribution to this work, and the nature of the contribution of each of the co-authors.

(2) they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise;

(3) they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;

(4) there are no other authors of the publication according to these criteria;

(5) potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit.

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<th>Professor Tracy Levet-Jones</th>
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<th>Signature 3</th>
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<tr>
<td></td>
<td>Deputy Head of Faculty (Research) and Assistant Dean Research &amp; Research Training</td>
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Statement of contribution and collaboration for Thesis Paper Two


In the case of Paper Two the nature and extent of contribution to the work was the following:

**Samuel Lapkin** contributed to the study design, data analysis and manuscript preparation.

Professor Tracy Levet-Jones and Doctor Conor Gilligan contributed to the study design and manuscript preparation with the capacity of their role as PhD supervisors.

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3. they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;
4. there are no other authors of the publication according to these criteria;
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Page 237 of 305
Statement of contribution and collaboration for Thesis Paper Three


In the case of Paper Three the nature and extent of contribution to the work was the following:
Samuel Lapkin contributed to the study design, data analysis and manuscript preparation.
Professor Tracy Levett-Jones and Doctor Conor Gilligan contributed to the study design and manuscript preparation with the capacity of their role as PhD supervisors.

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Declaration by co-authors

The undersigned hereby certify that:

(1) the above declaration correctly reflects the nature and extent of the candidate's contribution to this work, and the nature of the contribution of each of the co-authors;

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(3) they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;

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(5) potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit.

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<th>Signature 3</th>
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Statement of contribution and collaboration for Thesis Paper Four


In the case of Paper Four the nature and extent of contribution to the work was the following:

Samuel Lapkin contributed to the study design, data analysis and manuscript preparation.

Professor Tracy Levet-Jones and Doctor Conor Gilligan contributed to the study design and manuscript preparation with the capacity of their role as PhD supervisors.

Candidate's Signature | Samuel Lapkin | Date |
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Declaration by co-authors

The undersigned hereby certify that:

1. the above declaration correctly reflects the nature and extent of the candidate's contribution to this work, and the nature of the contribution of each of the co-authors;

2. they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise;

3. they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;

4. there are no other authors of the publication according to these criteria;

5. potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit.

Signature 1 | Professor Tracy Levet-Jones | Date |
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Signature 2 | Doctor Conor Gilligan | Date |
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Signature 3 | Professor Jefn Rostas Deputy Head of Faculty (Research) and Assistant Deputy Research & Research Training | Date |
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30 October 2012

Dear Samuel,

Re: 


Thank you for your email of 24 October requesting permission to include your publication in the Joanna Briggs Institute Database of Systematic Reviews (No.487) in to your PhD thesis; for online publication with the University of Newcastle’s Digital Repository (NOVA).

Permission to reproduce is granted. Full and correct referencing should be used and acknowledgement should be made to the “The Joanna Briggs Institute, The University of Adelaide”.

Congratulations on the award of your degree.

With kind regards,

Dr Edoardo Aromataris PhD
Editor, JBI Library of Systematic Reviews
The Joanna Briggs Institute
The University of Adelaide

www.joannabriggs.edu.au
Thank you for your Response to Conditional Approval submission to the Human Research Ethics Committee (HREC) seeking approval in relation to the above protocol.

Your submission was considered under Expedited review by the Chair/Deputy Chair.

I am pleased to advise that the decision on your submission is Approved effective 20-May-2011.

In approving this protocol, the Human Research Ethics Committee (HREC) is of the opinion that the project complies with the provisions contained in the National Statement on Ethical Conduct in Human Research, 2007, and the requirements within this University relating to human research.

Approval will remain valid subject to the submission, and satisfactory assessment, of annual progress reports. If the approval of an External HREC has been "noted" the approval period is as determined by that HREC.

The full Committee will be asked to ratify this decision at its next scheduled meeting. A formal Certificate of Approval will be available upon request. Your approval number is H-2011-0086.

If the research requires the use of an Information Statement, ensure this number is inserted at the relevant point in the Complaints paragraph prior to distribution to potential participants You may then proceed with the research.

**Please note and action (where appropriate) the following:**

1. Please note for future reference that it is of great assistance to the review process if the issues raised in the prior review are addressed in a covering letter, supporting the submission of the revised participant documents.
2. Amendment to the Covering Email to HOS.
Amend line 1 to "...invite your school to take part..." (deleting the word 'is').

3. Amendment to the Information Statement.
Page 1, under "Why is the research being done?" amend point 1 to "...New Zealand universities' nursing, pharmacy...".
(Apologies for not identifying this error the first time.)

### Conditions of Approval

This approval has been granted subject to you complying with the requirements for Monitoring of Progress, Reporting of Adverse Events, and Variations to the Approved Protocol as detailed below.

PLEASE NOTE:
In the case where the HREC has "noted" the approval of an External HREC, progress reports and reports of adverse events are to be submitted to the External HREC only. In the case of Variations to the approved protocol, or a Renewal of approval, you will apply to the External HREC for approval in the first instance and then Register that approval with the University's HREC.

- **Monitoring of Progress**

Other than above, the University is obliged to monitor the progress of research projects involving human participants to ensure that they are conducted according to the protocol as approved by the HREC. A progress report is required on an annual basis. Continuation of your HREC approval for this project is conditional upon receipt, and satisfactory assessment, of annual progress reports. You will be advised when a report is due.

- **Reporting of Adverse Events**

1. It is the responsibility of the person first named on this Approval Advice to report adverse events.
2. Adverse events, however minor, must be recorded by the investigator as observed by the investigator or as volunteered by a participant in the research. Full details are to be documented, whether or not the investigator, or his/her deputies, consider the event to be related to the research substance or procedure.
3. Serious or unforeseen adverse events that occur during the research or within six (6) months of completion of the research, must be reported by the person first named on the Approval Advice to the (HREC) by way of the Adverse Event Report form within 72 hours of the occurrence of the event or the investigator receiving advice of the event.
4. Serious adverse events are defined as:
   - Causing death, life threatening or serious disability.
   - Causing or prolonging hospitalisation.
   - Overdoses, cancers, congenital abnormalities, tissue damage, whether or not they are judged to be caused by the investigational agent or procedure.
   - Causing psycho-social and/or financial harm. This covers everything from perceived invasion of privacy, breach of confidentiality, or the diminution of social reputation, to the creation of psychological fears and trauma.
   - Any other event which might affect the continued ethical acceptability of the project.
5. Reports of adverse events must include:
   - Participant's study identification number;
   - date of birth;
   - date of entry into the study;
   - treatment arm (if applicable);
   - date of event;
   - details of event;
   - the investigator's opinion as to whether the event is related to the research procedures; and
   - action taken in response to the event.
6. Adverse events which do not fall within the definition of serious or unexpected, including those reported from
other sites involved in the research, are to be reported in detail at the time of the annual progress report to the HREC.

- **Variations to approved protocol**

If you wish to change, or deviate from, the approved protocol, you will need to submit an Application for Variation to Approved Human Research. Variations may include, but are not limited to, changes or additions to investigators, study design, study population, number of participants, methods of recruitment, or participant information/consent documentation. Variations must be approved by the (HREC) before they are implemented except when Registering an approval of a variation from an external HREC which has been designated the lead HREC, in which case you may proceed as soon as you receive an acknowledgement of your Registration.

**Linkage of ethics approval to a new Grant**

HREC approvals cannot be assigned to a new grant or award (i.e. those that were not identified on the application for ethics approval) without confirmation of the approval from the Human Research Ethics Officer on behalf of the HREC.

Best wishes for a successful project.

Professor Alison Ferguson  
Chair, Human Research Ethics Committee

---

For communications and enquiries:

**Human Research Ethics Administration**

Research Services  
Research Integrity Unit  
HA148, Hunter Building  
The University of Newcastle  
Callaghan NSW 2308  
T +61 2 492 18999  
F +61 2 492 17164  
Human-Ethics@newcastle.edu.au

**Linked University of Newcastle administered funding:**

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<td>Enhancing the teaching of medication safety to nursing, pharmacy and medical students through interprofessional education (IPE)</td>
<td>Levett-Jones Tracy.Lynn</td>
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## Cross Sectional Survey Content Validity: Summary of responses from the expert team for all the 35 survey draft questions

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Is there any unnecessary repetition of questions? If so which ones?

Check consistency e.g ‘others’ vs ‘others/s’ vs ‘others’; ‘IPE offerings’ vs ‘IPE experiences’

Are there any items or questions that should be included that have been overlooked?

Does IPE pose a threat/opportunity to your profession?

Combined comments from the expert team for all the 35 survey draft questions:

<table>
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<tr>
<th>Question Number</th>
<th>Amendments</th>
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<td><strong>Question 1</strong></td>
<td>Yes Questions 1 and 2 will assist in identifying non-respondents by university and profession.</td>
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<td>What if only one discipline of the 3 responds- are you going to send replies as a follow up? Off putting as 1st question, and does it help with eliminating not knowing which profession? Only for the purposes of follow up of non-responders Profession vs Discipline</td>
<td>Discipline changed to profession where applicable</td>
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<td><strong>Question 2</strong></td>
<td>Discipline changed to profession where applicable. Options for Question 2 changed to buttons from check boxes.</td>
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<tr>
<td>Discipline or profession or program? Check all that apply not helpful when you are asking them to identify just one that applies Discipline vs profession? Choose one only? Remove ‘check all that apply’ Change to profession</td>
<td>Discipline changed to profession where applicable</td>
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<td><strong>Question 3</strong></td>
<td>No change required; question amended.</td>
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<td>FTE persons or part time or full time Related to Q. 2- how do you know which programs its about? Multiple programs or one profession may be doing IPE? Perhaps name program</td>
<td>Tick box option available for multiple programs</td>
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<td><strong>Question 4</strong></td>
<td>Nil changes suggested by expert panel</td>
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<td><strong>Question 5</strong></td>
<td>Question 5 changed in response to other suggested changes</td>
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<td>But placement is wrong- should be later; probably just before Q.33- worth asking why not For whom/ Students/ academics</td>
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| Are you asking the individual/ their role e.g course coordinator or convenor? | May be ok as is  
| Do you think IPE experience would benefit to learning outcomes for your students? | Add free text to Yes/NO  
<p>| Why/Why not? | Used for Question 10 |
| <strong>Question 7</strong> |<br />
| What if they don’t know? |<br />
| At your university or at your faculty? Will they necessarily know the entire university situation? |<br />
| Are you aware of plans… |<br />
| What levels- organization vs small group |<br />
| <strong>Question 8</strong> |<br />
| Professions to be involved |<br />
| A nightmare to analyse though-why not have a series of closed questions etc? |<br />
| Change to profession |<br />
| <strong>Question 9</strong> |<br />
| Is it year of the program or when they first started IPE as a discipline? |<br />
| 1st or 2nd vs 2008 or 2009? |<br />
| May have been a lot of different initiative |<br />
| <strong>Question 10</strong> |<br />
| Where is the IPE experience for students located in your program (tick all that apply) |<br />
| What about an ‘other’ section? |<br />
| Could reword |<br />
| What is the nature of… |<br />
| <strong>Question 11</strong> |<br />
| Nil changes suggested |<br />
| <strong>Question 12</strong> |<br />
| Nil changes suggested |<br />
| <strong>Question 13</strong> |<br />
| Maybe use level of enrolment instead of year (i.e. students undertaking part-time or out-of-pattern enrolments) |<br />
| The year thing again, though ‘years of enrolment’ may be good enough |<br />
| ? Confusion re graduate schools |<br />
| This questions need to go earlier should be modified to deal with multiple programs |<br />
| May need to move to beginning |<br />
| <strong>Question 14</strong> |<br />
| Workshops added; Now Question 19 |</p>
<table>
<thead>
<tr>
<th>Question</th>
<th>Suggested Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add workshops perhaps – different IPE experience</td>
<td>If “clinical placements” counts won’t courses qualify?</td>
</tr>
<tr>
<td><strong>Question 15</strong></td>
<td>Should separate patient safety and or error reduction (not the same thing)</td>
</tr>
<tr>
<td></td>
<td>Clinical psychomotor skills is not a familiar term to me</td>
</tr>
<tr>
<td></td>
<td>Done ass suggested now Question 20</td>
</tr>
<tr>
<td><strong>Question 16</strong></td>
<td>Maybe add a box for not assessed</td>
</tr>
<tr>
<td></td>
<td>Add to “not assessed” as an option</td>
</tr>
<tr>
<td></td>
<td>Question changed to make it more clear- Not assed added as an option, now Question 21</td>
</tr>
<tr>
<td><strong>Question 17</strong></td>
<td>If above is not assessed add in here- not applicable</td>
</tr>
<tr>
<td></td>
<td>Ditto to Q.16 comment</td>
</tr>
<tr>
<td></td>
<td>Satisfaction is evaluation</td>
</tr>
<tr>
<td></td>
<td>Added to be part of Question 21</td>
</tr>
<tr>
<td><strong>Question 18</strong></td>
<td>If no (go to Question?)- link</td>
</tr>
<tr>
<td></td>
<td>Don’t use assessment/ evaluation interchangeably</td>
</tr>
<tr>
<td></td>
<td>Add free text</td>
</tr>
<tr>
<td></td>
<td>Why/ Why not?</td>
</tr>
<tr>
<td></td>
<td>Amended as suggested- now Question 23</td>
</tr>
<tr>
<td><strong>Question 19</strong></td>
<td>Not sure what is exactly needed, especially after answering all the previous questions</td>
</tr>
<tr>
<td></td>
<td>?Duplicates Q.14</td>
</tr>
<tr>
<td></td>
<td>Give examples/suggested items to include</td>
</tr>
<tr>
<td></td>
<td>Removed</td>
</tr>
<tr>
<td><strong>Question 20</strong></td>
<td>Nil suggested changes</td>
</tr>
<tr>
<td><strong>Question 21</strong></td>
<td>May repeat Q.33</td>
</tr>
<tr>
<td></td>
<td>Removed- similar to question 33</td>
</tr>
<tr>
<td><strong>Question 22</strong></td>
<td>Don’t you want to know also what they use for medication safety if not IPE?</td>
</tr>
<tr>
<td></td>
<td>Need a definition of medication safety</td>
</tr>
<tr>
<td></td>
<td>Included as part of Question 8</td>
</tr>
<tr>
<td></td>
<td>Definition of medication safety included</td>
</tr>
<tr>
<td><strong>Question 23</strong></td>
<td>? Needed- repeats</td>
</tr>
<tr>
<td></td>
<td>Not a repeat of any question- now Question 26</td>
</tr>
<tr>
<td><strong>Question 24</strong></td>
<td>Nil suggested changes</td>
</tr>
<tr>
<td><strong>Question 25</strong></td>
<td>Maybe level of enrolment rather than year</td>
</tr>
<tr>
<td></td>
<td>Ditto to Q.13 comments</td>
</tr>
<tr>
<td></td>
<td>Again? Ambiguity about graduate entry programs</td>
</tr>
<tr>
<td></td>
<td>Changed to level of enrolment- now Question 28</td>
</tr>
<tr>
<td>Question 26</td>
<td>Workshop added and Repeat removed</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Add in workshops perhaps ; Simulation is repeated</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 27</th>
<th>Added; now Question 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add teamwork, patient safety</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 28</th>
<th>Amended as suggested, now Question 31 and question including not assessed option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Would keep the full reference sentence, i.e. IPE medication safety experience (otherwise respondent may think they have already answered) Include ‘not assessed’</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 29</th>
<th>Nil suggested changes</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Question 30</th>
<th>No change necessary IPE- refers to interprofessional education so this includes teaching/learning; now Question 34</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is this in regards to teaching –learning or practice experiences?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 31</th>
<th>Option included and free text available for comments; now Question 34</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perhaps answering both Yes/ No requires a reason instead of please outline for Yes Add to “No” why not? i.e if No, why not? Questions is negative what value do you perceive? Value for what? Student outcomes-teaching</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 32</th>
<th>Examples of multimedia resources given; now Question 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add in maybe – or not-sure Need some more examples of what multimedia resources you are talking about How would you know if you don’t have IPE? Or for example include such as DVDs, websites with clinical scenarios No definition of IPE resources</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 33</th>
<th>Now Question 36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove (please specify) as this is the next question Q.34 Clarify ‘staff education experience with IPE’ and ‘comparable readiness of students’ Unsure what ‘comparable readiness’ is Duplicating Q. 21? Barriers/constraints Add to lack of policy or legislative requirement</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 34</th>
<th>Changed to a needs analysis question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duplicating Q. 21? Needs if not corrected above</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 35</th>
<th>Corrected</th>
</tr>
</thead>
<tbody>
<tr>
<td>From ethics point of view, should really split this from rest of the questions Electronic newsletter</td>
<td></td>
</tr>
</tbody>
</table>
Appendix G: Interprofessional Education Survey

Interprofessional Education Survey

Aim of the survey: The aim of this survey is to scope the extent to which interprofessional education (IPE) is used in Australian and New Zealand nursing, pharmacy and medical programs; and the extent to which IPE is used to teach medication safety.

Interprofessional education

Interprofessional education (IPE) is where learners from two or more professions [e.g. nursing, pharmacy or medicine] learn about, from and with each other to enable effective collaboration and improve health outcomes (Center for the Advancement of Interprofessional Education [CAIPE], 2002).

Medication safety

Medication safety refers to “activities to avoid, prevent or correct adverse drug events that may result from the use of medications” (National Prescribing Service, 2008, p.7).
Instructions

1. We have attempted to identify appropriate individuals to represent each school of nursing, pharmacy and medicine in Australia and New Zealand. If your institution offers all three of these programs, we will be seeking representatives from each profession to complete the survey. Therefore, please respond to the following questions in relation to your main professional area only.

2. You can save responses and return and continue the survey at a later time.

3. If you do not want to complete the survey and do not wish to receive reminder emails please click here….

4. Submission of this survey will be taken as implied consent

**Please note that in the web version of this survey, respondents were automatically directed to each relevant question in turn.**
SECTION A: DEMOGRAPHICS

1. What University do you represent?
   
   Your response will only be used to remove your institution from follow-up mailings to non-responders. All results will be reported in aggregate form with no institution individually identified.

2. What profession do you represent?
   - Nursing
   - Pharmacy
   - Medicine

3. What other health professional programs are offered at your university? (tick all that apply)
   - Dentistry
   - Pharmacy
   - Medicine
   - Midwifery
   - Nursing
   - Occupational therapy
   - Physiotherapy
   - Others (please specify)

4. Approximately how many students are currently enrolled in your program/course across all years (e.g. B Nursing)?
   
   [Blank space for response]
5. Across how many campuses is your program/course offered?
   - One
   - Two
   - Three
   - Four and more

6. Please select the best description for your program/course from the following
   - Undergraduate – conventional/normal entry
   - Undergraduate- Graduate entry
   - Post graduate
SECTION B: INTERPROFESSIONAL EDUCATION

Interprofessional education (IPE) is where learners from two or more professions [e.g. nursing, pharmacy or medicine] learn about, from and with each other to enable effective collaboration and improve health outcomes (Center for the Advancement of Interprofessional Education [CAIPE], 2002).

7. How is your program/course delivered? (tick all that apply)
   ☐ Face to face
   ☐ Online
   ☐ Distance
   ☐ Blended
   ☐ Others (please specify)

8. How do students in your profession learn the following? (please tick all that apply):
   Uni - unprofessionally i.e. without students from other professions
   Inter - interprofessionally i.e. with students from other professions

<table>
<thead>
<tr>
<th></th>
<th>Lectures</th>
<th>Tutorials</th>
<th>Clinical placements</th>
<th>Simulation sessions</th>
<th>Others (please specify)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teamwork</td>
<td>Uni</td>
<td>Inter</td>
<td>Uni</td>
<td>Inter</td>
<td>Uni</td>
</tr>
<tr>
<td>Interprofessional</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>communication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient safety</td>
<td>Uni</td>
<td>Inter</td>
<td>Uni</td>
<td>Inter</td>
<td>Uni</td>
</tr>
<tr>
<td>Medication safety</td>
<td>Uni</td>
<td>Inter</td>
<td>Uni</td>
<td>Inter</td>
<td>Uni</td>
</tr>
<tr>
<td>Leadership and</td>
<td>Uni</td>
<td>Inter</td>
<td>Uni</td>
<td>Inter</td>
<td>Uni</td>
</tr>
<tr>
<td>management skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. Please give a brief description of how your students learn about, from, or with students from other professions in the table below, following the format of the given examples:

<table>
<thead>
<tr>
<th>About</th>
<th>From</th>
<th>With</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd year course pharmacy where students learn about the roles and responsibilities of different members of the allied health team</td>
<td>A 1st year human bioscience course taught to nursing students by staff from the human bioscience department</td>
<td>A 2 hour workshop in which nursing, pharmacy and medical students work through case studies in small interprofessional groups</td>
</tr>
</tbody>
</table>
10. Do you think IPE experiences would be beneficial to your students' learning?
   - No
   - Yes

11. Are your students currently offered IPE experiences?
   - Yes (Please go to Question 13)
   - No, but are in the planning/development stage for adding a program/experiences (Please go to Question 12)
   - No, it was once considered but not implemented (Please go to Question 23)
   - No and it is not being considered at this time (Please go to Question 23)

12. Please give a description of the planned IPE experience below, including but not limited to, professions that will be involved; number of students; year of student enrolment and anticipated year of commencement of IPE

13. In what year did you first start to offer IPE?
14. In what year(s)/level of enrolment do students from your profession participate in the IPE activities?
   - 1
   - 2
   - 3
   - 4
   - 5
   - Post graduate
   - Other/s (please specify)

15. What kind of IPE experience do you offer?
   - Required – as part of the curricula
   - Elective - for academic credit
   - Extracurricular - no academic credit

16. Which academic profession(s) coordinates the IPE experience? (tick all that apply)
   - Nursing
   - Pharmacy
   - Medicine
   - Others (please specify)

17. What professions are included in the IPE experience? (tick all that apply)
   - Nursing
   - Pharmacy
   - Medicine
   - Others (please specify)
18. What types of IPE experiences are involved? (tick all that apply)

☐ Lectures
☐ Tutorials
☐ Problem Based Learning
☐ Clinical laboratories
☐ Clinical placements
☐ Simulation
☐ Standardised patients (actors)
☐ Workshops
☐ Other/s (please specify)

19. Are students assessed in the IPE offering?

☐ No
☐ Yes

If yes, which of the following methods is used? (tick all that apply)

☐ Group project
☐ Written exam
☐ Objective Structured Clinical Examination (OSCE)
☐ Small group participation
☐ Oral exam
☐ Peer assessment
☐ Simulation exercise
☐ Other/s (please specify)
20. What is the focus of student assessment during or following the IPE experiences? 
(tick all that apply)
- Knowledge acquisition
- Team skills
- Communication
- Clinical psychomotor skills
- Attitudes towards other professions
- Situation awareness
- Others/s (please specify)

21. Are the IPE experiences evaluated by students?
- No
- Yes
    If yes, which of the following methods is used? (tick all that apply)
    - Interdisciplinary Education Perception Scale (IEPS)
    - Readiness for Interprofessional Learning Scale (RIPLS)
    - Interprofessional Attitudes Questionnaire (IAQ)
    - Questionnaire (other)
    - Focus groups
    - Other/s (please specify)

22. Please describe what you consider to be the most innovative and effective features of the IPE experiences provided in your program.
23. To what extent do you perceive the following to be barriers/constraints in implementing IPE experiences? Please rate the barriers on a scale of 1 to 5 with 1 representing "No barrier at all" to 5 representing "A major barrier".

<table>
<thead>
<tr>
<th>Barriers</th>
<th>1 - No barrier at all</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 - A major barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of institutional support</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student resistance to IPE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of appreciation of the benefits of IPE by staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of appreciation of the benefits of IPE by students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff education/experience with IPE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of staff confidence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Funding limitations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timetabling restrictions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of appropriate classroom space</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of IPE appropriate teaching and learning resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy or legislative requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (please specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Medication safety refers to “activities to avoid, prevent or correct adverse drug events that may result from use of medications” (National Prescribing Service, 2008, p. 7).

24. Do you use IPE to teach medication safety?
   - No (go to Question 34)
   - Yes (go to Question 25)

25. Which academic profession(s) coordinates the IPE medication safety experience?
   (tick all that apply)
   - Nursing
   - Pharmacy
   - Medicine
   - Other/s (please specify)

26. What professions are included in the IPE medication safety experience? (tick all that apply)
   - Nursing
   - Pharmacy
   - Medicine
   - Other/s (please specify)
27. In what level/s of enrolment do students participate in the IPE medication safety experience?

<table>
<thead>
<tr>
<th>Profession</th>
<th>Level of enrolment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing</td>
<td></td>
</tr>
<tr>
<td>Pharmacy</td>
<td></td>
</tr>
<tr>
<td>Medicine</td>
<td></td>
</tr>
<tr>
<td>Others (please specify)</td>
<td></td>
</tr>
</tbody>
</table>

28. What types of experiences are involved in IPE for medication safety? (tick all that apply)
   - Lectures
   - Tutorials
   - Problem Based Learning
   - Clinical Laboratories
   - Clinical Placements
   - Simulation
   - Standardised patients (actors)
   - Workshops
   - Other/s (please specify)
29. What is the focus of the IPE medication safety experiences? (tick all that apply)
- Medication errors
- Patient safety
- Drug calculations
- Prescribing
- Dispensing
- Administration
- Teamwork
- Interprofessional communication
- Clinical psychomotor skills
- Other/s (please specify)

30. Are students assessed in the IPE offering?
- No
- Yes

If yes, which of the following methods is used? (tick all that apply)
- Group project
- Written exam
- Objective Structured Clinical Examination (OSCE)
- Small group participation
- Oral exam
- Peer assessment
- Simulation exercise
- Other/s (please specify)
31. What is the focus of assessment during or following IPE experiences? (tick all that apply)

- [ ] Knowledge acquisition
- [ ] Team skills
- [ ] Communication
- [ ] Clinical psychomotor skills
- [ ] Attitudes towards other professions
- [ ] Other/s (please specify)

32. Are there other IPE medication safety experiences you would like to tell us about?

33. Do you perceive any value in using IPE to enhance medication safety?

- [ ] No, Why not?
- [ ] Yes, please outline
SECTION D: INTERPROFESSIONAL EDUCATION NEEDS ANALYSIS

34. Would multi-media IPE resources such as DVDs, websites and online scenarios for teaching medication safety be of benefit in your teaching?
   ○ No
   ○ Yes

35. Would academic staff development in IPE be of benefit to you?
   ○ No
   ○ Yes

36. In your opinion which of the following do you think should be the main focus of IPE for medication safety teaching resources? Please rate the following on a scale of 1 to 5 with 1 representing "The highest priority" to 5 representing "The least priority".

<table>
<thead>
<tr>
<th>Area of focus</th>
<th>1 - 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitudes towards other professions</td>
<td></td>
</tr>
<tr>
<td>Interprofessional communication</td>
<td></td>
</tr>
<tr>
<td>Knowledge of roles of other professions</td>
<td></td>
</tr>
<tr>
<td>Medication errors</td>
<td></td>
</tr>
<tr>
<td>Teamwork</td>
<td></td>
</tr>
</tbody>
</table>

37. Please list/describe other perceived needs regarding IPE

38. Would you like to be informed of the progress of this Australian Learning and Teaching Council project via project electronic newsletter?
   ○ No
   ○ Yes
   If yes, please provide an email address

Thank you participating in this survey, your input is very valuable.
References


Appendix H: Cover letter/Invitation to Heads of Schools

Text of covering email to Heads of Schools

Interprofessional education (IPE) and medication safety: Cross-sectional survey and needs analysis of Australian and New Zealand universities

Dear

We would like to invite your school to take part in a project which is being carried out by researchers from the University of Newcastle, the University of Western Sydney, and the University of Tasmania. The project team is led by Associate Professor Tracy Levett-Jones from the School of Nursing and Midwifery at the University of Newcastle. The project is funded by the Australian Learning and Teaching Council.

One of the aims of this project is to scope the extent to which interprofessional education (IPE) is used to teach medication safety in Australian and New Zealand nursing, pharmacy and medical programs. The project will also examine the needs of nursing, pharmacy and medical programs and identify barriers in relation to the integration of IPE for the purposes of enhancing medication safety.

We would like to invite you to identify and provide us with contact details of an academic staff member within your school who has knowledge of how IPE and/or medication safety are integrated in your program. The nominee will be asked to complete a 15 minute online survey. All contact related to the project will be limited to the nominated academic staff member and the research team. We kindly request that you seek verbal permission from the nominee prior to providing us with their details.

If you would like further information please contact:

Samuel Lapkin Samuel.Lapkin@newcastle.edu.au

Thank you for considering this invitation.

Associate Professor Tracy Levett-Jones
RN, PhD, MEd & Work, BN, DipAppSc (Nursing)

Doctor Conor Gilligan
PhD, B.Biomed Sci (Hons)

Samuel Lapkin
RN, BN (Hons) (PhD candidate)

Complaints about this research

This project has been approved by the University’s Human Research Ethics Committee, Approval No. H-2011-0086. Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.
Appendix I: Information Statement for Cross-sectional survey

Survey Information Statement for the Research Project:

Interprofessional education (IPE) and medication safety: Cross-sectional survey and needs analysis of Australian and New Zealand universities

Doctor Conor Gilligan (Co-Supervisor)
Samuel Lapkin (Doctor of Philosophy Candidate)

You are invited to take part in a project which is being carried out by researchers from the University of Newcastle, the University of Western Sydney, and the University of Tasmania. The project team is led by Associate Professor Tracy Levett-Jones from the School of Nursing and Midwifery at the University of Newcastle and is being conducted as a component of Samuel Lapkin’s Doctor of Philosophy project. The project is funded by the Australian Learning and Teaching Council (ALTC).

Why is the research being done?
The aims of this stage of the project are to:
1. Scope the extent to which IPE is used to teach medication safety in Australian and New Zealand universities’ nursing, pharmacy programs,
2. Examine the needs of nursing, pharmacy and medical programs in relation to the integration of IPE and medication safety into curricula
3. Identify barriers and facilitators to curriculum integration of IPE for the purposes of enhancing medication safety.

Who can participate in the research?
We are recruiting academic staff members teaching into Australian and New Zealand universities’ nursing, pharmacy and medicine programs to complete the survey. The person completing the survey should have knowledge of the use of IPE within the program of the particular school.

What choice do you have?
Participation in this research is entirely your choice. Submission of this survey will be taken as implied consent. You will have an option of being excluded from follow up reminder emails if you wish. Whether or not you decide to participate, your decision will not disadvantage you. If you do decide to participate, you may withdraw from the project at any time without giving a reason and you have the option of withdrawing any data which identifies you.

What would you be asked to do?
If you agree to participate, you will be asked to complete a survey. The survey is composed of four sections with items specific to: (1) university demographics, (2) IPE teaching and learning experiences (3) medication safety teaching and learning experiences, and (4) needs analysis related to IPE. As part of the survey participants will be asked to provide the name of the institution and profession they represent. The
inclusion of this information is necessary for more meaningful analysis and reporting of the results. However, all results will be reported in aggregate form with no institution individually identified. At the end of the survey you will be asked if you would like to be informed of the progress of this project via project electronic newsletter. The email addresses collected for this purpose will be fed into a separate database from the main survey in order to protect the confidentiality of your survey responses.

How much time will it take?
The survey will take approximately 15 minutes to complete.

What are the risks and benefits of participating?
There are no direct benefits to the participants, of completing the survey. However, by providing detailed information about current practice and needs, all Australian and New Zealand universities may benefit from the study results and access to teaching and learning resources developed as part of the larger ALTC project, which will be available on the project website.

How will your privacy be protected?
All collected data will be password protected and access will be only available to the researchers and project IT assistant. Once data has been extracted from the web site it will be stored on a password protected computer or in locked storage. Data will be identified by participants’ numerical codes only.

How will the information collected be used?
A survey report will be prepared to provide a research based national overview of contemporary learning and teaching practices with regards to IPE and the needs of the higher education sector in regards to teaching medication safety. This report will be available on the project website. The results will also form the basis of papers submitted for publication in scholarly journals and at professional conferences. The survey will also form part of a thesis to be submitted for Samuel Lapkin’s Doctor of Philosophy degree.

What do you need to do to participate?
Please read this Information Statement and be sure you understand its contents before you consent to participate. If there is anything you do not understand, or you have questions, contact one of the researchers.

Please read this Information Statement and be sure you understand its contents before you consent to participate. If you would like to participate, please submit click the following link below to the survey. Proceeding in this manner will be taken as informed and implied consent that you are willing to participate. If you do not wish to respond to this survey, please click on the link below to decline:


Further information
If there is anything you do not understand, or you have questions, contact:

Samuel Lapkin  Samuel.Lapkin@newcastle.edu.au

Thank you for considering this invitation.

Associate Professor Tracy Levett-Jones
RN, PhD, MEd & Work, BN, DipAppSc (Nursing)

Doctor Conor Gilligan
PhD, B.Biomed Sci (Hons)

Samuel Lapkin
RN, BN (Hons) (PhD candidate)

Complaints about this research
This project has been approved by the University’s Human Research Ethics Committee, Approval No. H-2011-0086. Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.
### Notification of Expedited Approval

<table>
<thead>
<tr>
<th>To Chief Investigator or Project Supervisor:</th>
<th>Professor Tracy Levett-Jones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cc Co-investigators / Research Students:</td>
<td>Doctor Conor Gilligan</td>
</tr>
<tr>
<td></td>
<td>Mr Samuel Lapkin</td>
</tr>
<tr>
<td>Date:</td>
<td>09-May-2012</td>
</tr>
<tr>
<td>Reference No:</td>
<td>H-2012-0080</td>
</tr>
<tr>
<td>Date of Initial Approval:</td>
<td>09-May-2012</td>
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</tbody>
</table>

Thank you for your **Response to Conditional Approval** submission to the Human Research Ethics Committee (HREC) seeking approval in relation to the above protocol.

Your submission was considered under **Expedited** review by the Chair/Deputy Chair.

I am pleased to advise that the decision on your submission is **Approved** effective **09-May-2012**.

In approving this protocol, the Human Research Ethics Committee (HREC) is of the opinion that the project complies with the provisions contained in the National Statement on Ethical Conduct in Human Research, 2007, and the requirements within this University relating to human research.

Approval will remain valid subject to the submission, and satisfactory assessment, of annual progress reports. **If the approval of an External HREC has been "noted" the approval period is as determined by that HREC.**

The full Committee will be asked to ratify this decision at its next scheduled meeting. A formal **Certificate of Approval** will be available upon request. Your approval number is **H-2012-0080**.

**If the research requires the use of an Information Statement, ensure this number is inserted at the relevant point in the Complaints paragraph prior to distribution to potential participants** You may then proceed with the research.

### Conditions of Approval

This approval has been granted subject to you complying with the requirements for **Monitoring of**
Progress, Reporting of Adverse Events, and Variations to the Approved Protocol as detailed below.

PLEASE NOTE:
In the case where the HREC has “noted” the approval of an External HREC, progress reports and reports of adverse events are to be submitted to the External HREC only. In the case of Variations to the approved protocol, or a Renewal of approval, you will apply to the External HREC for approval in the first instance and then Register that approval with the University's HREC.

- **Monitoring of Progress**

Other than above, the University is obliged to monitor the progress of research projects involving human participants to ensure that they are conducted according to the protocol as approved by the HREC. A progress report is required on an annual basis. Continuation of your HREC approval for this project is conditional upon receipt, and satisfactory assessment, of annual progress reports. You will be advised when a report is due.

- **Reporting of Adverse Events**

1. It is the responsibility of the person **first named on this Approval Advice** to report adverse events.
2. Adverse events, however minor, must be recorded by the investigator as observed by the investigator or as volunteered by a participant in the research. Full details are to be documented, whether or not the investigator, or his/her deputies, consider the event to be related to the research substance or procedure.
3. Serious or unforeseen adverse events that occur during the research or within six (6) months of completion of the research, must be reported by the person first named on the Approval Advice to the (HREC) by way of the Adverse Event Report form within 72 hours of the occurrence of the event or the investigator receiving advice of the event.
4. Serious adverse events are defined as:
   - Causing death, life threatening or serious disability.
   - Causing or prolonging hospitalisation.
   - Overdoses, cancers, congenital abnormalities, tissue damage, whether or not they are judged to be caused by the investigational agent or procedure.
   - Causing psycho-social and/or financial harm. This covers everything from perceived invasion of privacy, breach of confidentiality, or the diminution of social reputation, to the creation of psychological fears and trauma.
   - Any other event which might affect the continued ethical acceptability of the project.
5. Reports of adverse events must include:
   - Participant's study identification number;
   - date of birth;
   - date of entry into the study;
   - treatment arm (if applicable);
   - date of event;
   - details of event;
   - the investigator's opinion as to whether the event is related to the research procedures; and
   - action taken in response to the event.
6. Adverse events which do not fall within the definition of serious or unexpected, including
those reported from other sites involved in the research, are to be reported in detail at the
time of the annual progress report to the HREC.

- **Variations to approved protocol**

If you wish to change, or deviate from, the approved protocol, you will need to submit an
Application for Variation to Approved Human Research. Variations may include, but are not limited
to, changes or additions to investigators, study design, study population, number of participants,
methods of recruitment, or participant information/consent documentation. Variations must be
approved by the (HREC) before they are implemented except when Registering an approval of a
variation from an external HREC which has been designated the lead HREC, in which case you
may proceed as soon as you receive an acknowledgement of your Registration.

**Linkage of ethics approval to a new Grant**

HREC approvals cannot be assigned to a new grant or award (ie those that were not identified on
the application for ethics approval) without confirmation of the approval from the Human Research
Ethics Officer on behalf of the HREC.

Best wishes for a successful project.

Professor Allyson Holbrook
Chair, Human Research Ethics Committee

*For communications and enquiries:*

**Human Research Ethics Administration**

Research Services
Research Integrity Unit
HA148, Hunter Building
The University of Newcastle
Callaghan NSW 2308
T +61 2 492 18999
F +61 2 492 17164
Human-Ethics@newcastle.edu.au

**Linked University of Newcastle administered funding:**

<table>
<thead>
<tr>
<th>Funding body</th>
<th>Funding project title</th>
<th>First named investigator</th>
<th>Grant Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Learning and Teaching Council/Research Grant(**)</td>
<td>Enhancing the teaching of medication safety to nursing, pharmacy and medical students through interprofessional education (IPE)</td>
<td>Levett-Jones Tracy.</td>
<td>G1000934</td>
</tr>
</tbody>
</table>
Appendix K: Text of covering email to Heads of Schools

The University of Newcastle

Profession Tracy Levett-Jones (Principal Supervisor)
Deputy Head of School (Teaching and Learning)
School of Nursing and Midwifery
Faculty Health
The University of Newcastle
University Drive, Callaghan
Phone 49216599
Fax 49216301
Tracy.levett-jones@newcastle.edu.au

Text of covering email to Heads of Schools

Interprofessional Education: Theory of Planned Behaviour Medication Safety Questionnaire

We would like to invite your university to take part in a project which is being carried out by researchers from the University of Newcastle, the University of Wollongong and the University of Tasmania. The project team is led by Professor Tracy Levett-Jones and is being conducted as a component of Samuel Lapkin’s Doctor of Philosophy project. The project is funded by the Australian Learning and Teaching Council and aims to develop and evaluate a series of web-based, interprofessional learning modules to teach health professional students about medication safety. You are being asked to help facilitate the recruitment of students who are in their second year of enrolment or later within your [Nursing/Medicine/Pharmacy] School to assist with part of the evaluation of this project. Participating in this project is voluntary.

Evaluating the impact of teaching innovations on students’ clinical practice behaviours is a challenge in educational research. We have created a questionnaire, based on instruments used to examine behavioural intentions in other contexts. Using a series of clinical scenarios, the web-based Theory of Planned Behaviour Medication Safety Questionnaire will explore students’ intentions to behave in a way that promotes medication safety. There are two phases in this part of the project, involving three separate groups of students:

1) Pilot testing and validating the Theory of Planned Behaviour Medication Safety Questionnaire and examining its capacity to measure the behavioural intentions of health professional students.

2a) Examining the impact of web-based interprofessional learning modules on health professional students’ behavioural intentions in relation to medication. Students in this group (control) group will be given access to web-based learning modules after completing the questionnaire.

2b) Examining the impact of web-based interprofessional learning modules on health professional students’ behavioural intentions in relation to medication safety. Students in this (experimental) group will be asked to work through web-based learning modules before completing the questionnaire.

Your university has been selected [insert randomly for phase 2a and 2b] to take part in phase [1/2a/2b] of the project. We ask that you forward this email and the attached Information Statement to appropriate academic staff members (for example Course Coordinators or Program Convenors) in your school who are involved in the teaching of undergraduate or post-graduate nursing, pharmacy or medical students in their second year of enrolment or later. These staff members are asked to forward the project Information Statement to students in the second year or later of any undergraduate or post-graduate pharmacy, nursing, or medical program.
When the project is completed a summary of results will be available on the project’s website and Heads of participating Schools will be notified when these are available. If you would like further information please contact:

Samuel Lapkin Samuel.Lapkin@newcastle.edu.au

Thank you for considering this invitation.

**Professor Tracy Levett-Jones**  
RN, PhD, MEd & Work, BN, DipAppSc (Nursing)

**Doctor Conor Gilligan**  
PhD, B.Biomed Sci (Hons)

**Samuel Lapkin**  
RN, BN (Hons) (PhD candidate)

**Complaints about this research**

This project has been approved by the University’s Human Research Ethics Committee, Approval No. H-2012-0080. Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.
Appendix L: Information Statement for the Research Project

Professor Tracy Levett-Jones (Principal Supervisor)
Deputy Head of School (Teaching and Learning)
School of Nursing and Midwifery
Faculty Health
The University of Newcastle
University Drive, Callaghan
Phone 49216599
Fax 49216301
Tracy.levett-jones@newcastle.edu.au

Survey Information Statement for the Research Project (Control Group):

Interprofessional Education: Theory of Planned Behaviour Medication Safety Questionnaire

You are invited to take part in a survey that is being carried out by researchers from the University of Newcastle, the University of Wollongong, and the University of Tasmania. The project team is led by Professor Tracy Levett-Jones and is being conducted as a component of Samuel Lapkin's Doctor of Philosophy project. The project is funded by the Australian Learning and Teaching Council (ALTC).

**Why is the research being done?**
The aim of this project is to examine the impact of web-based interprofessional learning modules on health professional students' behavioural intentions in relation to medication safety. Evaluating the impact of teaching innovations on health professional students' clinical practice behaviours can be challenging. Consequently we have developed a questionnaire that uses a series of clinical scenarios and explores students' intentions to behave in a way that promotes medication safety in their clinical practice.

**Who can participate in the research?**
Students enrolled in the second year or later of an undergraduate or postgraduate nursing, pharmacy or medical program at any Australian or New Zealand University are eligible to participate.

**What choice do you have?**
Participation in this research is entirely your choice. Completion of the questionnaire will be taken as implied consent. Because all responses are anonymous, once you complete the survey, your data cannot be withdrawn. Whether or not you decide to participate, your decision will not disadvantage you.

**What would you be asked to do?**
If you agree to participate, you will be asked to complete a web based questionnaire containing clinical scenarios and questions about decisions related to medication safety.

**How much time will it take?**
The online questionnaire will take approximately 10 minutes to complete.

**What are the risks and benefits of participating?**
There are no direct benefits for completing the questionnaire. However, your responses will inform the development of appropriate interprofessional web-based teaching and learning resources related to medication safety. Once you have completed the questionnaire, you will be given access to online...
interprofessional learning resources relating to medication safety. You may obtain education benefit from these modules. There are no anticipated risks for participating in this project.

**How will your privacy be protected?**
This survey will be anonymous. Your name and any details you provide will not be linked to any of your responses. You will be asked to provide the name of your university and the profession you represent. This will be used to remove your university from follow-up mailings to non-responders. However, all results will be reported in aggregate form with no university or person individually identified. All collected data will be password protected and access will be only available to the researchers. Only the researchers will have access to the survey data on the secure server. Once data has been downloaded from the survey program it will be stored on a password protected computer or in locked storage. Data will be identified by participants’ numerical codes only.

**How will the information collected be used?**
Data collected in this study will inform the development of teaching and learning resources and will form the basis of papers submitted for publication in scholarly journals and at professional conferences. No individuals or universities will be identified in any of these fora. The survey will also form part of a thesis to be submitted for Samuel Lapkin’s Doctor of Philosophy degree. You will be able to access a summary of the results on the project website http://www.ipeforqum.com.au/

**What do you need to do to participate?**
Please read this Information Statement and be sure you understand its contents before you consent to participate. If there is anything you do not understand, or you have questions, contact one of the researchers. To participate, please follow this link to complete the questionnaire [link was placed here]

Proceeding in this manner will be taken as informed and implied consent that you are willing to participate.

**Further information**
If you would like further information please contact:

Samuel Lapkin Samuel.Lapkin@newcastle.edu.au

Thank you for considering this invitation.

**Professor Tracy Levett-Jones**
RN, PhD, MEd & Work, BN, DipAppSc (Nursing)

**Doctor Conor Gilligan**
PhD, B.Biomed Sci (Hons)

**Samuel Lapkin**
RN, BN (Hons) (PhD candidate)

**Complaints about this research**
This project has been approved by the University's Human Research Ethics Committee, Approval No. H-2012-0080. Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.
Survey Information Statement for the Research Project (Experimental Group):

Interprofessional Education: Theory of Planned Behaviour Medication Safety Questionnaire

You are invited to take part in a survey that is being carried out by researchers from the University of Newcastle, the University of Wollongong, and the University of Tasmania. The project team is led by Professor Tracy Levett-Jones and is being conducted as a component of Samuel Lapkin’s Doctor of Philosophy project. The project is funded by the Australian Learning and Teaching Council (ALTC).

**Why is the research being done?**

The aim of this project is to examine the impact of web-based interprofessional learning modules on health professional students' behavioural intentions in relation to medication safety. Evaluating the impact of teaching innovations on health professional students' clinical practice behaviours can be challenging. Consequently we have developed a questionnaire that uses a series of clinical scenarios and explores students' intentions to behave in a way that promotes medication safety in their clinical practice.

**Who can participate in the research?**

Students enrolled in the second year or later of an undergraduate or postgraduate nursing, pharmacy or medical program at any Australian or New Zealand University are eligible to participate.

**What choice do you have?**

Participation in this research is entirely your choice. Completion of the questionnaire will be taken as implied consent. Because all responses are anonymous, once you complete the survey, your data cannot be withdrawn. Whether or not you decide to participate, your decision will not disadvantage you.

**What would you be asked to do?**

If you agree to participate, you will be asked to view one online interprofessional learning module focused on medication safety, and then complete an anonymous online survey. The survey uses scenarios and asks questions about your beliefs and decisions related to medication processes in your professional role.

**How much time will it take?**

You will be asked to work through one module on our project website. We would like you to engage with the modules for at least 30 minutes. The survey will take approximately 10 minutes to complete.

**What are the risks and benefits of participating?**

There are no direct benefits for completing the questionnaire. However, your responses will inform the development of appropriate interprofessional web-based teaching and learning resources related to
medication safety. Once you have completed the questionnaire, you will be given access to online interprofessional learning resources relating to medication safety. You may obtain education benefit from working through the online modules. There are no anticipated risks for participating in this project.

How will your privacy be protected?

This survey will be anonymous. Your name and any details you provide will not be linked to any of your responses. You will be asked to provide the name of your university and the profession you represent. This will be used to remove your university from follow-up mailings to non-responders. However, all results will be reported in aggregate form with no university or person individually identified. All collected data will be password protected and access will be only available to the researchers. Only the researchers will have access to the survey data on the secure server. Once data has been downloaded from the survey program it will be stored on a password protected computer or in locked storage. Data will be identified by participants’ numerical codes only.

How will the information collected be used?

Data collected in this study will inform the development of teaching and learning resources and will form the basis of papers submitted for publication in scholarly journals and at professional conferences. No individuals or universities will be identified in any of these fora. The survey will also form part of a thesis to be submitted for Samuel Lapkin’s Doctor of Philosophy degree. You will be able to access a summary of the results on the project website http://www.ipeforqum.com.au/

What do you need to do to participate?

Please read this Information Statement and be sure you understand its contents before you consent to participate. If there is anything you do not understand, or you have questions, contact one of the researchers. To participate, please follow the link to the online module and follow the instructions to complete the module [link will be placed here]. Once you have completed the module you will be directed to the questionnaire. Proceeding in this manner will be taken as informed and implied consent that you are willing to participate.

Further information

If you would like further information please contact:

Samuel Lapkin Samuel.Lapkin@newcastle.edu.au

Thank you for considering this invitation.

Professor Tracy Levett-Jones
RN, PhD, MEd & Work, BN, DipAppSc (Nursing)

Doctor Conor Gilligan
PhD, B.Biomed Sci (Hons)

Samuel Lapkin
RN, BN (Hons) (PhD candidate)

Complaints about this research

This project has been approved by the University’s Human Research Ethics Committee, Approval No. H-2012-0080. Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.
Appendix M: Theory of Planned Behaviour Medication Safety Questionnaire

Interprofessional Education: Theory of Planned Behaviour Medication Safety Questionnaire

Welcome!

Thank you for taking time to participate in this research project. Completing this questionnaire is an opportunity to provide your opinions regarding medication safety. The data you provide will be used to improve the quality of health professional education. The questionnaire will take about 10 minutes to complete. If you have any questions about the survey, please feel free to email: IPEforQUM@newcastle.edu.au or call: +61 249 85368
**Instructions**

1. The following questionnaire asks questions about beliefs and decisions related to medication safety.
2. There are no right or wrong answers.
3. Many questions in this survey make use of rating scales with 7 response options please answer according to your knowledge of your professional role.
4. Read each question carefully as some of the questions appear to be similar, but they do address somewhat different issues.
5. All responses to this survey are anonymous.
6. Submission of this survey will be taken as your implied consent.
7. If you do not want to complete the survey please click the cancel button below.
**SECTION A: SCENARIOS**

*What profession do you represent?*
- ONursing
- OPharmacy
- OMedicine

*(In the online version participants will only be provided with their respective profession specific scenarios based responses to the above question)*

**Scenario 1:**

**Scenario (for nursing students only):** You are a new graduate nurse who has just started working in the orthopaedic ward. You are reviewing Martin Johnson a 49 year-old male patient who has a pelvic fracture. On day two post op it was discovered that Martin had not received any medication for the prevention of venous thromboembolism. This was despite the recent VTE guidelines being readily available on the ward. Chemical and mechanical VTE prophylaxis were immediately commenced and there appeared to be no adverse patient outcomes.

**Scenario (for medical students only):** You are an intern who has just started working with the orthopaedic team. You are reviewing Martin Johnson a 49 year-old male patient who has a pelvic fracture. On day two post op it was discovered that Martin had not received any medication for the prevention of venous thromboembolism. This was despite the recent VTE guidelines being readily available on the ward. Chemical and mechanical VTE prophylaxis were immediately commenced and there appeared to be no adverse patient outcomes.

**Scenario (for pharmacy students only):** You are a recently registered clinical pharmacist. You are on the orthopaedic ward reviewing the medication chart of Martin Johnson a 49 year-old male patient who has a pelvic fracture. On day two post op it was discovered that Martin had not received any medication for the prevention of venous thromboembolism. This was despite the recent VTE guidelines being readily available on the ward. Chemical and mechanical VTE prophylaxes were immediately commenced and there appeared to be no adverse patient outcomes.

1. In this situation would you want the person responsible for this omission reprimanded?  
   *Yes / No*

2. This would be a straightforward decision

   *Strongly disagree 1 2 3 4 5 6 7 Strongly agree*

3. Reviewing the factors that contributed to this medication incident is the responsibility of a senior member of staff

   *Strongly disagree 1 2 3 4 5 6 7 Strongly agree*
4. It is important that the individual/s responsible for this medication incident are identified and cautioned

   Strongly disagree  1  2  3  4  5  6  7 Strongly agree

5. Reviewing of medications incidents and initiating practice improvement to prevent reoccurrence requires a team approach

   Strongly disagree  1  2  3  4  5  6  7 Strongly agree

6. I would find it difficult to speak to other members of the team if I identified this medication incident

   Strongly disagree  1  2  3  4  5  6  7 Strongly agree

7. I would expect my colleagues to tell me if I made this type of medication incident

   Strongly disagree  1  2  3  4  5  6  7 Strongly agree

8. My colleagues would expect me to take the initiative for reviewing the factors that contributed to this medication incident

   Strongly disagree  1  2  3  4  5  6  7 Strongly agree

9. I need to take the lead in reviewing medication incidents and related practice improvements to prevent reoccurrence

   Strongly disagree  1  2  3  4  5  6  7 Strongly agree

10. I feel comfortable questioning senior staff about medication incidents.

    Strongly disagree  1  2  3  4  5  6  7 Strongly agree

11. I have the confidence to initiate actions to prevent reoccurrence of this type of medication incident

    Strongly disagree  1  2  3  4  5  6  7 Strongly agree

12. As a recent graduate I am not in the position to address and follow up on medication incidents

    Strongly disagree  1  2  3  4  5  6  7 Strongly agree
13. I have the interprofessional communication skills required to manage this type of situation and prevent reoccurrence

Strongly disagree  1  2  3  4  5  6  7  Strongly agree

14. Medication incidents are related to human factors and are therefore difficult to prevent

Strongly disagree  1  2  3  4  5  6  7  Strongly agree

End of Scenario 1
Scenario 2:

Scenario (for nursing students only): Mrs Emily Latham, a 74 year old woman with type 2 diabetes has been admitted to hospital following a fall. Because of her elevated HbA1c (glycosylated hemoglobin) and concerns about her self-management of diabetes Mrs Latham’s hypoglycaemic medication is changed from metformin to glucovance. You are the nurse administering the new medication to the patient for the first time.

Scenario (for medical students only): Mrs Emily Latham, a 74 year old woman with type 2 diabetes has been admitted to hospital following a fall. Because of her elevated HbA1c (glycosylated hemoglobin) and concerns about her self-management of diabetes Mrs Latham’s oral hypoglycaemic medication is changed from metformin to glucovance. You are the JMO who is writing up this new medication.

Scenario (for pharmacy students only): Mrs Emily Latham, a 74 year old woman with type 2 diabetes has been admitted to hospital following a fall. Because of her elevated HbA1c (glycosylated hemoglobin) and concerns about her self-management of diabetes Mrs Latham’s oral hypoglycaemic medication is changed from metformin to glucovance. You are the clinical pharmacist reviewing Mrs Latham’s chart and you notice the new order.

15. When you [prescribe, administer, review] the glucovance should you explain to Mrs Latham why her medications have been changed?

   Yes/No

16. This would be a straightforward decision

   Strongly disagree 1 2 3 4 5 6 7 Strongly agree

17. Medication incidents can be prevented by including patients as active participants in their care

   Strongly disagree 1 2 3 4 5 6 7 Strongly agree

18. Patients need to understand why they are taking medications as well as when and how to take them

   Strongly disagree 1 2 3 4 5 6 7 Strongly agree

19. Detailed medication information will just confuse older people

   Strongly disagree 1 2 3 4 5 6 7 Strongly agree

20. My colleagues expect me to educate patients about their medications
21. Most patients expect education about their medications

22. My patients trust me to [prescribe, administer, dispense] the correct medications and therefore don’t need me to explain why they are being given each one

23. Educating patients about their medications is part of my role

24. I decide on the type and amount of information that patients are given about their medications

25. I rarely have time to educate patients about their medications

End of Scenario 2
Scenario 3:

Scenario (for nursing students only): Yeun-Sim is a 18 month old girl admitted to the paediatric unit for gastroenteritis and moderate dehydration. Her mother speaks limited English and is very anxious. You commence a flask of 0.45% NaCl + 2.5% Glucose IV @ 140mL/hour. You check on Yeun-Sim an hour later and realise that you have administered the wrong flask of IV fluids – the order was for 0.9% NaCl + 2.5% Glucose. You immediately discontinue the flask and change it to the correct one. There is no indication that Yeun-Sim’s condition has been affected by this incident.

Scenario (for medical students only): Yeun-Sim is a 18 month old girl admitted to the paediatric unit for gastroenteritis and moderate dehydration. Her mother speaks limited English and is very anxious. You order a flask of 0.45% NaCl + 2.5% Glucose IV @ 140mL/hour which the nurse subsequently administers. You check on Yeun-Sim an hour later and realise that you have ordered the wrong bag of IV fluids – you should have ordered for 0.9% NaCl + 2.5% Glucose. You immediately discontinue the flask and correct the order. There is no indication that Yeun-Sim’s condition has been affected by this incident.

Scenario (for pharmacy students only): Yeun-Sim is a 18 month old girl admitted to the paediatric unit for gastroenteritis and moderate dehydration. Her mother speaks limited English and is very anxious. During your review of Yeun-Sim’s chart you identify that a flask of 0.45% NaCl + 2.5% Glucose IV @ 140mL/hour was commenced an hour ago but the order was for 0.9% NaCl + 2.5% Glucose. There is no indication that Yeun-Sim’s condition has been affected by this incident.

26. Do you see a need to tell Yeun-Sim’s mother about this incident?  

Yes/No

27. This would be a straightforward decision

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

28. Irrespective of the medication or the situation I believe that the incident should be disclosed to Yeun-Sim’s mother

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

29. I would be not be inclined to tell Yeun-Sim’s mother about the incident as there is no harm to the patient

Strongly disagree 1 2 3 4 5 6 7 Strongly agree
30. I would be not be inclined to tell Yeun-Sim’s mother about the incident because she is already anxious and may have difficulty understanding because of her limited English

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

31. Adherence to hospital policies regarding medication incident disclosure is imperative

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

32. Disclosure of incidents such as this one causes the public to be distrustful of health care professionals

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

33. It is my role to inform patients or a member of their family if a medication incident occurs

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

34. Concerns about the reaction of Yeun-Sim’s mother may prevent me from telling her about the medication incident

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

35. Other health care professionals would expect me to tell Yeun-Sim’s mother of this incident

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

36. Concerns about what my colleagues may think would influence if and how I would disclose this medication incident to Yeun-Sim’s mother

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

37. I can decide on whether medication incidents are disclosed to patients and/or their family

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

38. The competing demands of clinical units would influence whether or not I would tell Yeun-Sim’s mother about this medication incident

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

End of Scenario 3
Scenario 4:

**Scenario (for nursing students only):** It is 0800 hours and a busy shift on the surgical unit. You are administering medications to the patients in a four bed room. An intern interrupts you and asks you a question about the medications of another patient. As a result you nearly make a medication error. This JMO often interrupts you with routine inquires when you are administering medications.

**Scenario (Medical students):** It is 0800 hours and a busy shift on the surgical unit. You are writing up discharge medications for four patients. A registered nurse interrupts you and asks you a question about the medications of another patient. As a result you nearly make a medication error. This RN often interrupts you with routine inquires when you are writing up medications.

**Scenario (Pharmacy students):** It is 0800 hours and a busy shift on the surgical unit. You are reviewing the medications for the patients in a four bed room. A registered nurse interrupts you and asks you a question about the medications of another patient. As a result you nearly make an incident in relation to medication review. This RN often interrupts you with routine inquires when you are reviewing medications.

37. I would discuss my concerns about being interrupted so often when I am obviously busy

Yes/No

38. This would be a straightforward decision

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

39. Frequent interruptions lead to medication incidents

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

40. I feel that interruptions are annoying but inevitable in busy clinical units

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

41. If the members of the health care team respect each other’s roles and responsibilities they will be judicious about interrupting each other

Strongly disagree 1 2 3 4 5 6 7 Strongly agree
42. Generally, other health professionals know they should keep interruptions to a minimum in order to prevent medication errors

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

43. I expect other health professionals to understand that interrupting me can lead to medication errors

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

44. My supervisor would expect me to find ways to minimise unimportant interruptions

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

45. Generally, I think that other health professionals do not understand my role and responsibilities so they do not hesitate to interrupt me

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

46. I'm not sure of the best way to tell someone that interrupting me is a risk to patient safety

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

End of Scenario 4
SECTION B: DEMOGRAPHICS

1. What university are you enrolled at?

Your response will only be used to remove your institution from follow-up mailings to non-responders. All results will be reported in aggregate form with no institution or individual identified.

2. Are there any other health professional programs offered at your university? (tick all that apply)
   - Nursing
   - Pharmacy
   - Medicine
   - Midwifery
   - Others (please specify)

3. Have you previously participated in or accessed any interprofessional education resources?
   - ONo
   - OYes
   If so, please describe them below

Question for the Experimental Group only

4. As part of this study did you view any interprofessional education modules before completing the questionnaire?
   - ONo
   - OYes
   If so, which IPE modules did you view?
   - Eileen Poole
   - Vanessa Anderson
   - Mark Green (not currently available)
   - Gavin Brown (not currently available)
   - Others (please specify)
Additional Questionnaire Evaluation Questions for Pilot Study Only

Please use the space provided below to comment on the structure, clarity or content of the questionnaire

End of questionnaire

Thank you for taking the time to complete this survey. Your participation is very valuable.

The IPE for QUM team
Appendix N: Script of web-based IPE learning module

INTERPROFESSIONAL EDUCATION FOR QUALITY USE OF MEDICINES

FOCUS OF SCRIPT: VTE prophylaxis guidelines and processes

The video you are about to view was adapted from an actual clinical case in which a serious clinical error occurred and this resulted in a person’s death. The coroner’s report following the inquest identified the following key areas for improvement:

- Communication between staff and during handover
- Documentation and clear identification of decisions
- Use of appropriate guidelines and protocols.

PATIENT: Mark Green, 65 year-old male

HISTORY:
- No pre-existing medical conditions; non-smoker
- No family history of Deep Vein Thrombosis (DVT) or Pulmonary Embolism (PE)
- Weight 75kg
- Mr Green was brought to the Emergency Department (ED) following a motor vehicle accident (MVA).
- A driver went through a stop sign and hit the side of his vehicle. Mr Green is experiencing pain in his right hip region. A small bruise is visible in that area.

INITIAL OBSERVATIONS:
- BP 130/82, HR 104 regular, RR 18, O₂ Sats 99% on room air, afebrile
- Plain X-rays of pelvis – showing fractured right neck of femur
- FBC – NAD, UEC – NAD
- Pain scale: 5-6 out of 10
Setting: Emergency Department

Day of admission: 2130

Orthopaedic Registrar enters…

OR: Hi there Mr Green…Mark is it…do you mind if I call you Mark?

MG: That's fine

OR: Ok Mark, I've had a look at your X-ray, and you have a fracture in your pelvis…its right up here in this bone [pointing on his own leg and on the x-ray]– it’s the neck of the femur, which is the top of the bone that runs down your thigh. So you'd be getting some pain on that right side at the moment?

MG: Nods

OR: Now, it's what we call a displaced fracture, so the broken part of the bone has separated, and we'll need to …go in and put it back together.

MG: looks quizzical…

OR: So we’ll need to operate and fix the fracture by joining the two broken bits with what is sort of like a nail. I can show you one on another x-ray I have here…[scrolling through images to show appropriate x-ray]. We’ll get you into surgery tomorrow morning and then it will be a case of getting you up and moving as soon as possible.

MG: OK…

OR: So we’ll get you up into the orthopaedic ward for the night but in the meantime I’ll just need to get you to sign some paperwork – just saying that you’re ok for us to fix you up basically…

OR is looking at patient chart and is about to write orders but is called away (hear voice at door or pager) and puts chart down, thanks patient and leaves in a rush

Critical Thinking Questions:

What did the orthopaedic registrar do well in this interaction?

What did the orthopaedic registrar do poorly in this interaction?

Was this a good example of informed consent? WHY/WHY NOT?

Was this an example of effective communication? WHY/WHY NOT?

At this stage is bleeding or venous thromboembolism (VTE) likely to be of greater concern?
Setting: Orthopaedic Ward
Day of surgery: 0100

The patient is being transferred to the orthopaedic ward for theatre in the morning.

Ward RN: Hi Meg – looks like you’re having a busy night down there.

ED RN: Flat out – hardly time to breathe! Hey I didn’t know you were in orthopaedic ward now.

Ward RN: Just started this week. But the consultant’s on holidays so it’s been quiet!

ED RN: Great. Anyway, you’ve got Mr Green here, he’s been in MVA and has a fractured right neck of the femur. He’s booked for surgery in the morning so [looking at watch] fasting until then. He was given 10mg morphine at 2330. Obs OK.

Ward RN: Ok, thanks I’ll take it from here.

ED RN: Thanks, I might be back up with another one yet! [rushes off]

Critical Thinking Question:
How could communication between the ED RN and ward RN have been improved?

At patient’s bedside in ward

Ward RN: (tidying bedding): Is that ok for you Mr Green?

MG: Yeah, it’s not too bad

Ward RN: You’ve got some pain?

MG: Yeah…

Ward RN: You had some morphine down in ED (pt nods) we’ll have to wait a bit longer before I can give you anything else.

MG: Yep, I think its easing a bit…

Ward RN: Ok well I’ll come back in a little while and check on you. (leaves room)

Mrs Green (patient’s wife): It’s not ok is it?

MG: Hurts like hell but I think it might be easing a bit

Mrs Green: laughs – don’t play tough…tell them when you’re in pain.

MG: Yeah, yeah…tell you what, I could do with something to eat – never did get to pick up that take-away…

Mrs Green: OK, I’ll ask the nurse…leaves to get nurse
Ward RN (returning with Mrs Green): *Sorry Mr Green, because you’re going in for surgery in the morning, I can’t give you anything orally – you need to fast for the surgery.*

MG: *oh great…*

Mrs Green: *He was on his way to pick up our Sunday night take-away dinner when this happened*

Ward RN: *Oh no…well you’ll be well and truly fasted by the morning then. You’re better off just trying to get some sleep – hopefully that will take your mind off the pain and the hunger.*

Mrs Green: *Do you think you can sleep or are you in too much pain?*

MG: *I’ll be right – you go – you should eat something and get some sleep. Tell the kids I’m OK.*

Ward RN: *(quietly to Mrs Green): You may as well go home and come back in the morning – try to get some rest (walks away, leaving the couple to talk).*
Setting: Operating Theatre (OT)

Day of surgery: 130

The patient was taken to theatre and internal fixation of fracture was undertaken.

Pre-operative orders did not include chemical or mechanical VTE prophylaxis.

During surgery, circulation observations were performed as well as pneumatic calf compression.

No orders were given to continue this post-operatively.

**OR:** [starting to write post-op orders in operation chart]...I'll write up analgesia and VTE prophylaxis with Clexane.... [pager goes off – beep beep beep, beep beep beep – glances at message] aaah – ok I've gotta get down to ED – I'll finish this later.

**OT RN:** Looking annoyed: Sure

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Setting: Orthopaedic ward

Day 1

Mr Green went back to the orthopaedic ward to recover after his surgery. Over the next two days he was visited by the orthopaedic intern (JMO) who asked about pain and movement but did not do a physical examination or review the medication chart.

Show patient in bed – different scenes to show time passing, wife sitting by bed reading, nurses coming to check vital signs, check PCA etc.

Intern visiting patient:

Intern: How is it feeling Mr Green?

MG: Oh, not too bad I ‘spose…all things considered.

Intern: So the pain relief is helping?

MG: Yeah, I don’t feel like I could run a marathon but I can cope while I’m laying here.

Intern: Ok, that’s good to hear.

MG: Listen…I just wondered…and I don’t mean to offend but I haven’t actually seen a….like a more senior Doctor at all.

Intern: Our consultant is actually away at the moment but he will be back tomorrow and he’ll probably do a round in the morning.

Mrs Green: Oh, good.

MG: Thanks Doc.

(fade)
Setting: Orthopaedic ward

Day 2

New Graduate RN (tidying pillows and sitting Mr Green up for breakfast): How are you feeling today Mr Green?

MG: Oh, just the same really

New Graduate RN How’s the pain?

MG: Still aches and sore as hell when I move my leg.

New Graduate RN (looking at PCA and medication chart): OK – what else are you ordered for pain .... (reading chart and looking concerned) .... I’ll be back in a little while Mr Green.

MG: Righto, thanks.

(Fade)

New Graduate RN (goes to nurses station and approaches another nurse): Hey Lyn I just noticed that Mr Green in bed 4B doesn’t seem to be on anything for VTE prophylaxis. He’s had surgery to repair a fractured NOF – shouldn’t he be on something?

Ward RN: Yeh you’d think so... you should tell Craig.

New Graduate RN: The intern?

Ward RN: Yeah, you know, the really friendly one (sarcastic)

New Graduate RN: oh no...I’m only a new grad, I can’t tell him what to do...can you talk to him?

Ward RN: No way, he won't listen anyway. Don’t worry about it – there’s probably a good reason for it. Anyway Mr McGarry the consultant will be back tomorrow.

New Graduate RN: OK then (looking worried)

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Setting: Orthopaedic ward

Day 3

Ward rounds

Consultant: Hi there Mr Green, I’m Rob McGarry, I’m the orthopaedic consultant here, and you know my registrar and intern

MG: Yep, hi

Consultant: So how have you been getting on since your surgery?

MG: Not too bad – I’m a bit sick of just lying here though

Consultant: Understandable! So the pain has been OK?

MG: Yeah, well to too bad but it does get pretty sore.

Consultant: Ok, but you’ve been able to move your legs a bit?

MG: Err – not so much, should I be? I mean it’s been a bit sore for that.

Consultant: [looking at chart] What have we got you on for pain…? [looks at chart and notices that no VTE is recorded…turns to RN]…what’s been happening with the Clexane?

New Graduate RN: was it ordered?

Consultant: Ummm – should have been – (turns to intern) Could you see if Oliver, the pharmacist is around…

Consultant: (turns to patient and lifts sheet from lower legs): do we have any stockings on you Mr Green? No, it doesn’t look like it…I’m just going to have a look at your legs if that’s ok…just looking for any swelling or anything like that…is there any pain?

MG: Yeah, it does hurt a bit, is that likely to be a problem?

Consultant: aah, well when we’re stuck in bed as you are, and we don’t get much movement, sometimes the blood can clot and cause some problems. Your right leg seems a bit swollen …. you don’t normally get puffy or mottled colour in the legs do you?

MG: No – never

Intern returns with pharmacist who takes patient chart and starts reading

Consultant: ok well I think we’ll send you down for an ultrasound and start you on some medication that will help to thin your blood a bit and should prevent this leading to anything else. We’ll keep an eye on it over the next few days though, and we’ll start to try and get you moving a bit as well. Have you seen the physio yet?

MG: No, not yet.
Consultant: OK well we might get someone up to see you later today and see if you can start to move those legs a bit. In the meantime, try to wiggle your toes a bit if you can – just as you’re lying there. I’ll see later on.

MG: righto

Consultant, pharmacist, intern, registrar and RN walk outside the patient’s room

Pharmacist: (turning to consultant and speaking quietly): there’s no mention here of VTE prophylaxis – nothing pharmacological or mechanical…I’d suggest starting immediately.

Consultant: It should have started pre-op…(turns to registrar)...we’ll need to start Mr Green on subcutaneous Clexane immediately – (addressing Pharmacist) what dose would you suggest?

Pharmacist: (looking at chart again): Well he’s 3 days post-op, and he hasn’t had anything at all – does he have any symptoms?

Consultant: A bit of redness in his legs and swelling. We should probably do an ultrasound.

Pharmacist: Well we’ll need to start Clexane, if the ultrasound shows a DVT a treatment dose would be 120 mg daily based on his weight and renal function. And we’ll also need to start warfarin in 2-3 days. If the ultrasound is clear a prophylactic dose will be OK.

Consultant: (to OR, intern and RN) We need to have a bit of chat about this if that’s ok – we’ll go to the meeting room…all turn and walk away.

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Critical thinking:

This grand round included members of the interprofessional medication team.

Is this usual practice?

What are some of the advantages of collaborating in this way?
Setting: Meeting room

Consultant: (addressing registrar, intern, new grad, and RN): ok, so we’ve just had what you might call a ‘near miss’ – Mr Green in Bed 5 was not on any pharmacological or mechanical VTE prophylaxis. [Facing OR] – the patient should have been started on Clexane …now I’m not sure why that didn’t happen – was there concern about contraindications?

OR: No I….I had to rush to ED….I was concerned about bleeding.

Pharmacist: Well… although heparin can be reversed readily with protamine if bleeding occurs, it’s not very effective with clexane. But he doesn’t appear to have any contraindications or medical conditions to make us worry about bleeding.

Consultant: Ok – so given that this man has no family history of blood clots but has had a hip fracture and has been immobile for…3-4 days now – I’d say he would be in the high risk category for VTE. We have VTE prophylaxis guidelines – what should we be doing for a patient in this category?

New graduate RN: Look I’m really sorry – I noticed this yesterday but I didn’t say anything - he should have been on a prophylactic anticoagulant and have TEDS on (looking concerned)...

OR: It’s not your fault… we should have picked this up (looking at intern) and there should have been some orders for getting him mobilised

Consultant: Yes – I had assumed that this was happening – it should be routine to assess patients for VTE risk – most will need some form of prophylaxis, if not pharmacological, then definitely TEDS, and routine physical examination of the lower limbs.

New graduate RN: none of this was written in the chart...

Consultant: But we do have protocols.

OR: I know; I should have started the Clexane...

Consultant: (assertively ) Look, this isn’t about blaming one person for a mistake – it’s about figuring out how we can prevent it from happening again. The risk should have been assessed and your decision recorded. The physical examination should be routine though – especially in this ward, this is important for all patients.

Pharmacist: If you’re not sure about the contraindications or the need for the pharmacological options call me and I can come and do a review.

Consultant: OK, thanks, and we need to, as a matter of course, follow the anticoagulant protocols and chart the decisions about prophylaxis in the appropriate place.

All nodding

Fade out
Critical Thinking Questions:

Who was responsible for the errors that occurred in this scenario? Should individuals who are to blame be identified?

Identify three stages in this scenario where the error could have been prevented or identified – what communication, teamwork, or leadership skills could be used in each of these stages to deal with the situation?
Setting: Orthopaedic ward

Later in Day 3

New Graduate RN attends patient with the Clexane injection.

**New Graduate RN:** Hi Mr Green, the Dr has ordered a new medication for you…I’m just going to have to give you this needle, I’ll put it in your abdomen, if that’s ok?

*Mr Green nods*

**New Graduate RN:** ok it shouldn’t hurt – here we go…

**Critical Thinking Questions:**

Was there a need to discuss the ‘near-miss’ with Mr Green and his wife?

What could the new graduate say to the patient before giving this new medication?

**Accompanying documentation:**

- Clinical Practice Guideline for the Prevention of Venous Thromboembolism in Patients Admitted to Australian Hospitals OR


- NIMS with section for daily VTE review

- Clinical questions on fasting, choice of med for pain etc