A BEST PRACTICES REVIEW OF SIMULATED EDUCATION APPROACHES TO ENHANCE COLLABORATIVE HEALTHCARE

by

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Abstract

Interprofessional simulation can provide health professional program educators with an effective means to prepare future practitioners to engage in meaningful collaboration. This systematic literature review was conducted to identify best practices recommendations to enhance collaborative healthcare using interprofessional simulated education innovations for learners in pre-licensure nursing programs and other health profession programs. Using a systematic review methodology, 375 articles were reviewed and 17 studies met the inclusion criteria. Based on the methodological strength of the research and the impact of the simulation innovations, the following simulation techniques were recommended: high-fidelity human patient simulators, role play, and didactic lecture and audience response didactic lecture, both followed by role play with a standardized patient. One approach used in interprofessional education simulations, instructor modeling, was related to particularly positive outcomes for learners. Instructor modeling demonstrated significant results for achieving interprofessional competencies when compared to no modeling. Future research is needed to identify the optimal timing for implementing interprofessional education innovations, for the development of interprofessional collaborative evaluation tools, and to determine the effects of collaborative practice on patient care. Research on the effectiveness of interprofessional simulation would be strengthened with innovations and evaluations based on educational models and learning theories.

Keywords: interprofessional, collaboration, simulation, education, nursing

A best practices review of interprofessional simulated education approaches to enhance collaborative healthcare

Over the past decade the need for healthcare professionals to engage in interprofessional collaborative practice to improve patient safety and provide optimal patient-centred care has been identified (Canadian Nurses Association [CNA], 2011; Health Canada, 2001; Institute of Medicine, 2004; Romanow, 2002; World Health Organization [WHO], 2007). To prepare healthcare professionals for this aspect of practice, Health Canada (2011), the Institute of Medicine (2003), and WHO (2010) have recommended that healthcare professionals be educated in an interprofessional context. In response to these global recommendations, health profession programs have begun transforming their curricula to provide interprofessional education (IPE) experiences to prepare collaborative practice-ready practitioners (Frank, 2007). In relation to healthcare, the goals of IPE are to prepare practitioners to engage in collaborative practice to achieve optimal patient care and improved health outcomes through the development of interprofessional knowledge, skills, and attitudes (Canadian Interprofessional Health Collaborative, 2010). Educators are challenged with developing IPE innovations to provide learners with experiences to acquire the competencies needed for interprofessional collaboration within the healthcare team. To evaluate the evidence addressing IPE in undergraduate health profession programs, Cooper, Carlisle, Gibbs, and Watkins (2001) conducted a literature review. The findings of the review revealed the benefits of IPE included the development of interprofessional knowledge and skills, and changes in attitudes. However, since this review interest in IPE has grown considerably with the focus now on the educational approaches that have the greatest impact on achieving the necessary skills for effective interprofessional collaboration. The importance of IPE in health profession education programs continues to be

strongly endorsed. For example, Dillon, Noble, and Kaplan (2009) have argued that the inclusion of IPE within health professional programs fosters the development of a culture of meaningful collaboration in post-secondary institutions that will continue to grow in future professional practice.

To support the integration of IPE into healthcare program curricula, interprofessional collaborative competencies supported by appropriate frameworks have been developed to guide curriculum changes. One such framework was developed by the College of Health Disciplines at the University of British Columbia (Wood, Flavell, Vanstolk, Bainbridge, & Nasmith, 2009). The 'BC Competency Framework for Interprofessional Collaboration' includes 20 competencies organized into the following three domains: interpersonal and communication skills; patient-centred and family-focused care; and collaborative practice which includes collaborative decision-making, roles and responsibilities, team functioning, and continuous quality improvement. Competency frameworks can guide educators as they develop and implement teaching-learning experiences for learners to achieve collaborative competencies. However, developing an IPE based curriculum and bringing together various professions does not come without its challenges.

Faculty availability and expertise, time, and budgetary issues are constraints that need to be addressed to ensure successful implementation. The varied core values underpinning healthcare professions can also pose challenges with the creation and implementation of IPE learning experiences (Canadian Medical Association, 2008; CNA 2005). Using nursing and medicine as an example, nursing has defined the core values of their profession to be caring, honesty, accountability, collaboration, integrity, and health promotion (National League for Nursing 2012; Uustal, 2001). The core values of medicine include values of honesty,

accountability, compassion, and self-policing (Stern, 1998). The medical professional has a 'disease-cure' focus where the nurse professional focuses on holistic patient care considering the physical, psychological, social, cultural, and spiritual aspects of the patient. Interprofessional collaborative education requires educators to take into account the knowledge, principles, and values of each health profession participating in the educational experience. This feat can be a daunting task for educators when creating a meaningful educational experience.

Nurses have recognized the importance of taking active roles in interprofessional collaborative teams to provide safe, high-quality patient care (CNA, 2011). Not unlike other nursing regulatory bodies, the College of Registered Nurses of British Columbia (2006) outlined that the newly graduated registered nurse is expected to establish and maintain therapeutic relationships in interprofessional care teams. Nursing education programs have, therefore, begun to integrate interprofessional teaching/learning components into their curricula. These efforts have led to collaboration with other health professional programs to develop educational opportunities for learners to gain the knowledge and skills necessary to meet interprofessional competencies (Baker et al., 2008; Garrett, MacPhee, & Jackson, 2010; Hobgood et al., 2010; LeFlore & Anderson, 2009).

To develop the knowledge, skills, and attitudes necessary to engage in meaningful interprofessional healthcare teams, health professional learners must have the opportunity to learn about, from, and with each other in situations that they see as relevant to their knowledge and skill development (Baker, et al., 2008; WHO, 2010). The use of IPE approaches has the potential to provide the learning experiences necessary to meet that goal. Educators have developed of a wide range of educational approaches; however, educators need to focus on the most effective means. For example, interprofessional simulation education is an innovation that

educators in health professional programs have begun exploring in several countries (Baker, et al., 2008; Dagnone, McGraw, Pulling, & Patterson, 2008; Dillon et al., 2009; Reese, Jefferies, & Engum, 2010). Interprofessional simulation education as an approach to IPE has gained increasing attention, in part, prompted by challenges in providing learners with IPE experiences in clinical and community settings and advances in technology. Advantages of interprofessional simulation education include the opportunity to design learning experiences that are tailored to curricula and learning needs. In addition, interprofessional simulated educational experiences provide the opportunity for learners to acquire knowledge and skills in collaborative practice before they move into clinical or community settings. Because learners are more prepared for collaborative practice before they enter healthcare settings there is the potential for enhanced patient safety and satisfaction, improved patient outcomes and potentially the need for less direct faculty supervision.

Simulation is an educational approach that can promote interprofessional collaboration and provide a means of meeting IPE competencies when woven through the curriculum (McCormick, Burton, & Werts, 2010). Simulation education innovations provide opportunities for educators to expose and immerse learners in IPE experiences allowing the learner to engage in experiential learning, a process where they are an active participant (McCormick et al., 2010) learning directly from their experience (LeFlore & Anderson, 2009). Simulation education also provides an opportunity for learners to actively integrate the concepts of interprofessional collaboration in a safe environment with educators who can provide support and guidance (Baker et al. 2008; Baxter, Akhtar-Danesh, Valaitis, Stanyon, & Sproul, 2009; Moule, Wilford, Sales, & Lockyer, 2008).

The use of simulation in nursing education is not a new concept. The history of nursing education is rich with examples where nurse educators have used simulation techniques to prepare learners for clinical practice such as; role play, case studies, mannequins, games, and multimedia (Tuoriniemi & Schott-Baer, 2008). Simulation continues to be widely used in nursing curricula to meet a variety of learning outcomes with the advantage of providing learners opportunities to gain knowledge and experience with skills that may not be easily obtainable in the clinical practice setting (Broussard, Myers, & Lemoine, 2009; Carlson-Sabelli, Giddens, Fogg, & Fiedler, 2011; Galloway, 2009; Sinclair & Ferguson, 2009). Nursing faculty shortages, lack of availability of practice areas, increased patient acuity, and the inability of educators to ensure that all learners have the opportunity to engage in interprofessional collaboration has reaffirmed the need for IPE using simulation in nursing education (Jefferies, 2008).

Research of interprofessional simulation education among nursing students and members of other health care professions is growing (Baker et al., 2008; Kyrkjebo, Brattebo, & Smith-Strom, 2006); however, identification of the most effective simulation technique(s) to enhance interprofessional collaboration needs to be addressed. This systematic literature review was conducted to identify best practices recommendations for simulated education approaches to enhance collaborative healthcare.

Aims and Objectives

The aim of this paper is to identify best practices for interprofessional simulation education to enable nursing students to achieve interprofessional competencies and promote interprofessional collaboration with other members of the healthcare team.

The objectives of this paper are to:

1. Identify primary research studies evaluating undergraduate interprofessional simulation education innovations that include nursing students.
2. Conduct a systematic review of published primary studies from January 2005-December 2011 of interprofessional simulation education innovations to identify best practices.
3. Make recommendations for future curriculum development and research related to interprofessional education.

For the purposes of this paper the following terms are defined as follows:

a) Simulation – A variety of educational techniques where participants have the opportunity to engage in an active learning process in an environment that provides the learner with the opportunity to participate in activities that mimic reality practice situations where dynamic realism can be experienced in an environment without jeopardizing patient safety (Baker, et al. 2008; Dagone, et al., 2008; Jefferies, 2005; Reese et al., 2010).

b) Interprofessional – Two or more professionals working together sharing knowledge and decision making to achieve a common goal.

c) Interprofessional education (in health care) – An educational approach underpinned by various educational philosophies providing an opportunity for learners from two or more professions to learn about, from, and with each other to enable effective collaboration and improve health outcomes (WHO, 2010).

d) Interprofessional collaboration – A dynamic and active process among multidisciplinary professions for communication and decision making directed toward knowledge sharing through team work which encompasses aspects of understanding, respecting, and valuing one another's roles, through effective communication; a relationship defined by a sense

of joint responsibility (Health Canada, 2011; Lindeke & Sieckert, 2005; Nies & Fickens, 2001).

Methodology

A systematic review was the methodology chosen for this project. Pope, Mays and Popay (2007) describe systematic review as an appropriate method to assess the effectiveness of evidence through a process of summarizing, appraising, and synthesizing the evidence. A systematic review is an effective tool for depicting a detailed, transparent view of the literature in an effort to integrate valid evidence providing a basis for rational, evidence-based decision making. The ultimate goal of a systematic review is to assess the findings of the included evidence, re-analyze, and combine the results to put forth theories, concepts or conclusions that develop from amalgamating the findings of each individual study. For a review to be defined as systematic the following features must be included: a protocol to guide the review process; a literature search utilizing a pre-planned, well-defined search strategy; critique and grading of the evidence; and clearly defined inclusion and exclusion criteria with analysis (Pope et al., 2007).

There are many approaches to summarizing, appraising, and synthesizing evidence. Most methods available were developed for either synthesizing qualitative or quantitative evidence separately, not for combining then synthesizing both types of evidence. Controversy exists regarding the legitimacy of combining evidence from different research methods within one review. However, the combination of both qualitative and quantitative has the potential to provide a more comprehensive view of the available evidence (Pope et al., 2007). In this project both qualitative and quantitative evidence were included.

Search Strategy

The literature included in this review was identified by searching the following electronic databases: EBSCO which included CINHAL, Medline, and Education Research Complete; ERIC, and EMBASE in consultation with a health sciences librarian. The literature search was limited to articles published between January 2005 and December 2011 in the English language with abstracts. The search terms and their respective number of hits are included in detail in Appendix A. The initial search resulted in 541 articles that were transferred to RefWorks©, an on-line data management tool to sort and organize the articles.

Screening the Evidence

After the electronic removal of duplicate articles, a total of 375 articles were eligible for classification from the electronic search. The primary screening of eligible articles included reviewing the titles and abstracts to identify articles that included the following three inclusion characteristics:

1. The study sample included students in pre-licensure nursing programs.
2. The focus of the educational innovation was interprofessional education.
3. The educational innovation was at the undergraduate level.

This screening resulted in the identification of 50 articles with potential for inclusion in the review. To confirm eligibility in this project, those 50 articles were read in their entirety and reviewed against the inclusion/exclusion criteria (Table 1). Of the 50 articles, 33 were excluded for the following reasons: study participants were not student learners in a professional healthcare program; the educational innovation did not include any learning objectives related to collaboration; the article was theoretical; or the research did not report data related to collaboration. A total of 17 studies met the criteria for inclusion in this study (Figure 1). It is

important to note that one study resulted in two publications and was considered as one study, see Appendix B for the comprehensive bibliography of studies included in this review.

Table 1

Inclusion and Exclusion Criteria

Inclusion Criteria	**Exclusion Criteria**
• Primary studies • Interprofessional education • Undergraduate education • Student registered nurses • The educational innovation must have at least one interprofessional collaboration objective • Evaluation outcome(s) must measure interprofessional collaboration as a learning objective	• Scholarly and theoretical articles • Unpublished literature • Studies reporting only simulation coordinator feedback • Studies do not report data related to collaboration

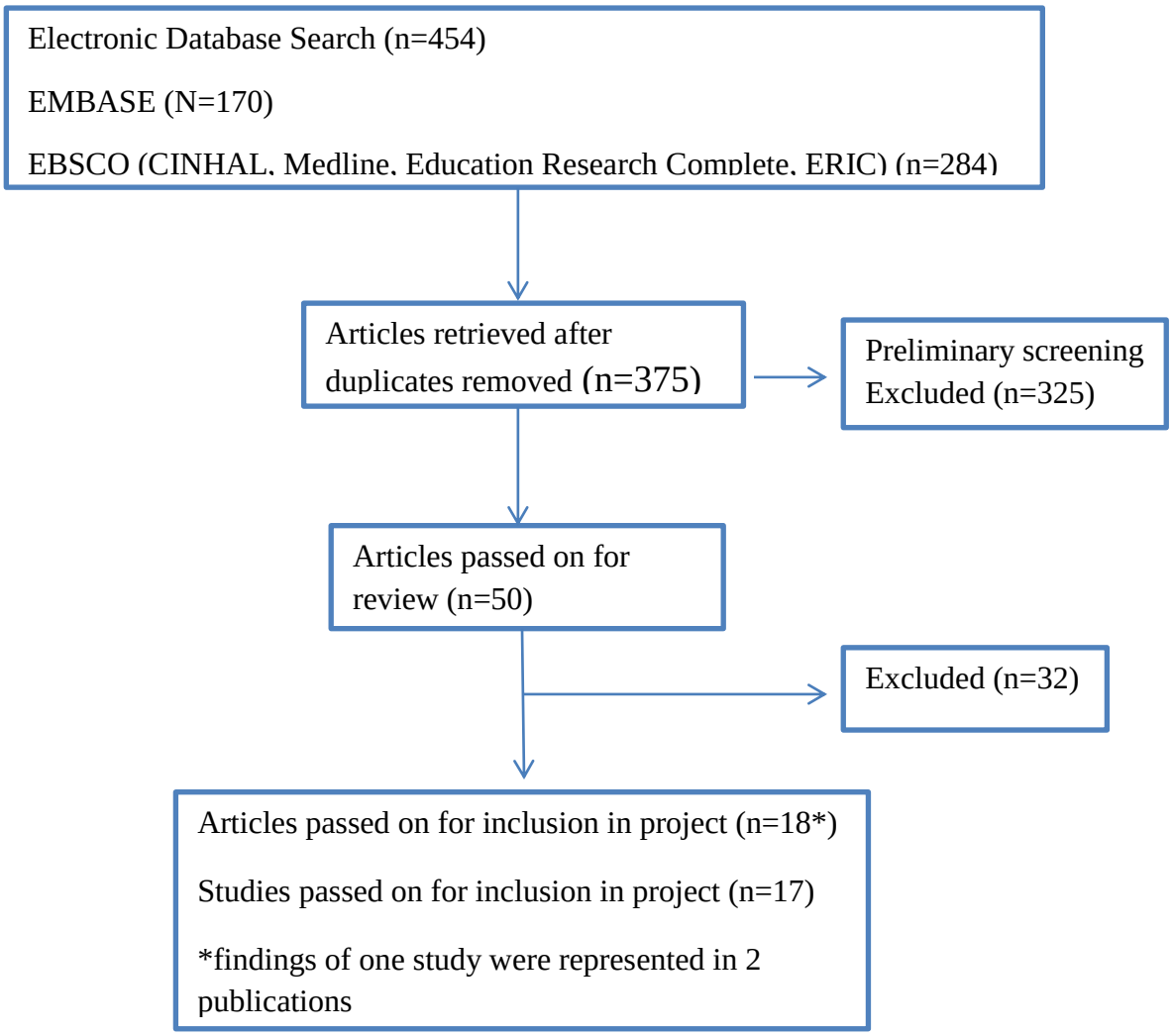

Figure 1. Summary of the Study Selection Process

Data Extraction

Guided by the aim of this review and suggestions put forth by Pope et al. (2007), a purposely designed data extraction table was developed.

The categories of the data extraction table included the following:

1. *Identification of the Research Study*. This category included the author, year published and country.

2. *Participants.* This category provided details of the study participants, their health profession program and year of study.
3. *Aim of the Study.* Described the main aim or purpose of the research study.
4. *Simulation Technique.* Described the simulation technique the researchers utilized for the interprofessional simulation education innovation.
5. *Characteristics of the Learning Experience.* This category included a description of the interprofessional educational innovation.
6. *Educational Model or Learning Theory.* This category indicated what, if any, educational model or learning theory underpinned the interprofessional educational innovation.
7. *Objectives of the Learning Experience.* The objectives of the educational innovation were outlined in this category.
8. *Evaluation – Methodology.* This category included the type of research methodology and the evaluation method(s) used to assess the study aims and learning objectives of the educational innovation.
9. *Evaluation – Outcomes.* Results of the study.

See Appendix C for table of studies included in the review.

Assessing the Evidence

Research quality. Evaluating the quality of the studies is an integral aspect in any systematic review, because the quality of the studies will ultimately affect the conclusions and recommendations of the review (Pope et al., 2007). The ease with which the quality of studies addressing teaching-learning experiences can be assessed poses a challenging task due to the lack of appropriate assessment tools (Reed et al., 2005). Using a variety of assessment tools based on principles of curriculum development and evaluation, Beach et al. (2004) developed a

quality rating tool to evaluate research studies addressing practice interventions. The scale was developed to assess cultural competence curricula using the following five domains: representativeness of targeted healthcare providers and/or patients; potential for bias and confounding; description of interventions and outcomes assessment; and analytic approach. To make the rating scale applicable to this project, it was modified. The modifications that were made include:

- The term healthcare providers was changed to student participants
- Removal of Section II: Focus of the Article – removal of the section does not negatively impact the rating scale because this section pertained specifically to the research for which the scale was devised
- Section V: Bias and Confounding, Question 10 – removed as it pertained to 'patient groups' and this review did not address patient groups
- Section VI: Description of the Intervention – "Was the simulation education innovation based on a clearly stated education model and/or learning theory?" – this question was added to the scale (Section III, Question 9)
- Section VIII: Analytic Approach – Question 18 and 19 were removed because they pertained to patient groups

This rating scale was used to evaluate the quality of each research study included in this project (see Appendix D).

Impact of the teaching-learning experience. The transfer of theoretical learning into practice settings, specifically interprofessional collaborative skills and knowledge, has the potential to ultimately impact professional practice and benefit patients. The Quality Assessment Model developed by Kirkpatrick (1967) has been widely used to evaluate education innovations

with the objective to develop professionals that can demonstrate the transfer of theoretical knowledge, skills, and attitudes into practice (Kirkpatrick 1995). The model includes four levels for assessing the student's response and impact of the educational innovation: reaction, learning, behaviour, and results. Reaction is the first level and relates to the student's view of the learning experience and satisfaction with the educational innovation. The second level relates to the knowledge and skills the students learned and developed. The third level addresses behaviour, behavioural change that was a result of the learning transferred to the practice environment. The final level relates to any improvements in patient outcomes as a direct result of the educational innovation. Kirkpatrick's Quality Assessment Model (1967) was adapted for use in this review to evaluate the impact of the simulated education experiences in relation to interprofessional collaboration and provided a means for interpreting the outcome measures of the studies included in this review. To meet the requirements for this review, the following modification of the model was made: Level 4 was kept as one level and not further sub-divided into two components due to the interrelationship between the two aspects of the level. The aforementioned change did not have an impact on the integrity of the model and did not affect the impact assessment of the teaching-learning experiences included in this project. It is important to note that the classification levels of the Kirkpatrick (1967) model do not progress in a hierarchical manner, that the levels are distinct, each assessing different aspects of the learner's experience and impact of the educational innovation. See Appendix E for the adapted Kirkpatrick (1967) model.

Identifying Best Practices

To identify best practices for interprofessional simulation education to enhance interprofessional collaboration among nursing students and other members of the healthcare

team, the approach described by Cameron, Jolin, Walker, McDermott, and Gough (2001) was utilized (Appendix F). This approach was chosen because it takes into consideration and recognizes the type of evidence education innovations present, the research using quasi-experimental trials, and other qualitative and quantitative methodologies. The evidence from the included studies was evaluated using the three pre-set categories of criteria pertaining to: effectiveness, plausibility, and practicality. The outcomes and the impact of the studies were addressed in the effectiveness criteria category. Plausibility criteria addressed research that included minimal or no evaluation and assessed research which included the following: (a) formative evaluation, pilot testing, and process evaluation; (b) clear behavioural objectives using appropriate behavioural principles; and (c) sensitivity to the issues of concern of the adopters, which in this case are the nursing educators. An interprofessional simulation education innovation would be rated as plausible if there was reason to expect an evaluation would produce positive outcomes. Practicality criteria pertained to the availability of the equipment needed to carry out the educational innovation, the cost of implementing and using the simulation technique, and the supportability, generalizability, and adaptability of the simulated education innovation. Each of the 17 studies included in this review were assessed and a best practices recommendation presented identifying the interprofessional simulation education innovation as recommended, promising, or not recommended.

Results

This review aimed to identify interprofessional simulation education innovations that could be used to enhance interprofessional collaboration between nurses and other health care providers. The studies included in this review comprised evaluations of a variety of simulation techniques to provide interprofessional teaching/learning experiences that involved nursing

students. The simulation techniques included the use of long-standing teaching approaches such as role play, instructor modeling, and case studies. Others took advantage of developments in technology to develop simulated learning experiences using high-fidelity mannequins. In total, 17 studies were identified. In the following sections, results of the systematic review of these studies are presented.

Interprofessional Simulation Characteristics

Aim of the interprofessional teaching-learning experience. Of the 17 studies included in this review, 11 presented clear, primary objectives related to interprofessional collaboration between student nurses and learners in other health professional programs. The interprofessional collaboration objectives of the remaining six studies were presented as secondary aims of the study.

Learners. All of the studies included undergraduate nursing students, in keeping with the criteria for inclusion in this review. The other healthcare profession disciplines that were included varied from one study to another. Learners from the following professions were represented: medicine, social work, pharmacy, physiotherapy, respiratory, occupational therapy, paramedic, health education, physical therapy, and special education students.

Sample size. The teaching group sizes ranged from groups of three to ten, with the average size being four. In three studies the size of the teaching groups was not included and one study assessed an on-line approach using simulated scenarios. In this study learners engaged independently in the teaching/learning experience.

Setting. In the majority of studies the educational innovation took place in academic settings with a simulation laboratory being the most common setting. Other areas used were

classrooms, practice settings, and in one study, the innovation was offered online permitting the learners to engage in the learning experience wherever they chose.

Type of simulation. A variety of simulation techniques were used. Of the 17 studies, 12 utilized one simulation technique and five studies presented simulation education innovations that combined more than one technique. The most commonly evaluated simulation technique was the human patient simulator (n=13). Six studies utilized role play, with the remainder of the studies using a variety of approaches (Table 2).

Table 2

Types of Simulation Used

Type of Simulation	Frequency
High-fidelity human patient simulator (HPS)	10
Medium-fidelity HPS	1
Unspecified fidelity HPS	2
Standardized patients	7
Role-play	6
Small group discussion	1
Didactic lecture	1
Video scenario exercise with audience response didactic discussion	1
DVD case studies	1
Hybrid – use of more than one simulation technique simultaneously	5

Learning theory. The majority of studies (n=11) included in this review did not present evidence of an underlying education model or learning theory in the design of the teaching/learning approaches or choice of outcome measurement tools. Bandura's Social Learning Theory (1977) directed the design of one educational innovation approach (LeFlore & Anderson, 2009). Jefferies Simulation Model (2007) based on constructivist learning theory underpinned the educational approach assessed in two studies (Reese et al., 2010; Reising, Carr, Shea, & King, 2011). Kolb's (1984) experiential learning theory along with concepts from Srivastava (2007) and Durkhiem (1933) directed the educational approach and provided the theoretical foundation for one study (Baker et al., 2008). In another study, The Conscious Competence Learning Model and Issenberg's 10 Features of Effective Learning (2002) guided the educational innovation and outcome measurement tools (Marken, Zimmerman, Kennedy, Schremmer, & Smith, 2010). The Sustained Attention/Mental Effort Scale based on the Theory of Attentional Inertia (Burn & Anderson, 1993) was used by one group to guide one component of their outcome measures (Williams, Brown, Scholes, French, & Archer, 2010).

Evaluation of the Interprofessional Simulation Teaching-Learning Strategy

Researchers used both qualitative and quantitative methods to evaluate the interprofessional education experiences. Although a mixed method approach was the method most commonly used (n=12), four studies used quantitative methods and one study employed a qualitative approach. Sample sizes varied considerably with two studies using relatively large samples of students (394 and 454 learners). However, the majority of studies included convenience samples of less than 100 learners.

Data collection. A variety of tools were used by the researchers to assess the interprofessional simulation education innovations that were used in the studies. The evaluation

tools varied from validated, self-assessment questionnaires to focus groups. Examples of validated tools included: The Mayo High Performance Teamwork Scale (Malec, Torscher, & Dunn, 2007); The Jefferson Scale of Attitudes Toward Physician-Nurse Collaboration (Hojat, et al., 2002); and the Learning Satisfaction Scale (Keller, 1987). Pre and post innovation assessments were completed in 53% of the studies, leaving the remaining 47% of the studies obtaining only post innovation assessments. Of the 53% of the studies that obtained pre and post innovation assessment data, three studies utilized a validated evaluation tool, with four studies using non-validated tools and the remaining two studies using both types. The post-innovation assessments were carried out immediately after the learners engaged in the education experience for all studies but one. In the only exception to this, learners completed the post-innovation assessment six weeks after the education experience, during which time the study participants were in clinical practice (Lewis, 2011). All but one study used more than one evaluation tool and one study did not report their data obtained using a validated self-assessment tool with small sample size cited as the rationale for not reporting.

Study quality. The research quality of the studies was evaluated using a modified version of Beach et al.'s (2004) rating scale. The use of this scale provided a score for each study, with a possible range of 0-32 (see Appendix D). The average score for the 17 studies was 19 with 12 studies scoring less than the average. The study conducted by LeFlore and Anderson (2009) achieved the highest score of 31.5, and the lowest score was 10 for the study conducted by Berg, Wong, and Vincent (2010). Three studies achieved a score of 23.5 or greater. Higher scores were associated with research studies that compared either different interprofessional simulation education innovations or different learner populations; those that clearly identified the enhancement of interprofessional collaboration as their primary objective; and those that utilized

a pre and post-innovation evaluation design to assess learning outcomes. Six of the 17 studies were based on a clearly stated education model or learning theory, two of which were in the top five highest scoring studies. The most common simulation techniques used in the top three studies were: high-fidelity human patient simulation, round-table case study discussion, and role play. The use of instructor modeling versus no modeling was evaluated in two of the top three studies. All of the top three studies evaluated the outcomes using interprofessional learner groups.

Impact of the interprofessional simulation education innovation. The impact of the educational innovation was evaluated using a modified version of The Quality Assessment Model of Kirkpatrick (1967); see Appendix E for the modified version used in this review and Table 3 for the level of impact each study achieved using their respective interprofessional simulation education innovations. Of the 17 studies, all achieved an impact in more than one of the model's four levels. The first impact level (learners were satisfied with the interprofessional simulation innovation) was achieved by 16 studies; 12 studies obtained an impact level at Level 2a (changes in learner attitudes and perceptions) and Level 2b (measuring the learner's acquisition of knowledge and skills related to interprofessional collaboration); three studies achieved an impact at Level 3 with learners indicating that they planned to apply their newly acquired learning in practice; while no studies achieved an impact at Level 4 (change in professional practice and/or increased benefits to patients or level of care).

Table 3

Level of Impact Achieved by Each Study and Study Quality Rating Scores

Study Authors, Year, Country	**Type of Simulation**	**Level of Impact the Achieved from the Interprofessional Simulated Education Innovation**	**Study Quality Rating Scale Score** (Max Score 32)
LeFlore & Anderson, 2009 United States	Hybrid - high-fidelity human patient simulator (HPS) & standardized patients, with and without instructor modeling	1, 2b	31.5
Hobgood et al., 2010 United States	Didactic lecture, audience-response didactic lecture, role play, high-fidelity HPS, & standardized patients	2a, 2b	25.5
Selle et al., 2008 United States	Hybrid - role play, small group discussion, with and without instructor modeling	1, 2a, 2b	23.5
McCormick et al., 2010 United States	High-fidelity HPS	1, 2b	22.5
Reising et al., 2011 United States	High-fidelity HPS & roundtable – case study discussion	1, 2a, 2b	22.5
Baker et al., 2008 Canada **& Dagnone et al., 2008** Canada	High-fidelity HPS	1, 2a, 2b	20
Reese et al., 2010 United States	High-fidelity HPS	1, 2a	19
Marken et al., 2010 United States	Hybrid - High-fidelity HPS and standardized patients	1, 2b	19
Dillon, et al., 2009 United States	High-fidelity HPS	1, 2a	19

Stewart et al., 2010 United Kingdom	High-fidelity HPS	1, 2a, 2b, 3	18
Schildmann et al., 2006 Germany	Hybrid - role play with standardized patients	1, 2a	17
Williams et al., 2010 Australia	DVD simulations using standardized patients	1, 2a, 2b	15
Lewis, 2011 United Kingdom	Medium-fidelity HPS	1	15
Morison & Stewart, 2005 United Kingdom	Hybrid - role play involving un-specified fidelity-HPS, standardized patients, and clinical practitioners	1, 2a, 2b, 3	14
Kyrkjebo et al., 2006 Norway	Unspecified-fidelity HPS	1, 2a, 2b	13
Wakefield et al., 2006 United Kingdom	Role play with standardized patients	1, 2a, 3	13
Berg et al., 2010 United States	Hybrid - unspecified-fidelity HPS with instructor modeling	1, 2b	10

Learning outcomes. The data from the studies were analysed resulting in the identification of four categories that were considered when assessing the impact of the simulated education innovations. The first three categories: learners' satisfaction with the learning experiences; their attitudes toward members of other healthcare professions; and their knowledge development of interprofessional collaboration, correlate with the classification levels of Kirkpatrick's (1967) model. The fourth category addressed the learners' development of confidence/comfort in relation to interprofessional collaboration with other healthcare professionals. Not all studies reported results for all four categories; however, the majority of reported outcomes that were applicable to the four categories, providing evidence to bring forth recommendations. Sixteen studies assessed learner satisfaction with the interprofessional

simulation education innovation indicating that the learners were satisfied with the experience, regardless of the type of simulation used. Role awareness and recognition of the importance of members of other healthcare professions was reported in 11 studies. The learners reported an enhanced understanding and recognition of the importance of the role other healthcare professionals play in an interprofessional team after engaging in the educational innovation. Knowledge development related to interprofessional collaboration was assessed by 12 studies; the learners of these studies reported an increase in interprofessional knowledge post simulation. Comfort/confidence related to the learner's self-perceived ability to collaborate with members of other healthcare professions was assessed by 10 studies. The learners of all 10 studies reported an increase in their confidence and comfort collaborating with other healthcare professionals after the simulated education innovation.

Four studies compared different simulation techniques to determine if one technique was superior over another for enhancing interprofessional collaboration (Hobgood et al. 2010; LeFlore & Anderson, 2009; Reising et al., 2011; Selle, Salamon, Boarman, & Sauer, 2008). The study by Hobgood et al. (2010) for example compared four different techniques to determine the effects of each technique on the enhancement of learner outcomes related to interprofessional knowledge, skills, and attitudes. The four techniques were didactic lecture, audience response didactic lecture, role play, and high-fidelity human patient simulation. The learners in all four approaches demonstrated an improvement in teamwork knowledge and attitudes related to interprofessional collaboration; however, no technique demonstrated a significant change in interprofessional skills. The results revealed that no simulation technique was more superior to the other in enhancing interprofessional collaboration. Reising et al. (2011) conducted a study to measure the effect of two different approaches for teaching interprofessional collaboration:

roundtable facilitator-led case study discussion and high-fidelity human patient simulation. The learners of both approaches reported that the educational innovation provided them with a better sense of their role on an interprofessional team and improved interprofessional communication skills. However, the learners that participated in the high-fidelity simulation innovation reported a clearer idea of the roles of other healthcare professionals compared to the learners in the roundtable group. Of notable interest, a significant difference in stress levels was reported between the groups. The learners that engaged in the high-fidelity simulation reported experiencing significantly more stress than the learners that engaged in the round-table, case study discussion.

The instructor modeling approach was used in three studies (Berg et al., 2010; LeFlore & Anderson, 2009; Selle et al., 2008) in combination with the chosen interprofessional simulation technique. The learners observed instructor modeling prior to participating in the simulation education innovation. A significant increase in learner confidence was reported between the learners that experienced instructor modeling in comparison to those that did not in both the LeFlore and Anderson (2009) and Selle et al. (2008) studies. LeFlore and Anderson (2009) assessed learning outcomes associated with the use of high-fidelity human patient simulation and standardized patients. One group of learners observed instructor modeling prior to engaging in the simulation session and the other group did not. The learners that experienced instructor modeling reported that they were significantly more satisfied with the educational innovation than the learners that did not experience modeling. The learners who observed instructor modeling also demonstrated more effective interprofessional communication with the emergence of a leader more likely to occur when compared to those learners that did not observe instructor modeling. LeFlore and Anderson (2009) suggest instructor modeled learning was more effective

than no modeling. Selle et al. (2008) compared instructor modeling and no modeling with learners that engaged in role play or discussion in their study. The learners in this study reported greater confidence in their ability to engage collaboratively with members of other healthcare professions. Both groups of learners in this study reported that role-play and discussion were helpful to further their understanding of interprofessional collaboration regardless of the opportunity to observe instructor modeling; however, the outcome measures of the learners that observed instructor modeling reflected a deeper understanding of the importance of interprofessional collaboration. The results of the pilot study by Berg et al. (2010) were insufficient to conclude if instructor modeling had a significant effect on interprofessional collaboration. It is important to note, this study did not use a comparison group that did not experience instructor modeling.

Only one study assessed the use of a high-fidelity human patient simulator with an interprofessional group of learners and a nurses-only group of learners (McCormick et al., 2010). This study showed no significant differences in learning outcomes between groups for collaborative knowledge as measured by the learner's self-assessed pre and post-innovation knowledge scores. However, the interprofessional group reported greater satisfaction and an increased confidence in their ability to collaborate with other healthcare professionals compared to in the nurses-only group.

Recommended Simulation Techniques

The studies included in this review were evaluated to identify best practices in relation to interprofessional simulation technique(s) for enhancing student nurses' knowledge, skills, and attitudes for interprofessional collaborative practice. The effectiveness, plausibility, and practicality of the simulation technique were the basis for the best practices recommendations

put forth. Based on sufficient evidence of effectiveness and practicality, six simulation techniques were recommended. The simulation techniques that were used in those studies included: high-fidelity human patient simulator, role play, didactic lecture, and audience response discussion. Deeming the simulation technique as practical meant that the technique was available, cost effective, and that it fit nursing education goals and curriculum related to interprofessional collaboration competencies. High fidelity human patient simulation and role play were the most commonly used simulation techniques in the recommended studies. Thirteen studies encompassing 14 various simulation techniques showed promise, with one simulation technique not recommended based on insufficient evidence and impractically (Table 4). Of significance, the studies that compared instructor modeling versus no modeling demonstrated that the use of their simulation technique without instructor modeling resulted in minimal change of the learner's knowledge, skills, and attitudes related to interprofessional collaboration. The findings of this review suggest that a variety of interprofessional simulation techniques were useful for enhancing interprofessional collaboration between nurses and other healthcare professionals and the use of instructor modeling demonstrated significant results in attaining outcomes favourable for interprofessional collaborative practice.

Table 4

Recommended Simulation Techniques

Author/ Year	**Simulation Technique**	**Description of Interprofessional Education Innovation**	**Quality of Evidence (Sufficient/ Insufficient/ Minimal or No change)**	**Plausibility**	**Practicality**	**Recommendation**
LeFlore & Anderson, 2009	Hybrid – High-fidelity HPS and one standardized patient **with instructor modeling**	Paediatric respiratory arrest	Sufficient	Plausible	Practical	**Recommended** based on sufficient evidence of effectiveness and practicality
Hobgood et al., 2010	High-fidelity HPS, followed by a simulation session using one standardized patient	TeamSTEPPS® Patient Safety Program	Sufficient	Plausible	Practical	**Recommended** based on sufficient evidence of effectiveness and practicality
	Role play, followed by a simulation session using one standardized patient	TeamSTEPPS® Patient Safety Program	Sufficient	Plausible	Practical	**Recommended** based on sufficient evidence of effectiveness and practicality
	Didactic lecture, followed by a simulation session using one standardized patient	TeamSTEPPS® Patient Safety Program	Sufficient	Plausible	Practical	**Recommended** based on sufficient evidence of effectiveness and practicality
	Video scenario exercise with audience response didactic discussion, followed by a simulation session using one standardized patient	TeamSTEPPS® Patient Safety Program	Sufficient	Plausible	Practical	**Recommended** based on sufficient evidence of effectiveness and practicality

Selle et al., 2008	Role play **with instructor modeling**	Development of an individualized education plan for a paediatric client with a traumatic brain injury	Sufficient	Plausible	Practical	**Recommended** based on sufficient evidence of effectiveness and practicality
McCormick et al., 2010	High-fidelity HPS	Asthma care and patient education	Insufficient	Plausible	Practical	**Promising**
Reising et al., 2011	High-fidelity HPS	Mock Code	Insufficient	Plausible	Practical	**Promising**
	Roundtable - Case study discussion	Mock Code	Insufficient	Plausible	Practical	**Promising**
Baker et al., 2008 and Dagnone et al., 2008	High-fidelity HPS	Advanced cardiac life support scenarios	Insufficient	Plausible	Practical	**Promising**
Reese et al., 2010	High-fidelity HPS	Mock Code	Insufficient	Plausible	Practical	**Promising**
Marken et al., 2010	Hybrid – High-fidelity HPS and one standardized patients	Discussing an infant health issue, intimate partner violence and suicidal thinking with a family member	Insufficient	Plausible	Practical	**Promising**
Dillon et al., 2009	High-fidelity HPS	Mock Code	Insufficient	Plausible	Practical	**Promising**
Stewart et al., 2010	High-fidelity HPS	Care of the paediatric patient with one of the following six potential clinical scenarios: bronchiolitis, croup, asthma, sepsis, acute gastroenteritis, heart failure	Insufficient	Plausible	Practical	**Promising**
Schildmann et al., 2006	Hybrid – role play with standardized patients	Interprofessional breaking bad news curriculum	Insufficient	Plausible	Practical	**Promising**
Williams et al., 2010	DVD simulations using standardized patients	Observations of 11 different clinical scenarios	Insufficient	Plausible	Practical	**Promising**
Lewis 2011	Medium-fidelity HPS	Simulated scenarios based on the SMART® project	Insufficient	Plausible	Practical	**Promising**

Kyrkjebo et al., 2006	Unspecified-fidelity HPS	Simulation scenarios related to the following: blood transfusion, basic resuscitation, management of central venous catheters, and administration of drugs	Insufficient	Plausible	Practical	**Promising**
Wakefield et al., 2006	Role play with standardized patients	Interprofessional breaking bad news curriculum	Insufficient	Plausible	Practical	**Promising**
Berg et al., 2010	Hybrid – High-fidelity HPS **with instructor modeling**	Shift report of patients with the following: shortness of breath, chest pain, anaphylaxis	Insufficient	Plausible	Practical	**Promising**
LeFlore & Anderson, 2009	Hybrid - High-fidelity HPS and one standardized patient **without instructor modeling**	Paediatric respiratory arrest	Minimal change	Plausible	Practical	**Not Recommended** based on sufficient evidence indicating minimal change in learner outcomes when compared to role play **with** instructor modeling
Selle et al., 2008	Role play **without instructor modeling**	Development of an individualized education plan for a paediatric client with a traumatic brain injury	Minimal change	Plausible	Practical	**Not Recommended** based on sufficient evidence indicating minimal change in learner outcomes when compared to role play **with** instructor modeling
Morison & Stewart, 2005	Hybrid- Role play using unspecified-fidelity HPS, standardized patients, clinical practitioners	Prepare and give explanation of insulin dependent diabetes and its management to the family of a paediatric patient newly diagnosed with diabetes	Insufficient	Plausible	Impractical	**Not recommended** based on insufficient evidence and impracticality

Discussion

Summary of Results

In this systematic review, research evaluating interprofessional simulation education strategies to enhance interprofessional collaboration for learners in pre-licensure nursing programs was identified and reviewed to describe best practices. Seventeen studies met the inclusion criteria and were included in this review. The IPE simulated experiences required interprofessional faculty collaboration and used a variety of resources from personnel to high-tech equipment. The effect that the teaching-learning innovations had on the ability to collaborate interprofessionally in practice settings was not evaluated; researchers instead focused on immediate outcomes of the simulated learning experiences. Overall, the findings of this systematic review demonstrated that learners were satisfied with interprofessional simulation education and the simulation innovations supported the competencies of IPE in developing knowledge, skills, and attitudes needed for collaborative practice.

The studies included in this review focused on a variety of simulation techniques and found that several provided avenues for enhancing IPE competencies among pre-licensure learners. The recommended simulation techniques were: high-fidelity human patient simulators, role play, and didactic lecture and audience response didactic lecture, both followed by role play with a standardized patient. One approach used in IPE simulations, instructor modeling, was related to particularly positive outcomes for learners. In two studies, researchers compared the use of instructor modeling and no modeling. The findings indicated that the learners who observed instructor modeling prior to engaging in the simulation session had significantly better outcomes than the learners that did not observe instructor modeling (LeFlore & Anderson, 2009; Selle et al., 2008). A third study also used instructor modeling; this pilot study showed promising

results with the use of this educational approach (Berg et al., 2010). Therefore, instructor modeling appears to be an effective teaching-learning approach in the context of IPE simulated learning experiences.

The findings of this systematic review suggest that when developing and implementing an interprofessional simulation education innovation, educators need to consider several factors. The following three factors will be discussed: the use of education models and learning theories on which to base the innovation and outcome measures, evaluation tools for the learning experience, and when to implement the learning experience.

Education Models/Learning Theory

Only six of the 17 studies in this review explicitly referred to the use of educational models or learning theories to guide the design and/or evaluation of teaching-learning innovations (Baker et al., 2008; LeFlore & Anderson, 2009; Reese et al., 2010; Reising et al., 2011; Marken, et al., 2010; Williams, et al., 2010). The use of education models and/or learning theories can guide the development and, strengthen the design of the teaching-learning experience, and aid in the understanding of evaluation outcomes (Cooper et al., 2001; Oandasan & Reeves, 2005). A variety of learning theories support the use of the simulation approach such as adult learning theory, constructivism learning theory, experiential learning theory, and novice-to-expert theory (Waldner & Olson, 2007). The use of appropriate education models and/or learning theories is also important in guiding the selection of evaluation strategies and tools. Finally, theory-based research in IPE could make an important contribution to the development of educational theory as it applies to health professional education.

Evaluation Methods

The outcome assessment tools used in the reviewed studies were primarily investigator developed and non-validated evaluation tools. The use of validated assessment tools that specifically and appropriately measure IPE learning is needed to measure learning outcomes including learners' understanding and experience of IPE and collaborative skills (Le, Spencer, & Whalen, 2008). Study findings need to be interpreted with this in mind since traditional teaching/learning assessment tools may not adequately assess IPE competencies (Cooper et al., 2001; Hall, Marshall, Weaver, Boyle, & Taniguchi, 2011; Le et al., 2008; Morrison & Stewart, 2005). As academic institutions begin to include IPE in their health professional curricula, evaluation methods that provide valid and reliable data concerning competencies for collaborative practice will be required. The development of tools to measure IPE competencies in health profession programs is beginning to be addressed in the literature (Le et al., 2008; Morrison & Stewart, 2005).

Timing

Deciding when to implement the IPE innovations in the curriculum is an important consideration. The majority of studies included in this review evaluated IPE simulated experiences that were provided to students in the upper levels of their educational programs. Debate exists regarding the optimal time to introduce and implement IPE in health profession programs. On one side of the argument, researchers advocate that IPE should be introduced later in the learner's education. Waiting until the learner has developed a sense of their profession and an understanding of their role is argued to be foundational to engaging in meaningful interprofessional collaboration (Charles, Bainbridge, & Gilbert, 2010; Parsell & Bligh, 1998). On the other side of the argument, researchers contend that the introduction of IPE early in health

profession programs has a greater impact on the learner's ability to collaborate effectively as a member of the healthcare team (Bassoff, 1983), because early exposure can help create a collaborative culture (Dillon et al., 2009). It is also thought that early introduction of IPE may also prevent the development of negative stereotypes and be influential in how learners come to 'know' members of other health professions (Oandasan & Reeves, 2005).

The majority of studies included in this review support the argument that IPE simulation experiences in upper levels of health professional programs have positive outcomes for learners. Positive changes were reported in learners' attitudes and perceptions of not only their own role in the healthcare team, but also that of other health professionals. The learners reported that the simulated learning experiences enhanced their awareness of the interdependence between their profession and other healthcare professionals, and increased their respect and appreciation for each other's knowledge, skill, and responsibility in the healthcare team. While it is possible that first and second year nursing and health professional learners may also benefit from some type of IPE simulated learning experiences, more work is needed to determine the most effective approach.

Implications for Nurse Educators

The findings of this review have implications for nurse educators who are endeavouring to prepare practitioners to collaborate in interprofessional healthcare teams. The findings suggest that simulated teaching-learning experiences can be effective in promoting knowledge, skills, and attitudes that may prepare learners for effective interprofessional collaborative practice. Nurse educators should therefore be encouraged to continue to develop IPE simulated teaching-learning experiences in collaboration with other educators such as those in medicine, social work, psychology, human kinetics, and pharmacy. The curricular mechanisms educators must

consider include the best type of educational innovation, evaluation measures, and when to implement the innovation. The educator mechanisms include faculty time, expertise, and access to resources to create, implement, and assess collaborative learning experiences. Not all academic institutions have access to a variety of health professional programs to create IPE learning opportunities; for those that do, scheduling difficulties may arise when trying to organize education experiences. In the majority of studies simulated IPE was provided to small groups of students, and there is a trend to incorporate expensive high-fidelity mannequins in learning experiences. The cost to implement and maintain IPE programs and innovations can, therefore, be a challenge with current day academic budgets. However, the limited availability of practice settings and the difficulty in finding interprofessional teams for students to collaborate with in practice may justify the cost of the resources needed for IPE innovations, such as interprofessional simulation. The lack of practice resources and the inability for educators to provide all nurse learners with interprofessional experiences in practice settings reinforces the value of providing interprofessional simulation education experiences. Strategies to support effective collaboration among educators from a range of health professions is needed to support the development of IPE simulated education. Finally, given the potential value of instructor modeling in IPE involving simulations, nurse educators also need to be provided opportunities to develop and maintain their own collaborative practice skills.

Future Research

As health professional programs incorporate IPE, educators require evidence on which to base curriculum development and teaching innovations. Further research is needed to evaluate the effect IPE has on creating a collaborative healthcare environment and whether the teaching-learning experiences are leading to improved patient safety and optimal care (Robertson &

Bandali, 2008). What follows are suggestions for future research to address the gaps in the literature and to continue to create evidence to support educators as they integrate IPE approaches into today's modern health professional program curricula. In evaluating promising IPE simulated teaching-learning experiences, multi-site, longitudinal studies are needed to increase sample sizes and to determine the conditions under which learners are able to transfer knowledge and skills acquired during simulations into effective collaborative practice in real world settings. Studies are also needed to determine the optimal timing of IPE simulation, and how teaching-learning experiences can take advantage of computer technologies to offer virtual, interactive simulations, especially in academic settings where the range of learners in health professional programs is limited. Initiatives also need to be explored to determine possibility of developing a collaborative simulation network among academic institutions for the amalgamation of resources to promote the sharing of tools and resources to support simulation in IPE. Lastly, more Canadian studies are needed. Educators developing IPE need to take into account the Canadian health care system, roles played by various health professionals, and opportunities for interprofessional practice, as well as the unique characteristics of our pre-license educational programs. Funding mechanisms are urgently needed to support evaluations of innovations in IPE under development in Canada.

Conclusion

Interprofessional simulation education innovations create an environment where learners have the opportunity to learn with, from, and about other health profession students. Interprofessional simulated education approaches were well received and deemed valuable by the learners in the reviewed studies. There is growing evidence to suggest that interprofessional simulation is a useful strategy for educators to implement collaborative learning in health

profession programs. Specifically, instructor modeling was shown to lead to significant outcomes related to enhancing collaboration. When choosing interprofessional simulation techniques, educators must consider the outcome(s) they wish to achieve and what resources are available. Based on the evidence available, it appears that a number of teaching-learning approaches can be used to enhance collaborative knowledge, skills, and attitudes. Interprofessional simulation provides health professional program educators with an effective means to prepare practitioners to engage in collaborative healthcare teams to meet the demands of providing safe, optimal patient care. Future research is needed to continue to develop evidence addressing the use of IPE using simulation in health profession programs and its effects on patient care.

References

Baker, C., Pulling C., McGraw, R., Dagnone, J., Hopkins-Rosseel, D., & Medves, J. (2008). Simulation in interprofessional education for patient-centred collaborative care. *Journal of Advanced Nursing, 64*(4), 372-379. doi:10.1111/j.1365-2648.2008.04798.x

Bandura, A. (1977). *Social learning theory*. New York, NY: General Learning Press.

Bassoff, B. (1983). Interdisciplinary education as a facet of health care policy: The impact of attitudinal research. *Journal of Allied Health, 12*(4), 280-286. Retrieved from http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Retrieve&list_uids=6654736&dopt=abstractplus

Baxter, P., Akhtar-Danesh, N., Valaitis, R., Stanyon, W., & Sproul, S. (2009). Simulated experiences: Nursing students share their perspectives. *Nurse Education Today, 29*(8), 859-866. doi:10.1016/j.nedt.2009.05.003

Beach, M., Cooper, L., Robinson, K., Price, E., Gary, T., Jenckes, M.,. . . Powe, N. (2004). Strategies for improving minority healthcare quality. Evidence Report/Technology Assessment No. 90 (prepared by the Johns Hopkins University Evidence-based Practice Center under contract 290-02-0018). *Agency for Healthcare Research and Quality*, Rockville, MN. Retrieved from http://www.ahrq.gov/downloads/pub/evidence/pdf/minqual/minqual.pdf

Broussard, L., Myers, R., & Lemoine, J. (2009). Preparing pediatric nurses: The role of simulation-based learning. *Issues in Comprehensive Pediatric Nursing, 32*(1), 4-15. doi:10.1080/01460802610178

Burns, J. & Anderson, R. (1993). Attentional inertia and recognition memory in adult television viewing. *Communication Research, 20*(6), 777-779. doi:10.1177/009365093020006002

Canadian Medical Association (2008). *CMA policy: Achieving patient-centred collaborative care*. Ottawa: Author. Retrieved from http://policybase.cma.ca/dbtw-wpd/Policypdf/PD08-02.pdf

Canadian Nurses Association (2005). *Position statement: Interprofessional collaboration.* Ottawa: Author. Retrieved from http://healthprofessions.dal.ca/Files/Position_Statement_on_IP_Collaborative_Practice.pdf

Cameron, R., Jolin, M., Walker, R., McDermott, N., & Gough, M. (2001). Linking science and practice: Toward a system for enabling communities to adopt best practices for chronic disease prevention. *Health Promotion Practice, 2*(1), 35-42. doi:10.1177/152483990100200109

Charles, G., Bainbridge, L., & Gilbert, J. (2010). The University of British Columbia model of interprofessional education. *Journal of Interprofessional Care, 24*(1), 9-18. doi:10.3109/13561820903294549

Cameron, R., Jolin, M., Walker, R., McDermott, N., & Gough, M. (2001). Linking science and practice: Toward a system for enabling communities to adopt best practices for chronic disease prevention. *Health Promotion Practice, 2*(35), 35-42. doi:10.1177/152483990100200109

Canadian Interprofessional Health Collaborative. (2010*). A national competency framework.* Vancouver, BC. Retrieved from http://www.cihc.ca

Canadian Nurses Association. (2011). *Position statement: Interprofessional collaboration.* Ottawa: CNA. Retrieved from http://www2.cna-

aiic.ca/CNA/documents/pdf/publications/PS117_Interprofessional_Collaboration_2011_e.pdf

Carlson-Sabelli, L., Giddens, J., Fogg, L., & Fiedler, R. (2011). Challenges and benefits of using virtual community to explore concepts among baccalaureate nursing students. *International Journal of Nursing Education Scholarship, 8*(1), 1-14. doi:10.2202/1548-923X.2136

College of Health Disciplines. (2008). *The British Columbia competency framework for interprofessional collaboration.* Vancouver: UBC. Retrieved from http://www.chd.ubc.ca/resources-publications?q=teaching-learning/competency/bc-framework-interprofessional

College of Registered Nurses of British Columbia. (2006). *Profile of a newly graduated nurse.* Vancouver: CNA. Retrieved from https://www.crnbc.ca/Downloads/390.pdf

Cooper, H., Carlisle, C., Gibbs, T., & Watkins, C. (2002). Developing an evidence base for interdisciplinary learning: a systematic review. *Journal of Advanced Nursing, 35*(2), 228-237. doi:10.1046/j.1365-2648.2001.01840.x

Dagnone, J., McGraw, R., Pulling, C., & Patteson, A. (2008). Interprofessional resuscitation rounds: A teamwork approach to ACLS education. *Medical Teacher, 30,* e49-e54. doi:10.1080/01421590701769548

Dillon, P. M., Noble, K. A., & Kaplan, W. (2009). Simulation as a means to foster collaborative interdisciplinary education. *Nursing Education Perspectives, 30*(2), 87-90.

Durkheim, E. (1933). *The divisions of labour.* Toronto, ON: Collier-MacMillan.

Frank, J. (2007). *Medical leadership and effective interprofessional health care teams: A competency-based approach*. Vancouver IMWC. Retrieved from http://crmcc.medical.org/publicpolicy/imwc/10_frank.pdf

Garrett, B., MacPhee, M., & Jackson, C. (2010). High-fidelity patient simulation: Considerations for effective learning. *Nursing Education Perspectives, 31*(5), 309-313. doi:10.1043/1536-5026-31.5.309

Galloway, S. (2009). Simulation techniques to bridge the gap between novice and competent healthcare professionals. *Online Journal of Issues in Nursing, 14*(2), 1-9. doi:10.3912/OJIN.Vol14No02Man03

Hall, P., Marshall, D., Weaver, L., Boyle, A., & Taniguchi, A. (2011). A method to enhance student teams in palliative care: Piloting the McMaster-Ottawa team observed structured clinical encounter. *Journal of Palliative Medicine, 14*(6), 744-750. doi:10.1089/jpm.2010.0295

Health Canada. (2001). *Social accountability: A vision for Canadian medical schools*. Ottawa: Health Canada. Retrieved from http://www.medicine.usask.ca/leadership/social-accountability/pdfs%20and%20powerpoint/SA%20-%20A%20vision%20for%20Canadian%20Medical%20Schools%20-%20Health%20Canada.pdf

Health Canada. (2011). *Health Canada collaborative learning environment (CLE) project stakeholder roundtable on next steps, October 4, 2011: Summary report.* Ottawa: Health Canada. Retrieved from http://www.cihc.ca/files/CLE%20Rountable%20Final%20Report%20-%20EN.pdf

Hobgood, C., Sherwood, G., Frush, K., Hollar, D., Maynard, L., Foster, B.,…Taekman, J. (2010). Teamwork training with nursing and medical students: does the method matter? Results of an interinstitutional, interdisciplinary collaboration. *Quality & Safety in Health Care, 19*(6), 1-6. doi:10.1136/qshc.2008.031732

Hojat, M., Gonella, J., Nasca, T., Fields, S., Cicchetti, A., LoScalzo, A.,...Torres-Ruiz, A. (2003). Comparison of American, Israeli, Italian and Mexican physicians and nurses on the total and factor scores of the Jefferson scale of attitudes toward physician-nurse collaborative relationships. *International Journal of Nursing Studies, 40*(4), 427-435. doi:10.1016/S0020-7489(02)00108-6

Institute of Medicine. (2003). *Health professions education: A bridge to quality*. Washington, DC: National Academies Press. Retrieved from http://www.nap.edu/openbook.php?isbn=0309087236

Institute of Medicine. (2004). *Keeping patients safe.* Washington, DC: National Academies Press. Retrieved from http://www.nap.edu/openbook.php?isbn=0309090679

Issenberg, S., McGagjie, W., Gordon, D. Symes, S., Petrusa, E., Hart, I., & Harden, R. (2002). Effectiveness of a cardiology review course for internal medicine residents using simulation technology and deliberate practice. *Teaching and Learning in Medicine, 14*(4), 223-228.

Jefferies, P. (2005). A framework for designing, implementing, and evaluating simulations used as teaching strategies in nursing. *Nursing Education Perspectives, 26*(2), 96-103.

Jefferies, P.R. (2008). Getting in S.T.E.P with simulations: Simulations take educator preparation. *Nursing Education Perspectives, 29*(2), 70-73.

Keller, J. (1987). Strategies for stimulating the motivation to learn. *Performance and Instruction, 26*(8), 1-7. doi:10.1002/pfi.4160260802

Kirkpatrick, D. (1995). *Evaluating training programs*. San Francisco, CA: Berrett-Koehler.

Kolb, D. (1984). *Experiential learning*. Englewood Cliffs, NJ: Prentice Hall.

Kyrkjebo, J., Brattebo, G., & Smith-Strom, H. (2006). Improving patient safety by using interprofessional simulation training in health professional education. *Journal of International Care, 20*(5), 507-516. doi:10.1080/13561820600918200

Le, Q., Spencer, J., & Whalen, J. (2008). Development of a tool to evaluate health science students' experiences of an interprofessional education (IPE) programme. *Annals Academy of Medicine, 27*(12), 1027-1033. Retrieved from http://www.annals.edu.sg/pdf/37VolNo12Dec2008/V37N12p1027.pdf

LeFlore, J.L., Anderson, M., Michael, J.L., Engle, W.D., & Anderson, J. (2007). Comparison of self-directed learning versus instructor-modeled learning during simulated clinical experience. *Simulation in Healthcare, 2*(3), 170-177. doi:10.1097/SIH.0b013e31812dfb46

Lindeke, L., & Sieckert, A. (2005). Nurse-physician workplace collaboration. *Online Journal of issues in Nursing, 10*(1). doi:10.3912/OJIN.Vol10No01Man04

Malec, J.F., Torsher, L.C., Dunn, W.F., et al. (2007). Mayo high performance teamwork scale (HPTS); reliability and validity for evaluating key crew resource management skills. *Simulation in Healthcare, 2*(1), 4-10. doi:10.1097/SIH.0b013e31802b68ee

McCormick, M., Burton, T., & Werts, N. (2010). Case scenarios and simulations as techniques to facilitate asthma education and team building among health care students. *Journal of Asthma and Allergy Educators, 1*(1), 18-22. doi:10.1177/2150129709355459

Morison, S., & Stewart, M. (205). Developing interprofessional assessment. *Learning in Health and Social Care, 4*(4), 192-202. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=c8h&AN=2009074031&site=ehost-live

Moule, P., Wilford, A., Sales, R., & Lockyer, L. (2008). Student experiences and mentor views of the use of simulation for learning. *Nurse Education Today, 28*(7), 790-797. doi:10.1016/j.nedt.2008.03.007

National League for Nursing (2012). *About the NLN*. New York, NY: National League for Nursing. Retrieved from http://www.nln.org/aboutnln/corevalues.htm

Nies, M., Hepworth, J., & Fickens, S. (2001). An interdisciplinary team approach to nursing scholarship. *Journal of Nursing Administration, 31*(9), 411-413. Retrieved from http://www.nursingcenter.com

Oandasan, I., & Reeves, S. (2005). Key elements for interprofessional education. Part 1: The learner, the educator and the learning context. *Journal of Interprofessional Care, 1*, 21-38. doi:10.1080/13561820500083550

Parsell, G., & Bligh, J. (1998). Interprofessional learning. *Postgraduate Medical Journal, 74*(868), 89-95. Retrieved from http://pmj.bmj.com/content/74/868/89.full.pdf+html

Pope, C., Mays, N., & Popay, J. (2007). *Systematic qualitative and quantitative health evidence: A guide to methods*. New York, NY: Open University Press.

Reed, D., Price, E., Windish, D., Wright, S., Gozu, A., Hsu, E., . . . Bass, E. (2005). Challenges in systematic reviews of educational intervention studies. *Annals of Internal Medicine, 142*(12) (Part 2), 1080-1089.

Reese, C., Jeffereis, P., & Engum, S. (2010). Learning together: Using simulations to develop nursing and medical student collaboration. *Nursing Education Perspectives, 31*(1), 33-37.

Robertson, J., &Bandali, K. (2008). Bridging the gap: Enhancing interprofessional education using simulation. *Journal of Interprofessional Care, 22*(5), 499-508. doi:10.1080/13561820802303656

Romanow Commission (2002). *Building on values: The future of health care in Canada (Final report. 1-356).* Ottawa, ON: Commission on the Future of Health Care in Canada. Retrieved from http://publications.gc.ca/pub?id=237274&sl=0

Sinclair, B., & Ferguson, K. (2009). Integrating simulated teaching/learning strategies in undergraduate nursing education. *International Journal of Nursing Education Scholarship, 6*(1), 1-11. doi:10.2202/1548-923X.1676

Srivastava, R. (2007). *The health care professionals guide to cultural competence.* Toronto, ON: Mosby.

Stern, D. (1998). Practicing what we preach? An analysis of the curriculum values in medical education. *American Journal of Medicine, 104*(6), 569-575. Retrieved from http://www.sciencedirect.com/science?_ob=ArticleListURL&_method=list&_ArticleListID=1947918916&_sort=r&_st=13&view=c&_acct=C000050484&_version=1&_urlVersion=0&_userid=1022551&md5=2178fb1db8c83bc026ab086ba5621e38&searchtype=a

Tuoriniemi, P., & Schott-Baer, D. (2008). Implementing a highfidelity simulation program in a community college setting. *Nursing Education Perspectives, 29*(2), 105-109.

Uustal, D. (2001). *Values and ethics in nursing: From theory to practice* (3rd ed.). Mississauga, ON: Jones & Bartlett Canada.

Waldner, M., & Olson, J. (2007). Taking the patient to the classroom: Applying theoretical frameworks to simulation in nursing education. *International Journal of Nursing Education Scholarship, 4*(1), 1-14.

Wood, V., Flavell, A., Vanstolk, D., Bainbridge, L., & Nasmith, L. (2009). The road to collaboration: Developing an interprofessional competency framework. *Journal of Interprofessional Care, 23*(6), 621-629. doi:10.3109/13561820903051477

World Health Organization. (2007). *Communication during patient hand-overs. Joint Commission International, 1*. Geneva: WHO Press. Retrieved from http://www.who.int/patientsafety/solutions/patientsafety/PS-Solution3.pdf

World Health Organization. (2010). *Framework for action on interprofessional education and collaborative practice.* Geneva: WHO Press. Retrieved from http://www.who.int/hrh/nursing_midwifery/en/

Appendices

Appendix A: Search Terms and Results

Databases searched	Search terms	Results
EBSCO • CINHAL • Medline with full text • Education Research Complete • ERIC	(interprofessional **or** interdisciplinary **or** multidisciplinary) **AND** nurs***AND** simulat*	371
EMBASE	**1.** (interprofessional **or** interdisciplinary **or** multidisciplinary). mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]	72,400
	2. nurs*.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]	547,387
	3. simulat*.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]	277,048
	4. (role adj play*). mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]	26, 583
	5. 3 **or** 4	302,862
	6. 1 **and** 2 **and** 5	250
	7. limit 6 to (abstracts and English language)	218
	8. limit to yr=”2000 - 2012”	170

Appendix B: Bibliography of Articles Included in this Review

Baker, C., Pulling, C., McGraw, R., Dagone, J., Hopkins-Rosseel, D., & Medeves, J. (2008). Simulation in interprofessional education for patient-centred collaborative care. *Journal of Advanced Nursing, 64*(4), 372-379. doi:10.1111/j.1365-2648.2008.04798.x

Berg, B., Wong, L., & Vincent, D. (2010). Technology-enabled interprofessional education for nursing and medical students: A pilot study. *Journal of Interprofessional Care*, *24*(5), 601-604. doi:10.3109/13561820903373194

Dagnone, J., McGraw, R., Pulling, C., & Patteson, A. (2008). Interprofessional resuscitation rounds: A teamwork approach to ACLS education. *Medical Teacher, 30*, e49-e54. doi:10.1080/01421590701769548

Dillon, P. M., Noble, K. A., & Kaplan, W. (2009). Simulation as a means to foster collaborative interdisciplinary education. *Nursing Education Perspectives, 30*(2), 87-90.

Hobgood, C., Sherwood, G., Frush, K., Hollar, D., Maynard, L., Foster, B., . . . Taekman, J. (2010). Teamwork training with nursing and medical students: does the method matter? Results of an interinstitutional, interdisciplinary collaboration. *Quality & Safety in Health Care, 19*(6), 1-6. doi:10.1136/qshc.2008.031732

Kyrkjebo, J., Brattebo, G., & Smith-Strom, H. (2006). Improving patient safety by using interprofessional simulation training in health professional education. *Journal of Interprofessional Care, 20*(5), p. 507-516. doi:10.1080/13561820600918200

Leflore, J., & Anderson, M. (2009). Interdisciplinary student teams. *Simulation in Healthcare, 4*(3), 135-142. doi:10.1097/SIH.0b013e318196f839

Lewis, R. (2011). Learning the ‘smart’ way... results from a pilot study evaluating an interprofessional acute care study day. *Nurse Education Today, 31*(1), 88-93. doi:10.1016/j.nedt.2010.04.001

Marken, P., Zimmerman, C., Kennedy, C., Schremmer, R., & Smith, K. (2010). Human simulators and standardized patients to teach difficult conversations to interprofessional health care teams. *American Journal of Pharmaceutical Education, 74*(7), 1-8.

McCormick, M., Burton, T., & Werts, N. (2010). Case scenarios and simulations as techniques to facilitate asthma education and team building among health care students. *Journal of Asthma and Allergy Educators, 1*(1), 18-22. doi:10.1177/2150129709355459

Morison, S., & Stewart, M. (2005). Developing interprofessional assessment. *Learning in Health & Social Care, 4*(4), 192-202. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=c8h&AN=2009074031&site=ehost-live

Reese, C., Jeffries, P., & Engum, S. (2010). Learning together: Using simulations to develop nursing and medical student collaboration. *Nursing Education Perspectives, 31*(1), 33-37. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=mnh&AN=20397478&site=ehost-live

Reising, D., Carr, D., Shea, R., & King, J. (2011). Comparison of communication outcomes in traditional versus simulation strategies in nursing and medical students. *Nursing Education Perspectives, 32*(5), 323-327. doi:10.5480/1536-5026-32.5.323

Schildmann, J., Härlein, J., Burchardi, N., Schlögl, M., & Vollmann, J. (2006). Breaking bad news: Evaluation study on self-perceived competences and views of medical and nursing students taking part in a collaborative workshop. *Supportive Care in Cancer: Official Journal of the Multinational Association of Supportive Care in Cancer, 14*(11), 1157-1161. doi:10.1007/s00520-006-0064-3

Selle, K., Salamon, K., Boarman, R., & Sauer, J. (2008). Providing interprofessional learning through interdisciplinary collaboration: The role of "modelling". *Journal of Interprofessional Care, 22*(1), 85-92. doi:10.1080/13561820701714755

Stewart, M., Kennedy, N., & Cuene-Grandidier, H. (2010). Undergraduate interprofessional education using high-fidelity paediatric simulation. *Clinical Teacher*, *7*(2), 90-96. doi:10.1111/j.1743-498X.2010.00351.x

Wakefield, A., Cocksedge, S., & Boggis, C. (2006). Breaking bad news: Qualitative evaluation of an interprofessional learning opportunity. *Medical Teacher, 28*(1), 53-58. doi:10.1080/01421590500312805

Williams, B., Brown, T., Scholes, R., French, J., & Archer, F. (2010). Can interdisciplinary clinical DVD simulations transform clinical fieldwork education for paramedic, occupational therapy, physiotherapy, and nursing students? *Journal of Allied Health*, *39*(1), 3-10. Retrieved from http://docserver.ingentaconnect.com/deliver/connect/asahp/00907421/v39n1/s3.pdf?expires=1334091945&id=68221872&titleid=6329&accname=University+of+British+Columbia+Library&checksum=0FA818E0F1A0A4F1129C9CA6A4BE3599

Appendix C: Data Extraction Table of Studies Included in this Review

Author/ Year Country	Participants Health Profession Nsample	Aim of the Study	Type of Simulation	Characteristics of Learning Experience	Educational Model/ Learning Theory	Objectives of Learning Experience	Evaluation Methodology	 Outcome
Morison & Stewart 2005 United Kingdom	12 3rd year NS 19 4th year MS	To examine appropriate methods for assessment of IP learning by undergraduate medical and nursing students and to involve Senior House Officers in this process	Hybrid- Role play using unspecified-fidelity HPS, standardized patients, clinical practitioners	Prepare and give explanation of insulin dependent diabetes and its management to the family of a paediatric patient newly diagnosed with diabetes Scenarios took place during the student's clinical education placement.	Not indicated	Introduce SHO to IP teaching, assessment, teamwork, & communication Learning scenarios related to development of clinical skills, teamwork and communication	Mixed-Methods Post-intervention assessment only Investigator-developed assessment tools	**Programme Evaluation** - 75% students agreed that they had learned to communicate with parents, with other healthcare professionals, and learned about the role other healthcare professionals play in patient care **3 themes emerged** 1. Value of role-play approach to learning 2. Teaching and assessing – provided SHOs with a good introduction to teaching undergraduates and learning about appropriate teaching methods 3. IP Interaction – convinced that it was important for NS & MS to learn together as this better reflected their future practice
Kyrkjebo et al., 2006 Norway	12 3rd year NS 12 Postgraduate INS 12 5, 6th year MS	To test a simulation training program in IP student teams based on the BEST-principles; to evaluate the structure and design. To examine students' experiences going through the program.	Unspecified-fidelity HPS	Simulation scenarios related to the following: blood transfusion, basic resuscitation, management of central venous catheters, and administration of drugs	Not indicated	No explicit learning objectives stated; however, learning scenarios related to development of team training, including fostering communication, co-operation, and leadership.	Qualitative Pilot Study Post-intervention assessment only Investigator-developed assessment tool	Students satisfied with the training program and discovered the usefulness of this kind of team training, requesting more of this in educational syllabus. Learned about their own performance, reactions, and lack of both professional competences and team skills. **Evaluation of the structure & design in the training program** - liked the lectures , did not consciously

								use the information during the simulation exercise - IS gained little from the videos, NS helped them understand the scenarios, MS did not see their physician role in the situations Videos could be more realistic - discussions after videos were seen as a useful introduction to the simulations - wanted the simulation cases to be more realistic, having 2 runs for each scenario useful because they could discuss and demonstrate some improvement in the second simulation run - useful to have the opportunity to discuss their performance after the simulation run - strongly recommended two simulations on the same topic - would have been better to use live persons as patients instead of mannequins **Students' experience of team skills** - focus on teamwork increased throughout the training program
Schildmann et al., 2006 Germany	24 2nd year NS 24 3rd-6th year MS	- Elicit previous experiences of MS and NS with breaking bad news - identify possible effects of the course on perceived key	Hybrid – role play with standardized patients	Interprofessional breaking bad news curriculum	Not indicated	No explicit learning objectives stated however, learning scenarios related to development of interprofessional communication and collaboration	Quantitative Pre/Post-intervention assessment Investigator developed assessment tool	NS and MS rated their key communication skills significantly better after the course Students valued the IP concept positively

		communication skills of the participants - obtain the views of participants on interprofessional aspects of breaking bad news						
Wakefield et al., 2006 United Kingdom	22 3rd year NS 12 5th year MS	Analyze the effects of bringing together a small group of NS and MS to learn the skills needed to break bad news to patients. Explore the facilitators' feelings about the project.	Role-play with standardized patients.	Interprofessional breaking bad news curriculum	Not indicated	Improve medical and nursing students' skills in breaking bad news, enhance team working, and enable students to learn more about each other's roles	Mixed-Methods SPIKES feedback assessment tool	*Results from the quantitative evaluation not presented due to the disproportionate and small sample size Themes identified - **Benefits of working together** - **Importance of valuing each other** IP teaching was a positive learning experience for both students and teaching staff. IP working allowed students to value each other as distinct but interrelated practitioners. IP working highlighted the need for learners to trust each other Those involved in IP teams felt more supported than when working alone
Baker et al., 2008 Canada AND Dagnone et al., 2008 Canada	101 4th year NS 42 3rd & 4th year MS 70 JMR	Report preliminary evaluations of an IPE through simulation project by focusing on learner and teacher reactions to the pilot modules.	High-fidelity HPS	Advanced cardiac life support scenarios	Adult learning theory. Experiential learning theory	- IP awareness among learners and educators - readiness of learners to work collaboratively with other health care professionals - integration of the specific competencies taught through the simulation curriculum	Mixed Method – Action research Post-intervention assessment only Queen's University Inter-Professional Patient Centred-Education Direction self-evaluation questionnaire	Consistently positive results – add value to education, provide a vehicle for understanding team roles, further desire for IP and simulation based training indicated by learners MS agreed the module led to better understanding of roles and perspectives of other professionals. High degree of awareness of interdependence

								between their profession and other health care professions identified -NS & MS agreed simulator based cardiac life support education adds value to their training.
Selle et al., 2008 United States	12 NS 11 PTS 8 SWS 6 SES (all students 3rd year or above)	Examine whether students learn IP teaming more effectively from 1. discussion of research, faculty **modeling** and role-playing, or from 2. discussion of research and role-playing **(no modeling)**	Role play with instructor modeling versus no modeling	Development of an individualized education plan for a paediatric client with a traumatic brain injury	Not indicated	No explicit learning objectives stated however, learning scenarios related to development of an understanding of interprofessional collaboration, and fostering communication	Quasi-experimental design Pre/Post-intervention assessment Investigator developed assessment tool	The group that experienced instructor modeling felt more prepared to participate in a team meeting than those who did not experience instructor modeling. Students experiencing instructor modeling significantly reflected a deeper understanding of the importance of interprofessional collaboration.
Dillon, et al., 2009 United States	68 4th year NS 14 3rd year MS	To initiate an interdisciplinary collaborative relationship between nursing and medical students; to determine the usefulness of an interdisciplinary approach using simulations as an educational strategy; and to analyze students' perceptions of collaboration	High-fidelity HPS	Mock Code	Not indicated	No explicit learning objectives stated however, learning scenarios related to interdisciplinary education and interprofessional collaboration	Mixed Methods Pre/Post-intervention assessment Investigator developed assessment tool (Qualitative) and the Jefferson Scale of Attitudes Toward Physician-Nurse Collaboration assessment tool (Quantitative)	**Quantitative Data** - supported the value of IP collaborative education using simulation education - MS data reported a significant difference in reflecting more positive attitudes toward collaboration and better understanding of autonomous role of nurse **Qualitative Data** - common themes of teamwork and communication emerged - MS acknowledged need to improve collaborative relationships with nurses - NS & MS saw better communication and teamwork as

								essential component of nurse-physician relationship
LeFlore, & Anderson 2009 United States	13 4th year NS 13 4th year SWS 13 2ND year NPS 13 2nd year RTS	To determine whether instructor-modeled learning with modified debriefing during team-simulated clinical scenarios would have better student outcomes compared with students who underwent self-directed learning with facilitated debriefing.	Hybrid – High-fidelity HPS and one standardized patient	Paediatric respiratory arrest	Social Learning Theory (Bandura, 1977)	To provide the opportunity for students to manage respiratory arrest. Evaluate students' ability to transfer knowledge regarding paediatric respiratory arrest from one scenario to a similar scenario using the same assessment and behavioural skills. - determine if team-simulated clinical scenarios would demonstrate greater ability to apply new knowledge, be more satisfied, have greater proficiency performing technical skills, and show more appropriate team behaviours.	Mixed-Methods Pre/Post-intervention assessment Investigator developed assessment tools and the Log feature from SimBaby©	**Knowledge Assessment Tool** Analyzed by profession; no statistically significant differences among NS, NP, SWS, RTS on the aforementioned tool **Satisfaction Survey** The instructor-modeled learning group were more satisfied with their learning approach and had increased comfort related to interprofessional collaboration. **Technical Evaluation Tool** Instructor-modeling group showed a statistically significant faster time to interventions **Behavioural Assessment Tool** The benefits of observing instructors model proper teamwork behaviours was clearly demonstrated; a leader was more likely to emerge and effective communication occurred among the team that had instructor modeling. No statistically significant differences were assessed between the groups when knowledge was assessed over two time periods.
Berg et al., 2010	12 NS 4 MS Year of study	Feasibility of conducting IP SBAR training with	Hybrid – High-fidelity HPS with instructor modeling	Shift report of patients with the following: shortness of breath, chest	Not indicated	Assess information transfer/communica-tion strategies of the	Quantitative Pilot Study Post-intervention	Students reported that the experience improved understanding of IP communication,

United States	not indicated.	nursing and medical students using remote technologies coupled with mannequin simulation. Feasibility of using a university-based faculty nurse experienced in simulation-based education as a mannequin operator, student evaluator, and mentor at a site distant from the students and simulation		pain, anaphylaxis		study participants	assessment only Investigator developed assessment tool	increased interest in communication skills, and increased their confidence for communicating clinical information to other health professionals. Students indicate that they were able to understand and follow feedback instructions from the remote instructor. Remote management of simulation scenarios and simulation debriefing appears to be feasible and acceptable to student learners.
Hobgood et al., 2010 United States	203 final semester NS 235 4th year MS	Randomized control trial of four pedagogical methods commonly used to deliver teamwork training and measured the effects of each method on the acquisition of student teamwork knowledge, skills, and attitudes	High-fidelity HPS, role play, didactic lecture, and video scenario exercise with audience response didactic discussion. All methods followed by a simulation session using one standardized patient.	TeamSTEPPS® Patient Safety Program	Not indicated	Teamwork attitudes, knowledge and skills in relation to team work training	Quantitative - Randomized Trial Pre/Post-intervention assessment Investigator developed assessment tools and the Mayo High Performance Teamwork Scale	Participants' attitudes towards teamwork improved significantly from pre- to post-intervention in all four groups. All four groups demonstrated an improvement in knowledge pre- to post-test. No technique demonstrated a greater significant change in teamwork skills over another technique. No significant differences between the four groups in the standardized patient ratings of teamwork skills. No simulation technique appeared to be superior for attitude or knowledge acquisition.
Marken et al.,	4 senior NS 1 senior PhS	Design and implement a demonstratio	Hybrid- High-fidelity HPS and one standardized	Discussing an infant health issue, intimate	The Conscious Competence	- Educate healthcare providers to	Mixed-Methods	Self-Assessment of all items showed at least 50% of

2010 United States	3 1st year Ph residents 3 pediatric MR 1 pediatric emergency medicine fellow	n project to teach interprofessional teams how to recognize and engage in difficult conversations with patients.	patient	partner violence, and suicidal thinking with a family member.	Learning Model and Matrix & Issenberg's 10 features of effective learning	successfully assemble and function in an interprofessional ad hoc team - Demonstrate competence while functioning as a member of an ad hoc interprofessional team engaged in difficult conversations	Pre/Post-intervention assessment Investigator developed assessment tools	students moved 1 stage higher in the matrix. Increases were found for all items; although change was only significant for questions 1-5 and 9. Students were satisfied with the program and felt they better understood what to do when confronted with difficult conversations. Students expressed desire to engage in additional simulation scenarios.
McCormick et al., 2010 United States	1st year NS 1st year RTS 1st year HES Total of 34 students * specific number of each profession not indicated	To determine the effect interdisciplinary education has on a student's knowledge, confidence, and satisfaction level about their ability to care for a patient with asthma and obesity.	High-fidelity HPS	Asthma care and patient education	Not indicated	Between the interdisciplinary group and the nurse-only group… 1. Is there a significant difference in pre and post-intervention knowledge about asthma care and management? 2. Is there a difference in the ability of students to effectively counsel asthma patients about weight management? 3. Is there a difference in the overall satisfaction in professional communication, coordinated care, and planning ability?	Quantitative Random assigned trial Pre/Post-intervention assessment Investigator developed assessment tools	Interdisciplinary group expressed greater satisfaction than the nurse-only group with their overall learning experience, and expressed greater confidence in their abilities to coordinate care and educate patients. Interdisciplinary simulation methods did not show a marked advantage over the single-discipline simulation methods for pre-test/post-test knowledge scores.
Reese et al., 2010 United States	13 3rd year NS 15 4th year MS	To investigate the use of an innovative teaching strategy using simulation to support collaboration	High-fidelity HPS	Mock Code	Jefferies Nursing Education Simulation Framework	1. What were students' perceptions of the educational practices in the simulation designed using the NESF? 2. How self-confident were	Mixed-Methods Post-intervention assessment only Investigator developed	There were no significant differences between the nursing and medical student groups evident in their perceptions of the educational practices of the simulation; self-

		between nursing and medical students in an educational setting.				the students caring for a surgical patient in a collaborative clinical simulation? 3. How satisfied were the students with the collaborative clinical simulation as an instructional method? 4. What were the students' perceptions of the collaborative aspect of the simulation measured by the collaborative scale? 5. Are there significant differences in the perceptions of the educational practices in the simulation, self-confidence satisfaction, and collaboration between the medical and nursing student groups?	qualitative questionnaire and the Simulation Design Scale, the Satisfaction and Self-Confidence Scale.	confidence to care for a surgical patient with complications in the future; and satisfaction with the collaborative aspects of the simulation. Overall, students were very positive in their responses in all facets of the simulation experience. Feedback and debriefing were selected by the students as the most important design feature in the simulation. Qualitative review revealed four themes: interaction with other disciplines, real-life situations, experience with a code, and uncertainty. Data from this study supports the use of the theory-based NESF to design high-fidelity clinical simulations.
Stewart et al., 2010 United Kingdom	46 3rd year NS 49 4th year MS	To develop, implement, and evaluate an interprofessional undergraduate programme using high-fidelity paediatric simulation to learn clinical competencies, and communication and teamworking.	High-fidelity HPS	Care of the pediatric patient with one of the following six clinical scenarios; bronchiolitis, croup, asthma, meningococcal septicaemia, acute gastroenteritis, and heart failure	Not indicated	Students should be able to: 1. Perform a clinical assessment of an acutely ill child 2. Initiate appropriate management of an acutely ill child 3. Work effectively as a member of the health care team 4. Communicate effectively with other members of the health care team 5. Demonstrate knowledge and understanding of	Mixed Methods Post-intervention assessment only Investigator developed assessment tool	**Quantitative Data** No statistically significant differences between NS and MS in any of the four domains, communication & teamworking and attitude to shared learning approached significance, with NS scoring higher than MS. **Qualitative Data** The majority of comments in all themes and categories from both professions were positive. Four themes… 1. Better way of learning

						the role of other health care professionals.		2. Future IPE 3. Role awareness 4. Unfamiliar setting (negative theme)
Williams et al., 2010 Australia	191 NS 87 PTS 19 OTS 97 PS Year of education not indicated	To investigate the usability of the DVD simulations, the impact on student learning, and the potential for using DVD simulations as a replacement and/or supplement for clinical fieldwork placement rotations.	DVD simulations using standardized patients	Observations of 11 different clinical scenarios.	Not indicated	No explicit learning objectives stated however, learning scenarios related to development of communication, teamwork and patient assessment skills.	Mixed methodology Post-intervention assessment only Investigator developed assessment tool measuring experience and relevance and validated assessment tools: 1. Sustained Attention/Mental Effort Scale 2. Learner Satisfaction Scale 3. Information Processing Quality	**Quantitative Data** Overall, the students' responses to the questionnaire indicated that they were satisfied with the DVD simulations with relation to attention, learning potential, clinical relevance to practice, and information-processing quality. **Qualitative Data** The data supported the notions of interdisciplinary teamwork, clinical placements, clinical placement education, and DVD quality evaluation and feedback.
Lewis 2011 United Kingdom	72 3rd year NS 16 4th year MS	To undertake initial evaluation of the SMART® (Student Management of Acute Illness – recognition and Treatment) day.	Medium fidelity HPS	Simulation scenarios related to the following: blood transfusion, basic resuscitation, management of central venous catheters, and administration of drugs	Not indicated	To explore the students' (both nursing and medical) knowledge and understanding of acute care, their attitudes to and experience of dealing with acutely unwell patients on the wards, and their views on interprofessional education in practice.	Mixed-methods Pre/Post-intervention assessment (administered 6 weeks after the program) Investigator developed assessment tool	Overall, there was an improvement in each of the categories for each student group after participating in the SMART® program.

Reising et al., 2011 United States	48 senior NS 20 2nd year MS	To compare the outcomes in affective and communication domains using a traditional (roundtable) model versus simulation in using and medical students	High-fidelity HPS and roundtable-case study discussion	Mock code	Jefferies Simulation Model	To understand interprofessional communication (nursing and medicine) within the context of the educational environment (traditional versus simulation). Evaluate the ability of the simulation to enhance the clinical scenario, facilitator effectiveness, actors, correlation of the scenario to patient care, value of the simulation approach, and overall presentation.	Mixed-Methods with randomized control Post-intervention assessment only Investigator developed assessment tool	**Quantitative Data** - 100% of both the NS & MS (both groups) noted that the encounter was helpful in the context of learning interprofessional skills; 98.3% had a better sense of their role on the clinical team; 55% also had a change in how they viewed their role in the clinical team - no differences between NS and MS on any of the following indicators: stress, group management, nervousness, and respect. Significant difference between interventions was the simulation group experiencing more stress during their encounter than the roundtable group. **Qualitative Data** - Across both groups, NS and MS indicated an overall appreciation for the experience to interact with another discipline. **Comparison of comments between NS and MS** - majority of NS and MS identified MS as leaders in the scenario, several students in both groups noted that it was important for everyone's input to be considered before decisions in patient care were made **Comparison of comments between simulation and roundtable groups** - ability for the simulation group to gain a better sense

								of timing during events, resulting in more comments about the realism of the encounter and also more clearly defined the multiple roles within the scenario and the ability (particularly among NS) to assume a variety of roles. **Interaction comments among the four groups** Both NS and MS reported and appreciated each other's skill levels and abilities in the management of patient care and both identified how important teamwork was in order to achieve a successful patient outcome

Abbreviations used in Data Extraction Table

HES – Health Education Student

HPS – Human patient simulator

INS- Intensive Nursing Student

IP- Interprofessional

IPE – Interprofessional Education

JMR – Junior Medical Resident

MR – Medical resident

MS– Medical Student

NS– Nursing Student

OTS – Occupational Therapy Student

PS, Paramedic Student

PhS – Pharmacy Student

PTS – Physical Therapy Student

RN – Registered Nurse RTS – Respiratory Therapy Student

SES – Special Education Student

SHO – Senior House Officer

SWS - Social Work Student

Appendix D: The (Modified) Johns Hopkins Evidence-based Practice Centre Rating Scale Tool for Measuring the Quality of the Included Studies (Murdoch, 2012).

Section I: Representativeness of the Student Study Participants

1. Does the study describe the setting and the study participant population? (e.g. type of health profession)	a. Adequate	(Setting AND population described)	2
	b. Fair	(One or more of these NOT reported OR poor description)	1
	c. Inadequate	(Not specified)	0
2. Does the study describe key characteristics of the study participants? ***Demographics: type of health profession, level of education***	**a. Adequate**	**(Complete demographic description (both features))**	**2**
	b. Fair	**(Partial demographic description (1 feature))**	**1**
	c. Inadequate	**(No demographic features described)**	**0**
3. Does the study describe the type of educational institution and the student population from which the study participants were drawn?	a. Adequate	(Setting AND population described)	2
	b. Fair	(One or more of these NOT reported OR poor description)	1
	c. Inadequate	(Not specified)	0

Section II: Bias and Confounding

4. Was there an appropriate comparison group?	**a. Adequate**	**(Setting AND population described)**	**2**
	b. Fair	**(One or more of these NOT reported OR poor description)**	**1**
	c. Inadequate	**(Not specified)**	**0**
	d. None	**Skip to item 7**	**0**
5. Was assignment of study participant groups randomized?	a. Yes		2
	b. Not randomized		1
	c. Unclear		0
6. Did the study participant group(s) have any important characteristic differences? ***Demographics: specialty training or level of education***	**a. Groups were equivalent in all factors**		**2**
	b. Groups have difference in one factor		**1.5**
	c. Groups have difference in more than one factor		**1**
	d. **Study participant characteristic not reported**		**0**

Section III: Description of the Interprofessional Simulation Education Intervention

7. Does the educational innovation have stated objectives?	a. Adequate	(Objectives stated clearly)	2
	b. Fair	(Objectives stated, but unclear)	1
	c. Inadequate	(Objectives not stated)	0
8. Was there a complete description of the educational innovation?	**a. Adequate**	(**Intervention could be replicated given the completeness of description)**	**2**
	b. Fair	**(some detail but insufficient to ensure replication)**	**1**
	c. Inadequate	**(Minimal to no detail)**	**0**
9. Was the simulation education innovation based on a clearly stated education model and/or learning theory?	a. Yes		2
	b. No		0

Section IV: Outcomes of the Interprofessional Simulation Education Intervention

10. Was there blinding of outcome assessors?	**a. Yes** **b. No** **c. No comparison group**		**2** **1** **N/A**
11. Assessment of outcomes was based upon:	a. Pre- AND post-innovation assessment b. Post-innovation assessment only		2 1
12. Were objective methods used to assess outcomes?	**a. Adequate** **b. Fair** **c. Inadequate**	**(Assessment methods were objective, e.g., statistics, video)** **(Objectivity of assessment is questionable, e.g., de-briefing, focus group, self-assessment** **(Assessment methods not objective, e.g., participant essay OR methods unclear)**	**2** **1** **0**

Section V: Analytic Approach

13. Did the study report the numbers AND the reasons for non-inclusion in the study analysis?	a. Numbers AND reasons for withdrawal reported or NO withdrawals b. Numbers OR reasons reported c. Neither numbers NOR reasons reported		2 1 0
14. What was the greatest percentage of study participants in a study group that withdrew from the study or did not complete an evaluation?	**a. < 10% withdrew or did not complete an evaluation** **b. 10-30% withdrew or did not complete an evaluation** **c. > 30% withdrew or did not complete an evaluation** **d. Withdraws/numbers that did not complete an evaluation not stated**		**2** **1** **0** **0**

Section VI: Statistical Quality and Interpretation

15. Does the study report the magnitude of difference between groups (include pre post assessment) AND an index of variability-including pre-post assessment (e.g., test statistic, p value, standard error, confidence interval)?	a. Adequate	(Both reported with index of variability using standard error or confidence intervals)	2
	b. Fair	(Both reported with index of variability using only test statistic or p value)	1
	c. Inadequate	(One or both not reported)	0
	d. No comparison	(Descriptive analysis only)	0
16. Were the appropriate analyses and/or statistical tests performed?	**a. Adequate**	**(Yes, for all analyses)**	**2**
	b. Fair	**(Yes, but for only some of the analyses)**	**1**
	c. Inadequate	**(Not performed for any of the analyses OR not able to tell)**	**0**
	d. Not applicable		**N/A**

Modified and adapted from Beach, Cooper, Robinson, Prove, Gary, Jenckes, et al. (2004). *Strategies for improving minority healthcare quality. Evidence Report/Technology Assessment No. 90*.

Appendix E: 'Modified' Quality Assessment Model of Kirkpatrick (1967)

Level 1	**REACTION** – Participants reaction to the interprofessional learning experience (satisfied with the experience)	Students views on the interprofessional simulation learning experience, its organization, presentation, content, teaching methods
Level 2a	**LEARNING** – Changes in attitudes and perceptions	Changes in students attitudes and perceptions between the professions represented
Level 2b	**LEARNING** - Acquisition of knowledge and skill	Students acquisition of knowledge and skills related to interprofessional collaboration
Level 3	**BEHAVIOUR** – Change in behaviours, transfer of knowledge and skills acquired	Students application or planned application of learning (new knowledge related to interprofessional collaboration) in practice or changes in practice environment
Level 4	**RESULTS** – Change in professional practice. Resulting benefits to patients/level of care	Refers to wider changes in the organization; enhancement of interprofessional collaboration, attributable to the simulated educational intervention. Improvement in patient safety and patient outcomes as a result of interprofessional collaboration

Appendix F: Criteria for Identifying Best Practices*

Effectiveness Criteria

Evidence may result from:

1. Outcome evaluation: There is a statistically significant change in behaviour.

2. Impact evaluation: (a) There is a statistically significant change in knowledge, attitudes, or beliefs, or (b) an environmental support or policy is successfully implemented and sustained.

Rating	Quality of Evidence *	Decision
A	Positive evidence obtained from a properly designed randomized controlled trial	Practice will be recommended as a 'best practice' if practicality is acceptable.
	Positive evidence obtained from well-designed quasi-experimental study	
B	Positive evidence obtained from a well-designed cohort or case-control analytic study	Practice will be recommended as a 'promising practice' if plausibility and practicality are acceptable.
	Insufficient evidence: weak design	
	No evidence (no data available or findings inconclusive)	
C	No positive change found, randomized controlled trial	Practice is not recommended.

*Considerations:

1. Evidence of effect decay (after positive initial effect) in an isolated intervention does not rule it out from consideration as it is assumed it will be implemented as part of a multi intervention program.

2. There is a need to particularly consider regression to the mean and secular trends in the weaker designs.

3. Mixed results do not exclude interventions from consideration. Evidence of population or participant impact on a sub-set of intervention goals is acceptable.

Plausibility Criteria

Evaluation Attributes

1. *Formative evaluation/pilot testing*: Formative methods (e.g., consultations, focus groups) have been used to assess relevance, comprehension and acceptability of activities, materials, methods, etc.

2. *Process evaluation*: Feedback has been gathered and integrated on program implementation, site response, participant response, practitioner response, provider competency.

Content Attributes

1. *Behaviour objective*: A specific desired behaviour change is addressed.

2. *Behaviour change principles incorporated*: Appropriate behavioural change principles are incorporated and operationalized adequately, e.g. goal setting, active participation, skill building, self-monitoring, social support, repeated contact, etc.

Process Attributes

1. *Collaborative approach*: Local individuals, groups, and intended recipients are involved in planning and implementation.

2. *Visibility*: Activity could be widely promoted in the community or setting, or those engaged in the activity are visible.

3. *Sustainability*: Currently active, or evidence of sustainability; not dependent of special resources.

4. *Community leader support*: Has the potential to elicit involvement/support/buy-in of formal and/or opinion leaders (channel specific leaders).

5. *Outreach (community buy-in)*: Engages individuals from the community with the objective of consulting, animating, or sensitizing the community to the issue.

6. *Mobilizes community resources*: Identifies and uses resources within the community.

Practicality Criteria

Cost Effectiveness – high impact for cost as determined by:

1. *Start up cost*: Reasonable for type of program

2. *Ongoing implementation cost*: Reasonable and appropriate cost for type of program

3. *Reach*: Potential for high participation rates in target population over time

4. *Projected longevity*: Program can be expected to run effectively multiple times

Availability: Packaged for dissemination. Or available in other useable and accessible format, at reasonable cost and without copyright barriers

Fit

1. *Supportability*: Necessary resources/supports could be available in [education/practice] communities

2. *Generalizability*: Even though created with a certain group or setting in mind, it can be used in a variety of contexts

3. *Adaptability*: Can easily be updated or modified to meet need of user groups

4. *Expertise required*: Level of expertise required for implementation is not a barrier and/or can be implemented by lay volunteers with minimal preparation

5. *Linguistic accessibility*: Appropriate level of language used

6. *Cultural accessibility*: Program is compatible with community characteristics and values

7. *Evaluability*: Possible to design a suitable evaluation

*****Source: Cameron, Jolin, Walker, McDermott, & Gough (2001).