Facilitating a Psychologically Safer Climate in Simulation-Based Education with Healthcare Learners: A Systematic Review of Effectiveness

Ashley Jackson, RN, BScN

A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science in Nursing

School of Nursing

Faculty of Health Sciences

University of Ottawa

"Psychological safety is no accident" Dr. Eve Purdy

Master Thesis Committee Members

Thesis Supervisor

Dr. Jane Tyerman Inf./RN, PhD, CCSNE

Professeure Agrégée/ Associate Professor

École des sciences infirmières / School of Nursing

Faculté des sciences de la santé / Faculty of Health Sciences

Université d'Ottawa / University of Ottawa

Courriel / Email: jtyerman@uottawa.ca

Thesis Committee Members

Dr. Michelle Lalonde, Inf., MN, PhD/ RN, MN, PhD

Professeure Agrégée/ Associate Professor

École des sciences infirmières / School of Nursing

Faculté des sciences de la santé / Faculty of Health Sciences

Université d'Ottawa / University of Ottawa

Courriel / Email: michelle.lalonde@uottawa.ca

Marian Luctkar-Flude, RN, PhD, CCSNE, FCNEI

Associate Professor

School of Nursing, Faculty of Health Sciences

Queen's University

Email: mfl1@queensu.ca

Preface

Contributions

I, *Ashley Jackson,* am the primary author of this original thesis work. On October 4th, 2021, I received approval from my thesis supervisor and thesis committee to conduct this thesis project. Due to the nature of the project, and in alignment with the Tri-Council Statement 2, ethics approval was not required.

My major contributions to this project include the identification of the research problem and question, completion of the literature review, creating the comprehensive search strategy/translation, choosing the appropriate inclusion/exclusion criteria, completed title, abstract and full text screening, quality appraisal, data extraction, data analysis, and implications for practice.

All thesis committee members provided guidance and expert opinion at all stages of the thesis process, with the majority being within the methodology and data analysis portion of the thesis. The consecutive paragraphs will discuss in detail the contributions of each committee member.

Dr. Jane Tyerman was my primary thesis supervisor. She was a part of all stages of the thesis process, including assisting in the development of my research question, choosing the most appropriate research paradigm and research methodology, resolving conflicts within the article screening process, and facilitating the interpretation of research findings and implications for practice. Further, Dr. Tyerman was heavily involved in the editing of the entire monograph.

Dr. Marian Luctkar-Flude was a member of my thesis committee. She played an extensive role in the development and formulation of the research question, made

recommendations regarding theoretical framework, and contributed to the data analysis. Dr. Luctkar-Flude and was an editor of the entire monograph.

Dr. Michelle Lalonde was a member of my thesis committee. She played an extensive role in the development of the research question, research methodology, data analysis, implications for practice and was an editor of the entire monograph.

Laura Killam was external to the thesis committee but served as an independent second reviewer for article screening and data extraction.

Marie- Cécile Domecq, University of Ottawa's health science Liberian, assisted in choosing the most relevant and appropriate databases to include in the systematic review.

Victoria Cole, University of Ottawa's health science Librarian, provided expert opinion in the creation of the search strategy.

Abstract

Simulation is considered a safe space for learning as no patient harm could occur. However, learner safety is equally significant to consider. Despite increased interest in simulation psychological safety, evidence synthesis to support the effectiveness of interventions remains lacking. This systematic review seeks to determine what interventions are effective for establishing and maintaining psychological safety within the three phases of simulation with healthcare learners. A Joanna Briggs Institute systematic review of effectiveness was conducted in accordance with the preferred reporting items for systematic reviews and meta-analyses. Articles published from 2011 to 2022 and their references from six databases were searched. Eight articles were included in the analysis. Psychological safety interventions were grouped into two categories: (1) single or (2) multidimensional. Single interventions were more likely to improve learner psychological safety. Several interventions can be used during all phases of simulation to foster a psychologically safer simulation learning environment.

Key Words: Psychological safety, nursing student, healthcare student, simulation

Dedications

My thesis work is dedicated to the numerous educators who choose to believe in me at all stages of my academic journey. Your unconditional positive regard is what got me to where I am today.

Ms. Malroonie, you placed the foundation that led me to believe that I could do hard things.

Ms. Andrea Barrow, you always supported my big goals, and you allowed my dreams to be limitless.

Dr. Melissa Pestill, you opened my eyes to the world of nursing education research and mentored me through my very formative years as a novice researcher.

Nurse Elaine Gimmel, thank you for taking me under your wing and believing in me as a new graduate nurse.

Dr. Thomas Foth, thank you for challenging me to ask the critical questions about the world. Your theory course radically changed my view of the world which intern changed my life.

Dr. Jane Tyerman, you are my biggest inspiration both in life and as a nursing researcher. Although you are the most ambitious person I know, you have always shown me that above all else, I am a person first. You have pushed me to reach new heights and I am looking forward to our next adventure.

Acknowledgements

I would like to thank my thesis committee for their endless grace, patience, and support as we undertook this project amidst a global pandemic. Dr. Marian Luctkar-Flude, you have welcomed and supported me into the world of simulation research. Thank you for encouraging and supporting me through all my research ideas. Dr. Michelle Lalonde, you are incredibly compassionate and caring. You allowed me the space and time to accomplish my research goals. Thank you for your mentorship over the last year. Dr. Jane Tyerman, you continue to push me outside my comfort zone in a safe way, you are an exemplar educator.

I would also like to acknowledge the University of Ottawa health science librarians, Victoria Cole and Marie-Cécile Domecq for their support and knowledge regarding the search strategy.

Wilmer John Santos, thank you for being an incredible mentor to me and sharing your immense knowledge regarding the systematic review process.

Lastly, to my research partner Laura Killam, I would not be where I am today without you. Thank you for being such an eager and dedicated second reviewer. I look forward to our long career in research together.

List of Abbreviations

Abbreviation	Definition
ACS	Analytical cross-sectional study
ADU	Automatic Dispenser Unit
CNO	College of Nurses of Ontario
CINHAL	Cumulative Index to Nursing and Allied Health Literature
INACS	International Nursing Association of Clinical and Simulation Learning
JBI	Joanna Briggs Institute
IPF	Intrapersonal Factors
MeSH	Medical Subject Headings
NCSBN	National Council of State Boards of Nursing
NCLEX	National Council Licensure Examination
NG	Nasogastric
NLN	National League for Nursing
OMHLTC	Ontario Ministry of Health and Long-Term Care
PEG	Percutaneous Endoscopic Gastrostomy
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PRISMA-P	Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols
PRESS	Peer Review of the Electronic Search Strategy
PS	Psychological Safety
QES	Quasi-experimental study
RAS	Rathus Assertiveness Schedule
RCPSC	Royal College of Physician and Surgeons of Canada
RCT	Randomized Control Trial
SBL	Simulation Based Learning
SBLE	Simulation Based Learning Experience
SE	Standard Education
SOGI	Sexual Orientation and Gender Identity Minority

Abbreviation	Definition
SR	Systematic Review
SWiM	Synthesis Without Meta-analysis
SU	Speaking Up
SUMARI	System for the Unified Management, Assessment and Review of Information
TCPS2	Tri-Council Policy Statement 2
TeamGAINS	Guided team self-correction, Advocacy-Inquiry, Systematic-constructivist
TeamSTEPPS	Team Strategies and Tools to Enhance Performance and Patient Safety
VS	Virtual Simulation
VR	Virtual Reality

Glossary of Terms

Healthcare Learner: Any student or licensed healthcare professional with a commitment to lifelong learning within their respective health discipline.

Pre-simulation Briefing: Learners engage in orientation to their simulation environment, learning objections and expectations. This occurs immediately before the participation phase of simulation (Tyerman et al., 2019).

Pre-simulation Preparation: The first phase of simulation in which learners engage in activates that will prepare them with the relevant knowledge and skill for the participant phase of simulation (Tyerman et al., 2019).

Psychological Safety: "a shared belief held by members of a team that it is safe for interpersonal risk-taking" (Edmondson, 1999, p. 350).

Simulation: An evidenced-based educational methodology for teaching a set of skills in a learning environment that replicates real life (INACSL, 2016c).

Simulation Debriefing: A formalized reflection where all participants in the simulation are able to process actions took in the simulation (INACSL, 2016c).

Simulation Participation: The scenario is enacted upon, and learners are assigned specific roles. Learners must be engaged within their role in order to meet the learning objectives (INACSL, 2016c; Luctkar-Flude, 2020).

Table of Contents

Chapter One: Introduction

This first chapter begins with a personal reflection of my experience as a learner within the simulation setting. Following the reflection is a background and formal literature review describing the scope of the issue and the state of the current literature. This chapter concludes with an overview of my research aims and objectives.

Reflection

As a registered nurse, a professional expectation by the College of Nurses of Ontario (CNO) is that we engage in reflective practice (CNO, 2019). I felt that it would be most appropriate to begin my thesis with a formal reflection on a memorable experience in simulation as a nursing student. This reflection is what inspired my thesis topic.

As a nursing student, I excelled in the theoretical aspects of nursing but often struggled to put theory into clinical practice. This was most evident in my experience with medication administration. I had an in-depth understanding of the pharmacology associated with each medication and achieved high scores on pharmacology exams. However, the action of administering medications to the patient caused me significant anxiety. I feared the risks associated with each medication and the outcome of potential medication errors. To combat this anxiety, I would obsessively check medications before administering them to the patient. Although others may have seen this as just being extra cautious, to me it was very distressing and caused a great deal of personal discomfort. My anxiety surrounding medication administration was multifactorial: I placed extremely high expectations on myself, I did not want to endanger any patients, and I wanted to pass nursing school without making any mistakes. Perfection was

my standard, and there was no room for any errors. I took medication administration seriously to the point where it became paralyzing.

Simulation theoretically, should provide students with a safe environment for practicing and developing psychomotor skills to assist them in attaining proficiency and confidence in medication administration. However, in my experience, simulation labs were not safe learning spaces. I was assigned to a simulation group with approximately eight students, some of whom I had never met before, as they entered the nursing program through different entry streams. We were expected to learn together by working in partners or groups. I never wanted to appear inadequate in front of my peers or the instructor. As a result, I constantly kept to myself and tried to "just get through" the required simulation lab. I was more focused on not seeming incompetent than learning the skills.

I can vividly recall an experience in a simulation lab that has stuck with me as I transitioned into being a Registered Nurse. In this lab, we were to learn about caring for persons with a nasogastric (NG) or Percutaneous Endoscopic Gastrostomy (PEG) tubes, including medication administration through these tubes. This was a new skill for me, and I had never seen an NG/PEG tube before this point. We had completed pre-simulation activities that covered a wide range of skills that were going to be practiced in the lab. The simulated patient was prescribed a medication that came in two very similar forms, an enteric-coated and non-coated oral tablets, with the same route, dose and matched the medication order. Furthermore, both tablets were in the same compartment of the medication automatic dispensing unit (ADU). When taking the medication out of the ADU, I chose the enteric-coated tablet, crushed it, dissolved it into the water and pushed the medication through the patient's NG tube. After giving the medication, my simulation instructor stopped the simulation and wanted to use my mistake as a

teaching moment for everyone. Rather than help me understand where I went wrong, the instructor explained to the class how catastrophic and fatal my mistake could have been if that medication had been a long-acting narcotic. Since I was already anxious about making a mistake that could hurt someone, I was absolutely horrified and humiliated in front of all my peers. This mistake made me doubt my abilities as a nursing student, and I worried: if I could make such a simple error like that in simulation, what other errors could I make in the clinical environment?

Looking back on this situation, I believe that making an example out of my mistake was not an effective way to debrief the event. This action caused me significant psychological distress. Although I left the simulation with an awareness of the dangers of crushing a long-acting substance, I still did not understand why crushing an enteric-coated non-narcotic medication is harmful to patients. Since I had already been humiliated in front of the class, I did not want to speak up and ask why.

I suspect that I was not the only student in that lab with a similar question. Social learning theory and vicarious reinforcement may help explain why no one else in the simulation spoke up and asked why crushing an enteric-coated medication was an incorrect nursing action. Bandura et al. (1963) conducted a foundational study on vicarious reinforcement in young children. In this study, when the children saw aggressive behaviour being punished, they were less likely to repeat that behaviour due to observing the negative consequences. Similarly, when that same aggressive behaviour was rewarded, they were more likely to repeat it. In the case of my medication administration error, the students in my simulation group may have observed the embarrassment caused by my error and may have become fearful of speaking up in the future due to the negative outcome they had just witnessed.

Although nursing students need to understand the magnitude of their responsibility, it should enable growth and learning rather than fear and anxiety. The instructor may have believed that their "real world" application may have been a good teaching opportunity, but describing fatal outcomes unrelated to the current situation was not beneficial to my learning. After this situation occurred, I realized that the lab was no longer a "safe container." In my subsequent simulation-based learning (SBL) experiences, I was terrified of making errors as I did not want to seem incompetent. As a result, I experienced adverse physiological reactions such as shaky hands, constant feelings of intense nausea, anxiety, and a clouded mind.

I would advise first-year Ashley that learning the skills in the simulation lab is more important than trying to appear competent. I would tell her not to be afraid to ask questions and keep asking them until she truly understood what she was doing. It is important to note that I am in no way suggesting that I should have been coddled in the simulation lab environment, and I am not naive to the fact that the clinical environment is a rather ruthless one where expectations and stakes are high. Ultimately, I envision a simulation learning environment where curiosity is encouraged, and students feel safe and supported to actively participate; no one should fear saying “I do not know” in front of their peers and instructors. The use of simulation in healthcare education is increasing, especially within schools of nursing, where it is often used as a substitute for clinical hours (Hayden et al., 2014). Therefore, it is paramount that educators strive to create psychologically safe simulated learning environments.

Background

The International Nursing Association for Clinical Simulation and Learning [INACSL] defines simulation as “an educational strategy in which a particular set of conditions are created or replicated to resemble authentic situations that are possible in real life” (Molloy et al., 2021, p. 62). Simulation is a high-quality, evidence-based educational tool that has been utilized across several different practice-based disciplines, including the military, aviation, medicine and nursing (Aebersold, 2016). In nursing education, simulation is no longer an "add-on" technique but rather a fundamental methodology for teaching students a wide array of clinical skills (Aebersold, 2018b). Simulations that are well-designed and led by effective facilitators contribute to enhanced learner knowledge, confidence, critical thinking, clinical judgement, and skill consolidation (Cant & Cooper, 2010; Cant & Cooper, 2017; Davies et al., 2021; Jacobs et al., 2020; McDonald et al., 2018; Wong et al., 2021). Both technical and nontechnical skills can be taught and reinforced effectively using simulation. Technical skills taught through simulation include, but are not limited to, cardiopulmonary resuscitation, intravenous catheter insertions, foley catheter insertion, and wound care techniques (Demirtas et al., 2021; Günay İsmailoğlu & Zaybak, 2018; Hawkins & Tredgett, 2016). Nontechnical skills taught include teamwork, communication, interpersonal communication skills, collaboration, decision-making, leadership, and stress management (Bracq et al., 2019; Lynch, 2020; Phillips et al., 2021; Pires et al., 2020). Simulation can be used across learner levels, from novices to fully licensed professionals (Galloway, 2009).

Simulation can be evaluated in three forms, formative, summative and high stakes (McMahon et al., 2021). Formative evaluation identifies knowledge gaps in skills, attitudes and monitors progress towards meeting clinical outcomes and competencies (McMahon et al., 2021).

Summative evaluations determine learning, skill acquisition and academic achievement at the end of a defined time period, such as the completion of a course (McMahon et al., 2021). High-stakes evaluation is a profess to determine competencies, gaps in knowledge and skills or to identify safety issues. The outcomes of high-stakes simulation have major consequences such as professional registration, academic pass/fail implications or certification (McMahon et al., 2021).

Simulation occurs in a variety of mediums and encompass in-person, in situ and virtual environments (Lopreiato et al., 2016). In person simulations include the use of manikin (represents a patient) or a standardized patient (a trained actor) (Lopreiato et al., 2016). In situ simulations occur in the actual clinical setting and provide a high level of clinical realism (Lopreiato et al., 2016). Virtual simulation (VS) includes VS gaming (also known as serious games), virtual reality (VR) and virtual escape rooms (Lopreiato et al., 2016). VS gaming is a game that is used for educational purposes rather than for pure entertainment (Lopreiato et al., 2016). VR allows for the use of technology to create a three-dimensional experience to achieve the intended learning outcomes (Lopreiato et al., 2016).

VS and in-person simulation have been shown to have similar student outcomes. Cobbett & Snelgrove-Clarke (2016) conducted a randomized study comparing traditional in-person and VS with undergraduate nursing students. Learning outcomes and self-confidence scores between the in-person and VS groups were not statistically significant, indicating that VS is as effective as traditional in-person simulations (Cobbett & Snelgrove-Clarke, 2016).

According to Luctkar-Flude (2020), the simulation experience can be categorized into three distinct phases: Pre-simulation, Participation, and debriefing. The three phases of simulation help one to understand that simulation is more than just the participation phase, as key learning moments occur before, during, and after a simulation session. The terms “pre-simulation

preparation" and "pre-simulation briefing" are used inconsistently within the literature (Page-Cutrara, 2014; Tyerman et al., 2019). The two phases before a simulation begins are the pre-simulation preparation and pre-briefing, which are not interchangeable terms (Tyerman et al., 2019). Pre-simulation preparation is any activity completed before the simulation to provide the students with foundational knowledge regarding the learning objectives for the simulation (Tyerman et al., 2019). Pre-simulation preparation actives include textbook readings, lectures, skills lab practice, online modules, mental rehearsal, cognitive aids, and making care plans (Tyerman et al., 2019). Pre-briefing occurs immediately before the simulation and is a dynamic interaction between the facilitator and learner (Luctkar-Flude et al., 2021; Nascimento et al., 2020; Tyerman et al., 2019). The pre-briefing should include an orientation to the simulation environment, instructions, a review of the learning objective, and clear expectations for each role (Tyerman et al., 2019). Completing both phases of pre-simulation in full has been shown to improve learner satisfaction, increase knowledge, improve performance, and decrease learner anxiety in SBL (Tyerman et al., 2019).

Once the pre-simulation phase has been completed, the learner will begin the simulation experience (Luctkar-Flude, 2020). The participation phase of the simulation event allows the student to immerse themselves in a clinical experience to achieve the learning outcomes (Luctkar-Flude, 2020). Learners may take on different roles such as observer or clinician roles (Luctkar-Flude, 2020). The simulation experience concludes with a debriefing session (Luctkar-Flude, 2020). The debriefing session allows the learner to reflect upon the strengths and limitations of their performance (Luctkar-Flude, 2020).

A seminal longitudinal study by the National Council of State Boards of Nursing (NCSBN) found that high-quality simulation could account for up to 50% of clinical training

hours (Hayden et al., 2014). This randomized controlled trial (RCT) multi-site study compared 666 nursing students from several American colleges divided among a control group of nursing students with less than 10% (n = 258) of clinical hours replaced with simulation to experimental groups with 25% (n = 288) and 50% (n = 276) of clinical hours replaced with simulation. A total of n = 847 pre-licensure nursing students from several American colleges enrolled in the study. The total number of students who completed the study was n = 666 (Hayden et al., 2014). Students were assessed by the National Council Licensure Examination (NCLEX-RN) scores, clinical competence), and readiness for practice at six weeks, three months, and six months post-graduation. The study found that simulated clinical experiences had comparable outcomes to in-person clinical and equivalent clinical competence six months following graduation (Hayden et al., 2014). These findings have been confirmed by subsequent studies (Aebersold, 2018b; Barra & Singh Hernandez, 2019; Bradley et al., 2019; Soccio, 2017).

Research within the field of simulation has increased exponentially in recent years (Harder, 2009; Mulyadi et al., 2021), in both the areas of in-person and VS mediums (Foronda et al., 2020; Harder, 2009; Luctkar-Flude & Tyerman, 2021). Positive student outcomes associated with simulation include improved student competence, decreased anxiety in the clinical setting, improved self-confidence, critical thinking, and better decision-making capabilities (Blum et al., 2010; Brown & Chronister, 2009; Gandhi et al., 2021; Lee et al., 2019; Saied, 2017). This has led to the increased use of simulation in nursing academia.

It was once believed that simulation provided learners with security and a “safe container” as their immediate actions would not have real-world consequences to live patients (Galloway, 2009; Rudolph et al., 2014). Although simulation has been shown to enhance patient safety, a growing body of simulation literature is concerned with learner psychological and

academic safety (Ganley & Linnard-Palmer, 2012; Harder, 2021; Roussin et al., 2018). Current research supports that some clinical SBL experiences can be associated with increased learner stress and anxiety, which may impact learning (Al-Ghareeb et al., 2017; Allen, 2018; Nakayama et al., 2018; Nielsen & Harder, 2013). Multiple studies have reported that some students experience high levels of stress and anxiety within the simulation learning environment (Al-Ghareeb et al., 2017; Allen, 2018; Nakayama et al., 2018; Nielsen & Harder, 2013), which may result in hesitancy to fully participate in all phases of the simulation session (Janzen et al., 2016). Ganley & Linnard-Palmer (2012) found that students felt nervous, humiliated, and intimidated within the simulation learning environment. According to MacLean et al. (2019), high student anxiety and stress levels negatively impacted students' learning within the simulation environment. High levels of anxiety within the learning environment become problematic as formative simulation experiences are intended to monitor and evaluate student progress with an opportunity for feedback, identification of learning gaps, and facilitation of learning (McMahon et al., 2021). Therefore, implementing methods to decrease anxiety is needed to promote engagement, support critical thinking and knowledge application (Konrad et al., 2021; Rudolph et al., 2014; Tyerman et al., 2019; Tyerman et al., 2021)**.**

Psychological Safety

Over the past decade, the simulation literature has grown within the area of psychological safety. The concept of psychological safety was first explored in 1965 by Schein & Bennis of MIT (Edmondson & Lei, 2014). Schein & Bennis (1965) suggested that psychological safety was fundamental for learners to feel secure and capable of behavioural change (Edmondson & Lei, 2014). Schein's later research identified that learning anxiety could be mitigated by establishing a psychologically safe environment (Edmondson & Lei, 2014).

There are three main types of psychological safety: individual, team, and organizational (Newman et al., 2017), of which team psychological safety is the most relevant to simulation-based education (Turner & Harder, 2018). Team psychological safety is best conceptualized as "a shared belief held by members of a team that it is safe for interpersonal risk-taking" (Edmondson, 1999, p. 350). Turner & Harder (2018) published a concept analysis regarding psychological safety within the simulation learning environment that defines a psychologically safe simulation learning environment as "a feeling or climate whereby the learner can feel valued and comfortable yet still speak up and take risks without fear of retribution, embarrassment, judgment or consequences either to themselves or others, thereby promoting learning and innovation" (Turner & Harder, 2018, p. 49). Using this definition of psychological safety in simulation, it is evident that “speaking up” is a significant component of psychological safety (Turner & Harder, 2018, p. 49).

By replicating the clinical environment, simulation-based education employs a team-based structure between a facilitator and other students. For the simulation to be effective, students must take several interpersonal risks within all phases of the simulation (Kolbe et al., 2020; Molloy et al., 2021; Roh et al., 2018; Roh et al., 2021; Tyerman et al., 2021). However, the debriefing phase may pose the most interpersonal risk (Kolbe et al., 2020). Debriefing is arguably one of the critical components of SBL, as this is where it is believed that the most learning occurs (Dreifuerst, 2012). During debriefing sessions, students reflect upon their performance and discuss actions with their peers, which may threaten their reputation or influence how other learners perceive them (Kolbe et al., 2020). Therefore, for effective debriefing to occur, learners must perceive that the group is a safe environment where mistakes can be openly discussed without fear of judgment or embarrassment (Kolbe et al., 2020).

Understanding the team dynamics and improving team psychological safety is of the utmost importance within the simulation environment.

When simulation environments are psychologically safe, they can foster a learning climate where students can learn from their mistakes, problem-solve as a team, and ultimately improve clinical skills (Turner & Harder, 2018). The aim of the following literature review is to discuss the available evidence regarding psychological safety within health care simulation environments for learners.

Literature Review

This literature review was conducted in consultation with the University of Ottawa's health science librarian. Five databases were searched, including Cumulative Index to Nursing and Allied Health Literature (CINHAL), Education source, PubMed, PsychInfo and Web of Science. The search terms used for the databases included Psychological Safety OR Safe Container AND Student AND Simulation OR Sim* AND Nur* OR Health Science.

To ensure that there are no recent systematic reviews on psychological safety in simulation per Joanna Briggs Institute (JBI) guidelines (JBI, 2020), I searched PubMed, PsycInfo, CINHAL, Google scholar, JBI, Cochrane, Campbell, and Epistemonikos. Further, to ensure there were no forthcoming systematic reviews in my topic area, I conducted a search of registered protocols within PROSPERO, JBI, Cochrane, and Campbell.

My inclusion criteria consisted of full-text, peer-reviewed articles, and English text only. Because psychological safety is a recent area of study, no date limitation was applied. The use of simulation as a teaching tool is not unique to nursing (Harder, 2009), so this literature review was broadened to include several disciplines of healthcare education. After reviewing the articles' titles and abstracts, 32 articles were included in this literature review. Endnote was used as my citation manager to keep track of the articles, and a literature matrix was created with key information from the articles. One concept analysis by Kang and Bae (2017) was excluded because it was only available in the Korean language as I could not obtain a translated version of the article.

The main themes generated from the literature review of psychological safety in simulation included defining a psychologically safe environment, the role of psychological safety

within the phases of simulation, creating psychological safety within virtual simulation, and student and faculty perspectives of key components of psychological safety.

Psychological Safety

Psychological safety has recently become a focus within nursing simulation research, and thus, a clear definition needs to be established. A concept analysis is often used in nursing scholarship to clarify and explain a concept of interest (Fitzpatrick & McCarthy; Fitzpatrick et al., 2016). Several different methodologies have been employed for completing a concept analysis, but Walker and Avant's (1993) method is the one most commonly used within nursing (Fitzpatrick et al., 2016). In order to provide a conceptual definition of psychological safety within SBL using Avant's method, we must first understand all elements. A concept analysis will help to clarify the concepts associated with psychological safety within simulation.

Two concept analyses regarding psychological safety in simulation were published between 2017-2018. The first concept analysis by Kang and Bae (2017) was excluded because it was not available in English. The second concept analysis by Turner and Harder (2018) focused on psychological safety for nursing simulation activities.

Defining Attributes. The three defining attributes of a psychologically safe simulation learning environment include (1) mistakes without consequences, (2) facilitator qualities, and (3) foundational activities (Turner & Harder, 2018).

Mistakes without Consequences. Mistakes made in in simulation should not have devastating consequences for both the learner and patient (Turner & Harder, 2018). Learners must be given the space to be curious, explore, try new things and the safety to speak up and ask questions (Turner & Harder, 2018). Learning without negative consequences allows the learner to practice and develop new skills without fear of harming a patient (Turner & Harder, 2018).

Facilitator Qualities. Having a skilled simulation facilitator is essential for psychological safety within a simulation session (Kostovich et al., 2020; Lateef, 2020; Turner & Harder, 2018). A known factor contributing to student success is positive relationships with their facilitators (Chan et al., 2017). However, the power balance between students and facilitators can be unequal, as the facilitator is in a position of power (Turner & Harder, 2018). Ingraham et al. (2018) describe how power imbalances can be positive and negative, noting how the hierarchy and power that facilitators hold may lead to incivility, including unfair treatment, bias, verbal abuse, and lack of respect for students. However, (Chan et al., 2017) argue that a power imbalance is positive for students, as some students may believe that the facilitators should have more power and use it to stop students from taking dangerous actions that could harm patients. In order for the power dynamic to stay beneficial, facilitators should be approachable to students, have appropriate knowledge and skills, be prepared, have excellent communication skills, and be professional at all times (Chan et al., 2017; Turner & Harder, 2018). Facilitators should empower students, encourage learner feedback, and create an open environment to ask questions (Turner & Harder, 2018).

Foundational Activities. Supporting psychological safety in simulation begins before the participation phase of the simulation (Turner & Harder, 2018). Foundational activities involve students being adequately oriented to their learning environment, including the physical space, equipment, and mannequins they will use in the simulation (Turner & Harder, 2018). Further, students need to take responsibility and accountability in their learning by completing their pre-simulation preparation activities. Turner & Harder conclude that simulation learning objectives need to be clearly defined at the beginning of a simulation so that students and facilitators are working towards the same goal.

***Antecedents*.** Turner & Harder (2018) identified four main in their concept analysis of psychological safety in SBL: controlled environment, formative education, confidentiality, and trust (Turner & Harder, 2018). The simulation environment must be well controlled where learning takes place in a non-threatening, predictable, and structured learning environment with clear boundaries established for the simulation (Turner & Harder, 2018). Predictability in the environment can be fostered through pre-simulation preparation activities (Luctkar-Flude et al., 2021; Rudolph et al., 2014; Turner & Harder, 2018). Predictability may lead students to participate in "learning-oriented behaviours," such as taking educational risks, seeking feedback, experimenting, and discussing their errors (Edmondson, 1999; Turner & Harder, 2018).

The formative (or summative) evaluation antecedent involves the evaluation plan and determining whether the simulation is a formative or summative evaluation (Turner & Harder, 2018). Whether used for evaluation purposes or not, establishing psychological safety is essential for optimal learning and the promotion of learning-oriented behaviours (Edmondson, 1999; Turner & Harder, 2018).

The remaining antecedents of psychological safety identified by Turner & Harder (2018) are confidentiality and trust. Students knowing that their performance during the simulation will remain confidential within the circle of learning helps establish mutual trust between learner and facilitator. Transparency and communicating the limits of confidentiality are fundamental (Rudolph et al., 2014). Situations may arise where student performance in simulation needs to be communicated with key members within the education circle, e.g., course professors or clinical instructors (Rudolph et al., 2014). Unsafe student performance in simulation may be necessary to communicate to members of the education circle such as a clinical instructor to avoid potential patient harm. It must be made explicit to students that although their performance will stay

confidential within the education circle, this may include key stakeholders who are outside of the physical simulation environment (Rudolph et al., 2014).

Outcomes. Creating a psychologically safe learning environment produces several positive outcomes. Students in a psychologically safe environment are more likely to learn from their mistakes and view mistakes as learning opportunities rather than failures (Edmondson et al., 2016; Kostovich et al., 2020; Stephen et al., 2020; Turner & Harder, 2018). When psychological safety is established in SBL, learners are more likely to utilize their problem-solving skills (Turner & Harder, 2018). For example, when students are faced with new or unfamiliar learning situations in simulation, learners are better able to work as a collaborative team and solve problems collectively to meet the learning objectives (Turner & Harder, 2018).

Concept Analysis Limitations. This concept analysis focused on in person simulation and lacked content specific to VS as a limitation. As a result, the generalizability and transferability of their analysis to VS are unknown. It is anticipated that the concept analysis findings may be as relevant in the virtual environment, as the INACSL Standards of Best Practice: Simulation, apply to both in-person and VS mediums (Watts et al., 2021). Tyerman et al. (2021) argue that theoretically, fundamental principles of psychological safety can be transferable and applicable to both in-person and VS. This includes orientation to the learning environment, transparent learning objectives and expectations, facilitators who are approachable and accessible to students, inviting feedback, and admitting knowledge gaps or mistakes (Turner & Harder, 2018; Tyerman et al., 2021). Some of these actions may look different in the VS environment, yet they remain foundational practices for establishing psychological safety within all forms of SBL. For example, orientation to the simulation environment is an important element of psychological safety (Dale-Tam et al., 2021a; INACSL, 2016b; Rudolph et al., 2014).

For in-person simulation, this orientation should include the physical environment (e.g., training mannequins), whereas for VS the orientation should include how to utilize the online simulation platform.

Although the Turner and Harder (2018) concept analysis was comprehensive, the concept of psychological safety can be ambiguous. Some (references) perceive that psychological safety exempts learners from all stressful environments and critical feedback. Rudolph et al. (2014) discussed that creating a psychologically safe learning environment does not construct an interpersonal risk-free zone; instead, it allows students to feel safe to take risks and embrace challenges

Psychological Safety within the Phases of Simulation

Simulation based learning includes three main phases: pre-simulation, participation, and debriefing (Luctkar-Flude, 2020). The pre-simulation phase involves learner preparation before the simulation-based learning activity (Luctkar-Flude, 2020). Pre-simulation is further broken down into two subcategories, including pre-simulation preparation and pre-briefing (Luctkar-Flude, 2020). Pre-briefing is often used synonymously within pre-simulation preparation in simulation research. Although some researchers identify these as two discrete components (Tyerman et al., 2019), for the purposes of this literature review, the discussion surrounding pre-simulation will be under pre-briefing.

Pre-Briefing. Although cultivating psychological safety may seem like an abstract goal, pre-briefing strategies can help foster a psychologically safe learning environment within SBL (Rudolph et al., 2014). Rudolph et al. (2014) wrote a foundational article identifying pre-briefing strategies for establishing psychological safety, including being transparent about the

expectations, having a fiction contract in place, attention to logistical details, and respecting the learner.

Pre-Briefing Strategies. According to Rudolph et al. (2014), the facilitator must be transparent about the learning objectives and the type of evaluation (formative or summative) that will be occurring in the SBL during the pre-simulation preparation and pre-briefing phase. Students review the learning objectives and are oriented to the physical environment, and this orientation should include an explanation of the physical environment and a discussion on proper simulation etiquette. Rudolph et al. (2014) also noted that simulation logistics - such as the length of the simulation, when breaks will occur, and cellphone policies - must be made clear to the participants. Further, students must be aware of how the simulation will be assessed because when higher stake (summative or high stakes) testing is involved, as it can create a more stressful environment, threatening psychological safety.

The second pre-briefing strategy described by (Rudolph et al., 2014) is "establishing a fiction contract" between the participants and the facilitator (p.341). The fiction contract is a collective agreement whereby the learner and facilitator mutually agree to treat the SBE as they would in a real clinical environment. Despite advances in technology, not all aspects of the simulation will genuinely replicate the real world. Rudolph et al. (2014) therefore, argue that a fiction contract should be established before the start of the simulation. The fiction contract can be a verbal or written agreement and is a form of psychological fidelity.

The third pre-briefing strategy for fostering psychological safety identified by Rudolph et al. (2014) is a commitment to respecting learners. They argue that facilitators must value learners' perspectives and should carry the assumption that all learners are inherently rational. Having an unconditional positive regard for students can be demonstrated by assuming that

mistakes are inevitable and are not a moral deficit. Rather, the world around the learner has informed how they see the situation and thereby the actions they choose to make in the simulation (Rudolph et al., 2014). Rudolph et al. (2014) urge facilitators to further investigate the background context of a learners' mistakes.

Strategy Evaluation. At the time of the Rudolph et al. (2014) publication, the strategies discussed were considered anecdotal, as psychological safety within simulation had not been well-addressed in the simulation literature. More recently, Roh et al. (2018) conducted a post-test-only experimental study to test the pre-simulation strategies of fiction contract and concept mapping, which were interventions initially discussed by Rudolph et al. (2014). Roh et al.'s simulation focused on cardiopulmonary resuscitation, which requires high levels of psychological safety. Fifty fourth-year nursing students were assigned to either an experimental or control group, both of which completed 100 minutes of pre-simulation pre-briefing. Pre-briefing content included clinical skills review, clarification of learning objectives, and providing an opportunity to ask the facilitator questions. The experimental group signed a fiction contract and completed a concept mapping exercise. Students completed a post-test to measure psychological safety, using the Korean version of the team psychological safety scale ($\alpha = .88$). The results of this study indicate that establishing a fiction contract before a cardiopulmonary resuscitation simulation contributed to higher levels of team psychological safety ($t = 2.754$, $p = .008$) and team performance ($t = 7.488$, $p = < .001$). The concept mapping enabled the participants to go into the simulation with a pre-established plan and care options with appropriate rationale. Thus, Roh et al. demonstrated that a fiction contract and concept mapping are effective tools for establishing psychological safety within SBL.

Debriefing. According to the Society for Simulation in Healthcare (SSH), debriefing is defined as "a formal, collaborative, reflective process with simulation learning activity" (Lopreiato et al., 2016, p.8). Following a simulated clinical experience, debriefing is considered a critical learning activity (Dreifuerst, 2009; Palaganas et al., 2016; Shinnick et al., 2011). Debriefing is an active practice that helps students critically reflect upon their actions to improve their performance and skills (Al Sabei & Lasater, 2016). Debriefing methods are categorized as either synchronous or asynchronous (Atthill et al., 2021). The previous INACSL Standards of Best Practice states that debriefing should occur immediately after the simulation and that in-person synchronous debriefing is the "gold standard" debriefing methodology (INACSL, 2016a). However, the most current INACSL (2021) guideline for debriefing states that as long as the debriefing needs of the learners are met, there is no preferred debriefing methodology or time (Decker et al., 2021). Kolbe et al. (2020) conducted a hybrid literature review exploring strategies that foster psychological safety within the debriefing phase of the simulation. They note that psychological safety is not an event, but rather, a dynamic process (Kolbe et al., 2020). One does not “reach” a state of ongoing psychological safety. Psychological safety is an active process that needs to be established, evaluated, and re-established throughout the entire simulation process. It goes beyond the facilitator saying “everything that happens in simulation, stays in simulation” (Kolbe et al., 2020). Therefore, ensuring psychological safety is a practice that requires continual effort and evaluation by both the learners and the facilitator. Implicit and explicit methods can be implemented before, during and after the debrief to facilitate psychological. Strategies they identified include the facilitator utilizing the time in the simulation effectively (i.e. starting and finishing on time), ensuring a private debriefing location, maintaining learner and group confidentiality, being transparent, and clarifying expectations.

Strategies they identified for use during the debrief include being empathetic, making eye contact, having positive student affect, authenticity, inclusivity, normalization of mistakes, and mutual vulnerability. Post-debriefing strategies identified include positive regard, confidentiality, inviting feedback, and offering support.

Kolbe et al. (2020) also discuss several threats to psychological safety within simulation debriefing and how these threats can be challenging for facilitators to manage. Some threats to psychological safety in simulation debriefing include learners arguing, criticizing each other or becoming angry or losing their temper (Kolbe et al., 2020). The management of psychological safety threats within debriefing is considered an advanced facilitator skill (Kolbe et al., 2020). This further reinforces the need for simulation facilitators to have high-quality formal training in debriefing facilitation (Decker et al., 2021).

Kolbe et al. (2020) also identify some clear signs that learners may demonstrate when their perception of psychological safety is being threatened during the debrief, including arguing, criticizing each other, and losing their temper. They encourage facilitators to assess learners for responsive behaviours, including decreased interaction, defensiveness, expressing criticisms such as the lack of realism, arguing, or demonstrating closed body language. When facilitators recognize these signs of threatened psychological safety, re-establishing psychological safety should be prioritized. Kolbe et al. stress that all facilitators must understand that learners are inherently rational, and that “difficult” behaviours may be a manifestation of feeling psychologically unsafe. Suggested strategies to re-establish psychological safety include clarifying expectations, maintaining eye contact, using inclusive language, validating students, and expressing appreciation.

Speaking Up

A significant component of psychological safety is speaking up; however, these are not interchangeable terms and there are distinct differences between the two terms. Psychological safety is specifically concerned with interpersonal risk taking (Edmondson, 1999). Speaking up is concerned with challenging authority or seeking clarification with an emphasis on assertiveness (Fagan et al., 2016; Kolbe, Burtscher, et al., 2013).

Speaking up is a concept that has been extensively explored within the literature, especially pertaining to patient safety (Kim et al., 2020; Nacioglu, 2016; Sayre et al., 2012). Fang et al. (2016) published a concept analysis surrounding nursing students speaking up for patient safety. The concept of speaking up originates from advocacy. Over the last two decades, nurses' autonomy within healthcare has substantially increased. This increase in nurses' autonomy has significantly enabled nurses to speak up and advocate for patients. Speaking up can be defined as challenging authority or seeking clarification. The defining attributes of speaking up include advocacy, being heard and a sense of agency. The antecedents to speaking up include knowledge, cultural and generational factors, attitude, confidence, organizational structural, silence, supervision, and support. The consequences to speaking up include distress, being ostracised, reprimanded, and moral distress (Fagan et al., 2016).

Virtual Simulation

SBL has extended into the virtual environment as nursing simulation research into VS and game-based learning continues to expand. VS can improve learner learning engagement, clinical reasoning, and knowledge, indicating that it is an effective teaching tool (Atthill et al., 2021; Cant & Cooper, 2017; Keys et al., 2021; McDonald et al., 2018). The effectiveness of VS is further supported by Cobbett and Snelgrove-Clarke (2016) RCT of traditional in-person

simulation versus VS within an undergraduate nursing program. Participants' learning outcomes and self-confidence scores between the in-person and VS groups did not significantly differ. The authors concluded that VS was just as effective as in-person simulation.

With the increasing use of VS, it is important to establish psychological safety within VS environments (Dale-Tam et al., 2021a). The COVID-19 pandemic has rapidly increased the use of VS within schools of nursing, medical schools, and hospitals (Atthill et al., 2021; Bradley et al., 2020; De Ponti et al., 2020; Luctkar-Flude & Tyerman, 2021) due to restricted in-hospital clinical experiences (Bradley et al., 2020). Nursing programs were left to find innovative ways to ensure that the students received the required number of clinical hours needed to graduate (Bradley et al., 2020). Technology poses logistical barriers, so ensuring the psychological safety of the learners should be of high priority (Dale-Tam et al., 2021a).

A study by Dale-Tam et al. (2021) investigated a Canadian hospital's shift of its in-person simulation program to a virtual medium due to the restrictions associated with COVID-19. As a quality improvement project at this hospital, the researchers decided to test if pre-simulation strategies could be used to establish psychological safety in VS environments. Eight nurses participated in a surgical nursing orientation via VS. To establish psychological safety, the facilitators explicitly discussed the objectives of the simulation, oriented the participants to the e-simulation platform, expressed a commitment to confidentiality, and only used performance as a formative learning opportunity. After completing the e-simulation, the participants were given a definition of psychological safety and asked whether they felt as though the e-simulation experience was psychologically safe, measured with "yes" or "no" responses. All of the participants (n = 8) expressed that they felt psychologically safe (no p-value reported).

Therefore, there is weak evidence to support that pre-briefing activities help to cultivate psychological safety within the VS environment.

Research Paradigms

Research regarding psychological safety is conducted within multiple paradigms, including qualitative, quantitative, and mixed methods. The following is an exploration of the current state of the literature.

Qualitative Research. Within the qualitative paradigm, both students' and faculty members' perspectives of psychological safety have been examined.

Student Perspectives. A common theme present in much of simulation psychological safety literature is that having a supportive and encouraging facilitator helps create a psychologically safe learning space. Students feel psychologically safe when their facilitators use encouraging words, validation, professional tone, respect, and are unbiased towards the student (Stephen et al., 2020). When facilitators are transparent about expectations and evaluation methods and provide learners with orientation to the simulation environment, psychological safety is further enhanced (Stephen et al., 2020). Students felt psychologically safer when their simulation performance was not linked to course grades (Stephen et al., 2020).

Another theme identified by Stephen et al. (2020) was the ability to learn without fear. It is essential to establish an environment where learners do not feel judged or criticized by their facilitator or fellow peers (Stephen et al., 2020). Unfortunately, peer-to-peer bullying can occur during SBE, threatening students' psychological safety within the simulation (Goldweber et al., 2013; Kassem, 2015; Stephen et al., 2020). Students reported feeling less psychologically safe when randomly assigned to groups of unfamiliar students because working in groups with unfamiliar peers could lead to feelings of "stage fright" (Stephen et al., 2020). Therefore, having

the autonomy to choose their groups made the students feel more psychologically safe. Although the facilitator plays an important role in establishing psychological safety, this article highlights that fellow learners in the simulation are also responsible for creating psychologically safe learning spaces (Stephen et al., 2020).

Faculty Perspectives. Kostovich et al. (2020) examined faculty perceptions of psychological safety within SBL. Faculty (n = 37) answered open-ended questions on an online survey. Five themes were generated from the data: setting the stage, it's ok, its only sim, everyone is here to learn, planned strategies, and facilitator as an observer.

The *"setting the stage"* theme describes facilitators discussing the importance of the pre-briefing phase for ensuring psychological safety. Facilitators stated that within the pre-briefing, they would communicate with the students what would be happening in the proceeding simulation, orient the learners to the physical simulation environment, and have the learners make a fiction contract.

The theme "*It's ok, it's only sim,"* refers to the facilitator's commitment to not punishing students' mistakes as mistakes are an inevitable part of the learning process and the importance of confidentiality. A strategy suggested for ensuring confidentiality between the learners is to have everyone sign a confidentiality form before attending the simulation.

The "*Everyone is here to learn"* theme refers to facilitators' commitment to reassuring learners that their mistakes in simulation would not harm any live patients. Further, as a strategy to enhancing clinical decision-making and critical thinking, SBL activities should provide learners with an opportunity to practice skills before attending the live simulation (Doody & Condon, 2013; Kostovich et al., 2020).

The "*Planned strategies"* theme refers to facilitators employing troubleshooting strategies to support learners during the simulation. This includes access to textbooks and peer or facilitator providing cues when struggling, which the INACSL Standards of Best Practice in facilitation methods also support (Persico et al., 2021).

The "*Facilitator as an observer"* theme refers to facilitators taking a more "hands-off" approach, whereby the facilitator will not interfere with the simulation and allow the students to act independently. Once the simulated experience has concluded, debriefing occurs, where the student and facilitator discuss the events in the simulation. This approach allows for students to act independently (Kostovich et al., 2020).

On another note, some researchers question the need for psychological safety in nursing simulation. Cantrell (2021) questions whether psychological safety research within simulation is relevant, arguing there is no direct link between psychologically safe simulation learning environments and positive healthcare outcomes. Harder (2021) notes that current research exploring psychological safety has primarily explored how it can be cultivated within SBL environments and suggests there is a significant gap in the literature involving psychological safety outcomes at the organizational, group, and team levels. However, Harder states this critical gap establishes a need to further explore why psychological safety within simulation is crucial, especially during times of COVID-19 when the use of simulation was rapidly integrated into many health professionals' training. Therefore, the importance of and need for psychological safety in SBL have also been brought to the forefront (Harder, 2021).

Quantitative. It should be noted that the authors Roh et al. used the academic safety scale to measure psychological safety in both their 2021 and 2020 studies. One could argue that academic safety and psychological safety are not the same variables. Ganley and Linnard-Palmer

(2012) state that academic safety includes both physical and psychological safety and sets the stage for team learning where appropriate. This would suggest that academic safety encompasses more than psychological safety in isolation. Therefore, using the academic safety scale to measure levels of psychological safety may not have been completely valid.

Measurement. The measurement of psychological safety used within the literature is inconsistent. Until recently, there were no published scales specifically measuring psychological safety within nursing simulation environments. The Psychological Safety in High Fidelity Simulations tool developed by (Park & Kim, 2021a) is the first published psychometric scale measuring nursing students' perceived level of psychological safety in SBL. The tool contains 14 items using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Higher total scores (max 70) indicate a strong level of psychological safety. The internal reliability of this instrument is high ($\alpha = .91$), making it a reliable tool to be implemented in future research for the measurement of psychological safety in simulation (Polit, 2010).

Existing Systematic Reviews

During this preliminary search of existing systematic reviews, I found three relevant systematic reviews on psychological safety ((Newman et al. (2017), O'Donovan and McAuliffe (2020a) and (2020b)). However, none of these reviews effectively addressed my research question.

Newman et al. (2017) conducted a systematic review examining the antecedents and outcomes of psychological safety within work environments. This review included 83 studies published between 1990-2015. Psychological safety was categorized in terms of individual, team, and organizational level. Existing research focused primarily on the team level with minimal research at the organizational and individual. The review found that theories

underpinning most studies included social learning theory, social information processing theory, social identification theory, and social exchange theory. Outcomes of psychological safety identified within the literature included innovation, attitudes, communication, knowledge-sharing, voice behaviours and creativity. Although this review discussed the antecedents and outcomes of psychological safety extensively, it did not explicitly recommend how to cultivate a culture of psychological safety. Although it furthers understanding of psychological safety, a limitation of this review was the decision to exclude all studies, including studies focusing on psychological safety in education. Therefore, the state of the literature regarding student/ learner psychological safety has not been synthesized.

O'Donovan & McAuliffe published two systematic reviews exploring psychological safety within healthcare teams, including factors that led to psychological safety and specific interventions that promote or improve psychological safety within healthcare settings (O'Donovan and McAuliffe (2020b). The first review examines factors that lead to psychological safety (O'Donovan and McAuliffe (2020a, 2020b). Thirty-six articles published between 1999 and 2019 were included in this systematic review. Thirteen "enablers" of psychological safety were identified and categorized into individual, team, or organizational enablers of psychological safety. At the individual level, enablers of psychological safety include professional responsibility and individual differences. The enablers at the team level include leader behaviour, status, hierarchy, and inclusiveness, change-oriented leadership, leader support, peer support, familiarity with the leader and team members. Organizational-level enablers included safety culture, continuous improvement culture, organizational support, and familiarity across the teams. It was not explicitly stated that studies with a population with students were excluded. However, the summary table of the included studies does not list any

studies wherein nursing students were included. Only 3 of the 36 articles included medical interns and residents who could arguably be considered students. Therefore, the student/learner context is not well represented within this review.

The second systematic review by O'Donovan and McAuliffe (2020a) focuses on specific interventions that promote or improve psychological safety within healthcare settings. The review included a total of 14 articles published between 1999 and 2018. This review identified five categories of interventions, including educational interventions and simulation exercises, leader's video presentations, educational workshops, and interventions without educational components. The researchers concluded that they could not confidently state which interventions were most effective at improving psychological safety due to inconclusive results (O'Donovan & McAuliffe, 2020a). Furthermore, this review highlighted that outcome measures of psychological safety were inconsistent. More objective psychological safety measures should be developed to assess interventions more accurately.

The second review also discusses how psychological safety within health care teams is important for interdisciplinary healthcare teams (O'Donovan & McAuliffe, 2020a). Psychological safety within healthcare teams is important given the high stakes and high risk of healthcare environments. When a healthcare team has a high level of psychological safety, it can lead to more team cohesion and improved outcomes (O'Donovan & McAuliffe, 2020a). O'Donovan & McAuliffe note that although psychological safety is necessary for safe and effective healthcare team environments, a culture of fear and perceived low psychological remains. A significant limitation of this review study is that it excluded any study related to psychological safety interventions within student groups (O'Donovan & McAuliffe, 2020a).

Research Gap

It is clear from the available literature that psychological safety is important within healthcare teams. The number of empirical studies regarding psychological safety within the healthcare and simulation environment continues to grow. Although three systematic reviews regarding psychological safety were recently published, they share a significant gap by explicitly excluding healthcare students. There is currently no knowledge synthesis that effectively captures psychological safety interventions within healthcare students and specifically within the simulation environment. Yet, the literature regarding psychological safety in simulation with healthcare students continues to proliferate. Therefore, a systematic review of psychological safety in the SBL environment, including students. is warranted.

Research Aim and Objectives

The aim of this quantitative systematic review was to synthesize the existing literature regarding interventions that support student psychological safety in simulation-based learning with healthcare learners. A systematic review of effectiveness was completed to address this research aim.

The specific objectives include:

1. To assess the effectiveness of interventions aimed to establish psychological safety within the three phases of simulation with health care learners.
2. To identify how psychologically safety is measured in SBL environments

The specific research questions include:

Primary Question:

i. What interventions effectively establish and maintain psychological safety within the three phases of simulation with healthcare learners?

Secondary Question:

ii. How is psychological safety measured in the SBL?

Chapter Two: Philosophical Assumptions

Chapter two discusses pragmatism and how this philosophical perspective informs my research study. This chapter concludes with an explanation of the National League for Nursing (NLN) Jefferies Simulation Theory and how it is used as a framework for my systematic review.

A paradigm is a set of beliefs that guides one through interpreting the world around them (Weaver & Olson, 2006). There are three main components to a paradigm: ontology, epistemology, and methodology (Houghton et al., 2012). Several different paradigms are used within nursing research, including positivism, post-positivism, interpretivism, critical theory, social theory, and pragmatism (Weaver & Olson, 2006).

Ontology

Different schools of thought exist regarding the philosophical question of "what is" and the truth about reality (Floridi, 2003). The philosophical concept of ontology is concerned with one's beliefs about reality (Floridi, 2003). Several contextual and environmental factors affect "what is truth." I believe truth is not a fixed concept and is a fluid dynamic that changes with time and context. Our different lenses of the world are impacted by our past experiences and influence how we interpret the world around us. Although we may see the world through our own unique lens, there are commonalities that can be collectively shared.

Epistemology

Epistemology is concerned with the researcher's relationship with their research. I believe that each problem is unique and will require different approaches to address the need. Issues are rarely straightforward and often will require different methods to resolve (Houghton et al., 2012). I believe that we need to embrace the messiness of our world and take the best approach to

solving the issue. Sometimes this will mean immersing ourselves within the research, and other times, we may be required to take a more hands-off approach.

Pragmatism Philosophical Assumptions

Pragmatism is a paradigm that arose from the "paradigm war" between positivism and constructivism (Polit & Beck, 2021). The philosophical doctrine of pragmatism originates from the philosophers Charles Sanders Peirce, William James and John Dewey (Ormerod, 2006). Charles Sanders Peirce developed the theory that meaning and real-world application are how one can come to know truth and are thus the central tenets of pragmatism (Ormerod, 2006). William James is known as the face of pragmatism as wrote the seminal text “Pragmatism: A New Name for Some Old Ways of Thinking” (Ormerod, 2006). John Dewey further developed pragmatism and its practical application into the realm of education and politics. Ultimately, John Dewy believed that knowledge is an “instrument for action” (Ormerod, 2006, p. 893).

Pragmatism is a research paradigm that is based on the assumption that researchers should adopt the approach that best solves the problem at hand (Kaushik & Walsh, 2019). Pragmatism is flexible in its ontology and epistemology because the goal is to solve the problem in the way that makes the most sense (Kaushik & Walsh, 2019). The research question is an important aspect of a pragmatic approach because it is believed that the inquiry and methodology should be informed by the specific research questions (Polit & Beck, 2021). The Pragmatic paradigm is predominantly used in mixed-method research but can also be utilized within the quantitative paradigm (Polit & Beck, 2021).

Pragmatic Ontology

A pragmatic approach allows for flexibility in one's beliefs about reality, as pragmatists agree that there is no one true reality (Houghton et al., 2012). Practicality is central to

pragmatism, and the research question and intended outcomes drive the "truth" about reality (Polit & Beck, 2021). One does not have to choose between a positivist or constructivist paradigm but must utilize the paradigm which best addresses the research question (Houghton et al., 2012). The focus of the research is the practicality of the outcomes rather than the research process (Houghton et al., 2012).

Pragmatic Epistemology

A pragmatic approach is action-focused, and as a result, the researcher's relationship with the work is determined by what best meets the needs of the research question (Kivunja & Kuyini, 2017). Several types of research methods fit within the pragmatic paradigm but traditionally, pragmatism is used in mixed-methods research because it allows for the integration of quantitative and qualitative data (Kivunja & Kuyini, 2017). However, methodologies such as case studies, narrative inquire, quasi-experimentalism, and ethnographies also fit this paradigm (Kivunja & Kuyini, 2017).

A pragmatic approach is most fitting for this education problem. The research problem comes from the actual simulation learning environment. The goal of this research project is to change current simulation practice to create safer learning environments for learners. Therefore, a practical-based theoretical assumption is most fitting.

Theoretical Framework

According to Polit et al. (2020), a theory "is a systematic explanation of some aspect of reality" and a framework "helps to guide the inquiry and interpret the findings" (p.42). Godfrey et al. (2010) argue that frameworks are utilized in literature synthesis to inform the search strategy, clarify the study outcomes, identify gaps and areas for future research. This systematic review is guided by the NLN Jefferies Simulation Theory theoretical framework.

NLN Jeffries Simulation Theory

The NLN Jeffries simulation theory has six main components: context, background, simulation design, simulation experience, facilitator and education strategies, participant and outcomes (Jeffries et al., 2015). C*ontext* covers the entirety of the framework and has a significant impact on the simulation. The context includes considering the purpose of what skills are being taught, the simulation location (e.g., in-person or virtual), and how the simulation will be evaluated (training or evaluating skills). *Background* encompasses the goals, expectations, and resources available**.** The students' learning needs and curriculum requirements must guide the simulation. The *simulation design* must consider the learning objectives and outcomes, simulation design, fidelity level (high or low), participant and observer assigned roles, the flow of the activities, the strategies to be employed, and the briefing/debriefing. This theory suggests that the actual *simulation experience* should be learner-centred, embrace a collaborative approach, be interactive, and foster experiential-based learning. *Facilitator and Educator strategies* should be dynamic and interactive for the participants. Trust between the facilitator and participant maintains a positive simulation experience. *Participant's attribute's* will affect the learning experience. Attributes include age, experience, anxiety, gender, and self-confidence. It is critical that the participants "buy in" to the scenario to create a more realistic experience. Psychological fidelity and engagement are crucial aspects of the simulation experience. Lastly**,** *outcomes* should affect three levels, including the system, patient and participant (Jeffries et al., 2015).

I believe the NLN Jeffries simulation theory is an appropriate framework to guide my systematic review. The NLN Jefferies Simulation Theory is a well-known and validated theoretical framework which guides nursing simulation practice and research. The NLN Jeffries

Simulation theory was first published in 2005, and has undergone several revisions since then (Jeffries, 2005). The NLN theory commonly underpins studies in the field of simulation, especially as it pertains to nursing education simulation research. Additionally, the NLN framework is in alignment with my philosophical assumptions of pragmatism. Pragmatism is concerned with the real-world application of research findings (Feeler, 2019). The NLN framework blends well with the simulation process, making my study's findings easy to implement into the SBL environment.

Chapter Three: Methods

This chapter provides a discussion on systematic reviews and why it was the most appropriate research method for answering my research question. The chapter concludes with the systematic review protocol that was developed and used for this study.

Knowledge syntheses are a fundamental aspect of knowledge translation and are essential for evidence-informed healthcare (Tetzlaff, 2009). A systematic review is a form of knowledge synthesis which aims to answer a research question by systematically reviewing, appraising, extracting, and analyzing relevant data (Tetzlaff, 2009). There are several methodologies for conducting a systematic review, including **t**he Cochrane Collaboration, Campbell Collaboration**,** and the Joanna Briggs Institute (JBI) (Tetzlaff, 2009). The systematic review presented in this paper was conducted using the JBI methodology.

JBI is an internationally recognized methodology for systematic reviews that is commonly used for health and nursing-related topics (Aromataris & Munn, 2020). Using the JBI methodology aligns with my philosophical assumptions, as JBI takes a pragmatic approach to literature synthesis, as evidenced by its mission and vision. The mission of JBI is to promote and support evidence-based healthcare with a vision of better evidence leading to better outcomes and a brighter future (Aromataris & Munn, 2020).

Historically, systematic quantitative reviews of RCTs were thought to be the "gold standard" and were the most favoured form of systematic reviews (Hong et al., 2017). However, RCTs cannot answer all research questions, particularly many of interest to nursing and other healthcare fields, so a growing trend is synthesizing other forms of research designs. For example, mixed-method reviews allow for a rich understanding of a phenomenon by integrating qualitative and quantitative perspectives (Hong et al., 2017).

JBI offers review guidelines for over ten different review types (Aromataris & Munn, 2020). All JBI systematic reviews involve eight steps: formulating a question, inclusion and exclusion criteria, locating the studies, selecting studies, critically appraising the quality of the studies, data extraction, analyzing and synthesizing the data, and presenting and interpreting the results (Aromataris & Munn, 2020).

This study employed a *systematic review of effectiveness* as described in the JBI guidelines (Aromataris & Munn, 2020). A systematic review of effectiveness is the most appropriate and feasible methodology to address my research question. Although there is valuable research that utilizes qualitative and quantitative data, quantitative data will best address my research question. Qualitative data is valuable for uncovering perspectives and explanations for phenomena, my research question is concerned with finding the most effective strategies for improving student psychological safety within a simulation. This question can be best addressed with empirically tested studies to uncover what strategies have universal benefits across multiple studies and research sites. The goal of this research is to find universally effective strategies that could be discussed in best practice guidelines and implemented back into the SBL environment. One could argue that a mixed methods review would also be appropriate, but resources, time, and feasibility are also important factors to consider when undertaking a review. I am a novice researcher who has never completed a systematic review before, and a mixed review is a more advanced type of literature synthesis. Therefore, considering all factors, a systematic review of effectiveness is the most appropriate approach.

In April 2021, the primary researcher (A.J.) and the secondary reviewer (LK) attended the JBI comprehensive systematic review training program at Queen's University and received a certificate of completion (see Appendix A). This systematic review was conducted following the

JBI methodology for systematic reviews of effectiveness evidence. The systematic review protocol was developed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P 2015) checklist (Shamseer et al., 2015). The title of this review has been registered through the JBI Systematic Review register (see Appendix B). The JBI Systematic Review register protects your title from being used by other researchers.

Ethics

In November 2020, the researcher (A.J.) completed the Tri-Council Policy Statement 2 (TCPS2) modules (see Appendix C). The University of Ottawa has an ethics and integrity office that reviews and assesses the research ethics associated with each study conducted at the university. There are three types of reviews: a full research ethics board review, minimal risk review, and an expeditated review. However, the proposed literature synthesis will not include any primary data and does not involve human participants. Therefore, a submission to the University of Ottawa ethics board was not required for the completion of this systematic review.

Protocol

This systematic review protocol was made following the JBI Systematic review of effectiveness template, using the standardized JBI language (JBI, n.d.). The standardized JBI Systematic review of effectiveness template is attached as Appendix D.

Review Questions

The purpose of this systematic review is to identify the best available evidence on the establishment of psychological safety within simulation for healthcare learners.

The questions posed by this review were:

i. What interventions effectively establish and maintain psychological safety within the three phases of simulation with healthcare learners?

ii. How is psychological safety being measured?

Keywords

healthcare; learner; psychological safety; speaking up; simulation, stress reduction

Inclusion Criteria

Participants. Kostovich et al. (2020) examined faculty perceptions of psychological safety within SBL. The population includes any healthcare learners. A learner, in this case, consists of students and/or licensed practicing healthcare professionals. All healthcare professionals are required to commit to lifelong learning. Therefore, all healthcare professionals are considered learners. The operational definition of a "Healthcare Professional" will be as defined by the Ontario Ministry of Health and Long-Term Care (OMHLTC) (OMHLTC, n.d.). The OMHLTC recognizes 26 regulated health professions, which include: audiology and speech-language pathology, chiropody and podiatry, chiropractic, dental hygiene, dental technology, dentistry, denturist, dietetics, homeopathy, kinesiology, massage therapy, medical laboratory technology, medical radiation technology, medicine, midwifery, naturopathy, nursing, occupational therapy, opticians, optometry, pharmacy, physiotherapy, psychology, psychotherapy, respiratory therapy, traditional Chinese medicine, and acupuncture.

Interventions. This review considered any intervention aimed at improving psychological safety or its related components, including "speaking- up." Some of the interventions of interest included establishing a fiction contract, orientation to the simulation environment, unconditional positive regard, pre-briefing, debriefing, mindfulness, formalized education**,** and cognitive aids.

Comparator(s). This review considered studies that compared their interventions to alternative interventions or no interventions. Further, this review considered studies that compare intervention**s** in any SBL environments, including but not limited to in-person simulation, VS, VS gaming, escape room**s,** and VR. This review included studies that compare the intervention to any level of fidelity, including but not limited to low, medium, high, and mixed.

Outcomes. This review considered studies that measured the outcome of psychological safety or its related component "speaking- up." The operational definition of psychological safety is one's belief that it is safe for interpersonal risk taking (Edmondson, 1999). O'Donovan and McAuliffe (2020) also utilized the outcome variable "speaking-up" in relation to psychological safety in their systematic review. In this study, "speaking up" is operationally defined as an individual using voiced behaviours, challenging authority or assertiveness.
Types of Studies. This review considered all quantitative studies. This is demonstrated within both experimental and quasi-experimental study designs, including RCTs, non-randomized controlled trials, before and after studies, pre-test/post-test studies, and interrupted time-series studies. In addition, analytical observational studies, including prospective and retrospective cohort studies, case-control studies and analytical cross-sectional studies will be considered for inclusion. This review also considered descriptive observational study designs, including case series, individual case reports and descriptive cross-sectional studies for inclusion.

Exclusion Criteria

Studies were excluded if they were published before January 1st, 2011. Additionally, all unpublished articles, theses and dissertations, qualitative study designs, study protocols, and abstract-only studies were excluded. Lastly, this study was explicitly concerned with

interventions targeted at fostering psychological safety within the actual simulation environment. Therefore, studies where the simulation itself was the intervention were excluded.

Search Strategy

The search strategy was developed in consultation with the University of Ottawa's Health Science Librarians. The Librarians assisted in choosing the included databases and provided instruction on using the databases and citation management.

The research question contains three major concepts: healthcare learners, simulation, and psychological safety. To ensure that these concepts were effectively covered, a trial search was created for each of these concepts. The initial search strategy was informed by reviewing published systematic reviews that focussed on each topic. A logic grid of keywords was created in a Word document from the index terms and keywords identified from titles, abstracts, and search strategies of published peer-reviewed papers and systematic reviews.

A draft search strategy was created in Medline using Medical Subject Headings (MeSH) terms, keywords, and Boolean operators (see Appendix E). The final search strategy date was limited to January 1st, 2011, to May 10th, 2022. The Medline search strategy was peer-reviewed by a health science librarian that was not previously consulted on the initial search strategy. The search strategy was peer-reviewed using the Peer Review of the Electronic Search Strategy (PRESS) checklist (see Appendix F). Edits were made to reflect the feedback provided by the PRESS evaluation.

Once the comprehensive search strategy was finalized in Medline (OVID), a complete detailed search strategy was translated for the other identified databases: CINAHL (Ebsco Host), Education Source (Ebsco Host), PsychInfo (OVID), Medline (OVID), Eric (OVID) and Nursing

and Allied Health (Proquest). To ensure accurate translation of the search strategy, a quality check was performed. The initial search was completed on November 16th, 2021 (see Appendix G) and a final search was re-run on May 10th, 2022 (see Appendix H).

A.J. reviewed the reference lists of all included sources of evidence identified for full-text review to identify any additional articles not retrieved in the search which met the inclusion criteria for this review. Studies published in any language were included. Since the researcher is unilingual (English), **t**he program "deepL translation" was used for translation assistance during the full text screening process.

Included Databases.

CINAHL (Ebsco Host), Education Source (Ebsco Host), PsychInfo (Ovid), Medline (OVID), Nursing and Allied Health (Proquest), Eric (OVID).

Study Selection

Following the search, all identified citations were collated and uploaded into CovidenceÓ systematic review management software (Veritas Health Innovation (VHI), Melbourne, Australia). The CovidenceÓ software assists reviewers in screening articles by resolving discrepancies and removing duplicate articles. The titles and abstracts were screened in CovidenceÓ by two independent reviewers for assessment against the inclusion criteria for the review. Three independent reviewers contributed to this review: reviewer one, A.J.; reviewer two, L.K.; and reviewer three, J.T.

To ensure inter-rater reliability, A.J. and L.K. did a test screen and reviewed three articles together. The third reviewer was only contacted for discrepancies. Full-text versions of articles that passed the title and abstract screen were retrieved. The full texts were assessed against the

inclusion criteria in CovidenceÓ by A.J. and L.K. The inter-reliability Cohen's Kappa scores (k) for the title/abstract and full-text screenings were .38 and .14, respectively (Appendix I)

Appendix I explains the exclusion rationale for the retrieved full-text articles that were not included in the final review. Any disagreements that arose between the reviewers at each stage of the selection process were resolved through discussion between A.J. and L.K., or with the third reviewer J.T. The third reviewer is the thesis supervisor and made the final decision for any disputes.

Assessment of Methodological Quality

Eligible studies were imported into the JBI System for the Unified Management, Assessment and Review of Information (JBI SUMARI) for the quality appraisal (JBI, Adelaide, Australia). Two independent reviewers (A.J. and L.K.) critically appraised articles using the standardized critical appraisal instruments from JBI for RCT, quasi-experimental, and analytical cross-sectional studies (see Appendix J). Authors of papers were contacted to request missing or additional data for clarification. The critical appraisal results are reported in Appendix K. All eligible studies, regardless of the results of their methodological quality, underwent data extraction and synthesis.

Data Extraction

Two independent reviewers (A.J. and L.K.) extracted data using a modified version of the standardized JBI data extraction tools (See Appendix K). Multiple full article read-throughs were conducted by each independent reviewer (A.J. and L.K). The data extracted included specific details about the participants, study methods, interventions, and outcomes of significance to the review objective.

Search Results

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Appendix L) shows that the search strategy yielded a total of 1634 articles with 380 duplicates. 1258 articles underwent title and abstract screening, and 100 articles were eligible for full-text review. Eight articles met the inclusion and exclusion criteria and were included in the final review.

Chapter Four: Data Analysis

Eight studies that met the inclusion criteria were included for data extraction and analysis. According to JBI there are two methods for analyzing data in a systematic review of effectiveness: a meta-analysis or a narrative summary (Tufanaru et al., 2020). Due to the significant heterogeneity in the study's methodology, population, and measurement of psychological safety or speaking up, a meta-analysis was not possible. Therefore, a narrative synthesis with vote counting was the most appropriate method for analyzing the extracted data. In order to ensure rigour in my narrative synthesis, the Synthesis Without Meta-analysis (SWiM) checklist was utilized (Campbell et al., 2020) (see Appendix N). There are diverse methods for assessing the methodological quality of a systematic review (Pussegoda et al., 2017). To decrease risk of bias and support transparency, the SWiM checklist was completed. The SWiM checklist has nine items and covers topics including the groping of data, method of synthesis, presentation of data, summary of findings and limitations (Campbell et al., 2020).

Additionally, the preferred reporting items for systematic reviews and meta-analyses checklist was also used to ensure proper reporting within this systematic review (Page et al., 2021) (see Appendix O).

Inductive reasoning was used to cluster study outcomes into two main categories: psychological safety or speaking up (SU). Psychological safety (PS) was operationally defined as interpersonal risk taking whereas speaking up was defined as a person's ability to use voice behaviours, be assertive or challenge authority. In total, PS (n = 3) represented 37.5% of studies and speaking up (n = 5) represented 62.5% of included studies as shown in Table 1.
Data were further grouped by interventions, population, simulation context and measurement of data (Table 2). Once data was grouped, a vote count was performed in order to answer the

research questions posed in Chapter One. A vote count can be used as an alternative method for data analysis when it is not possible to complete a meta-analysis (McKenzie & Brennan, 2019). The vote count approach allows for answering weather there is any evidence for an effect (McKenzie & Brennan, 2019).

Table 1

Dependent Variables of Included Studies

Dependent Variable	Citations
Psychological Safety (n = 3)	Henricksen et al. (2017) Kolbe et al. (2013) Roh et al. (2018)
Speaking up (n = 5)	Guris et al. (2019) Friedman et al. (2017) Oner et al. (2018) Robb et al. (2015) Raemer et al. (2016)

Findings

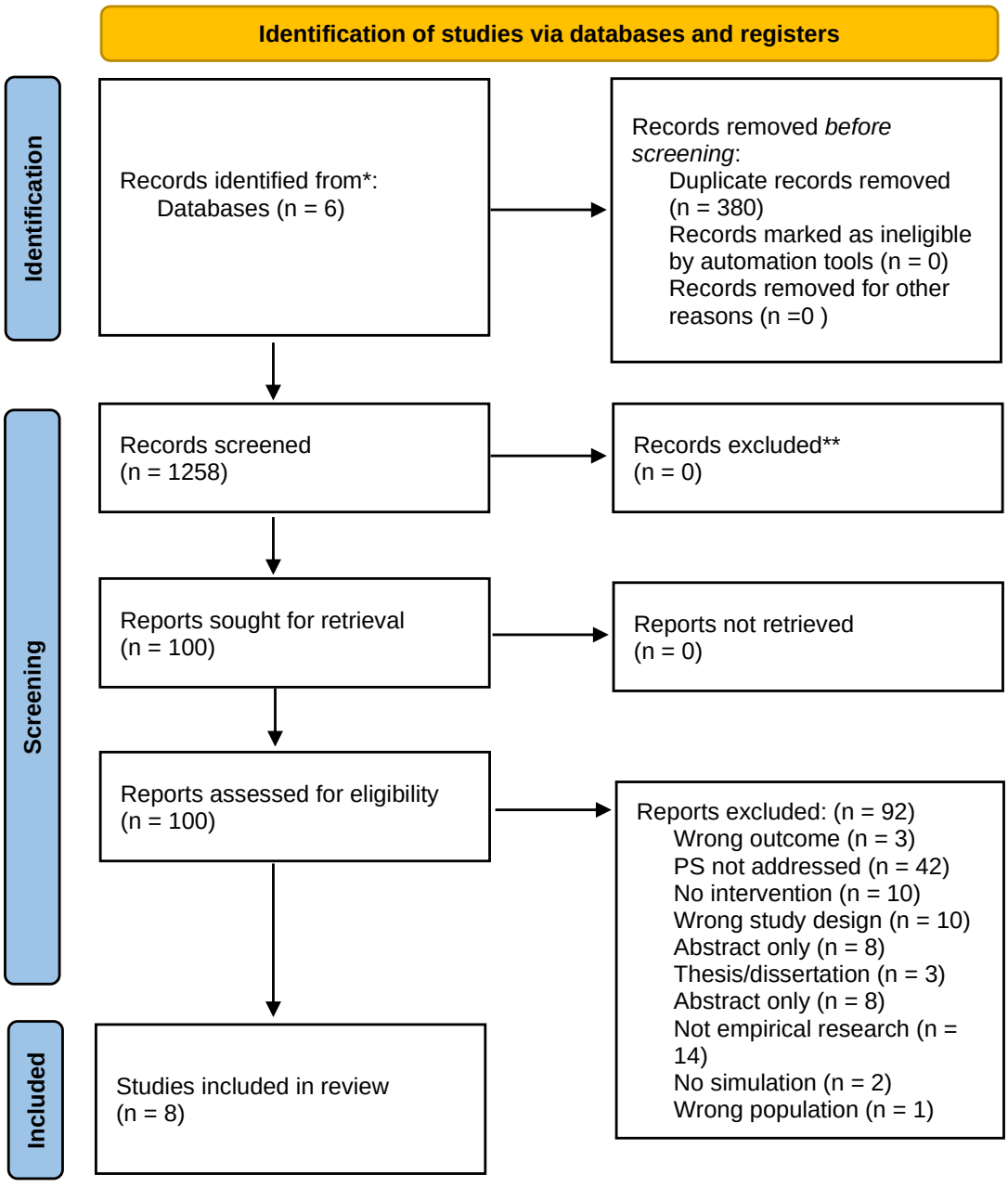
Search Results

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Figure 1 shows that the search strategy yielded a total of 1634 articles with 380 duplicates. A total of 1258 articles underwent title and abstract screening, and 100 articles were eligible for full-text review. Eight articles met the inclusion and exclusion criteria and were included in the

final review: (Friedman et al., 2017; Guris et al., 2019; Henricksen et al., 2017; Kolbe, Weiss, et al., 2013; Oner et al., 2018; D. B. Raemer et al., 2016; Robb et al., 2015; Roh et al., 2018).

Figure 1

PRISMA diagram of search results



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

Sample Characteristics

The majority of the included articles were published between the years of 2017-2019 (n = 5), with the most common publication location being within the United States of America. More than half of the study settings were within an in-person simulation training setting, with 37.5% of studies being conducted in situ. 50% of the articles are RCTs, 37.5% were quasi-experimental studies (QES), and 12.5% were analytical cross-sectional studies (ACS). An equal number of studies investigated students and licensed professionals, and 25% of articles included a combination of both students and licensed professionals. Medicine and nursing were the most prominently represented health discipline, with only 25% of articles being interdisciplinary. The distribution of studies by characteristic is summarized in Table 2. Further, Table 3 summarizes the findings of all included studies.

Table 2

Distribution of Study Characteristics

Characteristic	Category	Frequency of studies	Percentage of studies
Publication Year	2011-2013	1	12.5%
	2014-2016	2	25.0%
	2017-2019	5	62.5%
	2020-2022	0	0%
Country	USA	5	62.5%
	Canada	1	12.5%
	Switzerland	1	12.5%
	Korea	1	12.5%
Setting	Simulation Lab	5	62.5%
	In situ	3	37.5%
Study Design	Randomized Control Trial	4	50%
	Quasi-Experimental	3	37.5%
	Analytical Cross sectional	1	12.5%
Sample Size	20-39	1	12.5%
	40-59	4	50.0%
	60-79	2	25.0%
	>80	1	12.5%
Status of Participant	Student (unlicensed)	3	37.5%
	Licensed professional	3	37.5%
	Both	2	25%
Health Discipline	Medicine	3	37.5%
	Nursing	3	37.5%
	Interdisciplinary	2	25.0%

Table 3

Summary of Included Studies

Citation	Study Design	Population (n =)	Simulation Topic	Intervention	Outcome Variable and Measurement	Results
Guris et al. (2019)	RCT	• Anesthesiology residents (Post Graduate Year 2) • (n =22) ○ *Control group* (n=11) ○ *Intervention group* (n=11)	• Bradycardia related to surgical retraction • Incorrect extubating • Medication error	**Control** • Standard educational only (SE) **Intervention** • Standard educational + (SE+) • Additional education regarding communication and multitasking during a crisis • Cognitive Aid: given speaking up script and checklist	**Variable:** • Assertiveness **Measurement**: • Likert scale intra-personal factors (IPF): self-efficacy (Cronbach's .86), social outcome expectations (Cronbach's .86) and assertive attitude (Cronbach's .67) **Variable:** • Speaking up performance **Measurement**: • Independent blinded research assistances observed the timing and quality of speaking up using the "Advocacy-inquiry rubric"	All variables were measured at three time points: • Baseline (before intervention), • Post-test (immediately after) • Follow up (8 months post) **Assertive Attitude** Mean (SD) Max total score = 5 *SE* • Baseline = 2.6 (.46) • Post-test = 2.97 (.77) • Follow up = 2.76 (.63) *SE+* • Baseline = 2.79 (.54) • Post-test = 3.36 (.60) • Follow up = 3.42 (.65) **Speaking up performance** Mean (SD) Max score = 10 *SE* • Baseline = 3.92 (2.10) • Post-test 1 = 5.48 (2.72) • Post- test 2 = 5.16 (1.44) • Follow up = 6.11 (2.49) *SE+* • Baseline = 4.14 (2.28)

Citation	Study Design	Population (n =)	Simulation Topic	Intervention	Outcome Variable and Measurement	Results
						• Post-test 1 = 6.00 (2.96) • Post-test 2 = 6.07 (1.89) • Follow up = 6.06 (1.62)
Friedman et al. (2017)	RCT	• Second year anesthesia residents • (n = 50) o *Control group* (n = 24) o *Intervention group* (n = 26)	• Unexpected critical events: "Can't intubate, can't ventilate"	**Control:** • Standard education **Intervention:** • Additional training regarding challenging authority	**Variable:** • Speaking up/ challenging authority **Measurement:** • Blinded Independent reviewers using the Modified Advocacy-Inquiry score • Used deception	**Best Challenge:** • Control: median score: 3.5 (3.0–4.4 [3.0–6.0]) • Intervention: median score: 5.0 (4.5–5.6 [4.0–6.0]) • (Cohen's d effect size = 2.0; Mann- Whitney *U* test = 52.5; $p < .001$) **Total Number of Challenges** • Control: median score: 7.5 (5.6–10.0 [3.0–14.5]) • Intervention: median score: 12.8 (10.0–16.0 [8.5–20.0]) • (Cohen's d effect size = 1.6; Mann-Whitney *U* test = 79; $p < .001$)
Henricksen et al. (2017)	ACS	• Nurses • Medical residents • Medical students • Attending physicians • Respiratory therapists • Patient care technicians • Pharmacists • Social workers • Dental residents (n = 3900)	• 9 types: 1. floor nursing 2. complex: emergency department and cardiac, neonatal and pediatric intensive care 3. orientating: new employees and new nurses	**Control:** None **Intervention:** • Simulation participant psychological safety algorithm • A series of interventions intent to prevent psychological distress • Levels of distress Optimal: no distress *Level 1:* mild	**Variable:** • Psychological Distress **Measurement:** • Perceived psychological distress using the psychological safety algorithm	**Level of Psychological Distress** / # of sessions (n =) / Participants (n =) Overall: 399 / 3900 None: 372 / 3866 Level 1: 16 / 19 Level 2: 12 / 14 Level 3: 1 / 1 **Event Timing** / Level 1 (n = 14) / Level 2 / Level 3 (n = 1)

Citation	Study Design	Population (n =)	Simulation Topic	Intervention	Outcome Variable and Measurement	Results
			4. Medical sessions- fellows, residents, interns and medical students 5. ECMO (Extracorporeal membranous oxygenation), 6. medical transportation 7. Pediatric trauma 8. Mock code sessions 9. Other (dental, oncology, workplace violence, task trainer, operating room.	*Level 2:* moderate *Level 3*: severe		<table><tr><td></td><td></td><td>(n = 12)</td><td></td></tr><tr><td>Prebrief</td><td>7 (50%)</td><td>4 (33.3%)</td><td>0</td></tr><tr><td>Scenario 1</td><td>3 (21.4%)</td><td>2 (16.7%)</td><td>0</td></tr><tr><td>Debrief #1</td><td>2 (14.3%)</td><td>5 (41.7%)</td><td>0</td></tr><tr><td>Scenario 2</td><td>0</td><td>0</td><td>1 (100%)</td></tr><tr><td>Debrief #2</td><td>0</td><td>0</td><td>0</td></tr><tr><td>Throughout</td><td>2 (14.3%)</td><td>1 (8.3%)</td><td>0</td></tr></table>
Kolbe et al. (2013)	QES	• Anesthesia nurse (n = 28) • Anesthesia Resident (n = 29) • Anesthesia Staff (n = 4)	• Unexpected critical events: difficult intubation, cardiac arrest, tension pneumothorax	**Control:** None **Intervention:** • Debriefing tool: TeamGAINS	**Variable** • Psychological Safety **Measurement:** • Modified German version of Amy Edmonson's physiological safety scale	<table><tr><th>**Psychological Safety**</th><th>Mean (SD)</th></tr><tr><td>Pre-test</td><td>3.36 (.63)</td></tr><tr><td>Post-test</td><td>3.48 (.55)</td></tr></table> Max Score = 5 t1 (M= 3.36, SD = .63)

Citation	Study Design	Population (n =)	Simulation Topic	Intervention	Outcome Variable and Measurement	Results
					(Cronbach's .69)	t2 (M= 3.48, SD = .54) t (59) = -2.26, p = .028
Oner et al. (2018)	RCT	• Nurses	• Obstetrics	**Control:** • Standardised handoff tool: (I-PASS) - Illness Severity, Patient Summary, Action List, Situational Awareness and Contingency Planning **Intervention:** • Education (AACT) - Simulation-based assertiveness/advocacy/ CUS/two-challenge education	**Variable** • Speaking up/ assertiveness **Measurement:** • Rathus Assertiveness Schedule (RAS) (r = .78, P < .01) • Gerry Assertiveness scale (r = .57) • Secret shopper method	• RAS [mean (minimum–maximum): 40.0 (5–99) vs. 32.5 (1–80), P = .06] • Assertiveness Scale [mean (minimum–maximum): 75.72 (57–87) vs. 76.94 (59–97), P = .765].
Raemer et al. (2016)	RCT	• Non-trainee anesthesiologists (attending staff) • n= 40 o *Control group* (n = 20) o *Intervention group* (n = 20)	• Operating Room: Venus air embolism and unprofessional behaviour	**Control:** • Standardized introduction **Intervention:** • Workshop on speaking up: Education and cognitive aids	**Variable** • Speaking up **Measurement:** • Video analysis • 2 independent reviewers: Coded conversations and actions	• There were no statistically significant differences between the intervention and control groups for any included events
Robb et al. (2015)	QES	• Nurses • n = 47 o *Control group* (n = 21) o *Intervention group* (n = 26)	• Operating Room: High blood loss surgery	**Control:** • Standardized patient **Intervention:** • Virtual team member (surgeon and anesthesiologist)	**Variable** • Speaking up **Measurement:** • Post hoc video and transcript coding: • Stopped the line	• Fishers Exact test showed no significant differences between the conditions (p = .869)

Citation	Study Design	Population (n =)	Simulation Topic	Intervention	Outcome Variable and Measurement	Results
					• Incident report • Shifted responsibility • Gave in • No objections	

Roh et al. (2018)	QES	• Nursing students (4th year)
		• n = 50
		  ○ *Control group* (n = 23)
		  ○ *Intervention group* (n = 27)
			• Cardiac arrest	**Control:**
				• Standard Pre-briefing activities
				
				Intervention:
				• Standard pre-briefing
				• concept mapping
				• fiction contract
					Variable
					• Psychological Safety
					
					Measurement:
					• Korean Version of Amy Edmonson's Team Psychological Safety Scale (Cronbach's .70)
						Team Psychological Safety — Mean (SD)
						Control Group — 5.33 (.63)
						Intervention Group — 5.81 (.60)
						
						Max Score = 7
						
						t= 2.754, p = .008

Methodological Quality

The critical appraisal portion of the systematic review is an essential component in reducing bias and determining the generalizability of the data (Tufanaru et al., 2020). JBI requires that reviewers use the JBI standardized critical appraisal checklist (Tufanaru et al., 2020). Three quality appraisal tools were used to assess the methodological quality of the included studies: (1) the JBI checklist for RCTs, which contains 13 items (Tufanaru C et al., 2020); (2) the JBI checklist for quasi-experimental studies, which contains nine items (Tufanaru C et al., 2020); and (3) the JBI checklist analytical cross-sectional study, which contains eight items (Moola S et al., 2020). Each question had three options: "yes" (2 points), "unclear" (1 point), or "no" (0 point). This point system is in alignment with two current systematic reviews done by Fernandez et al. (2020) and Santos et al. (2022). Each article was scored by dividing the article's total score by the maximum total points, giving a quality score from 0-1 (Fernandez et al., 2021). The ranking of methodological quality was ranked by the quality scoring system used in the systemic review by Dilig-Ruiz et al. (2018). A study was considered "weak" if it scored <.50, "low-moderate" if it scored between .51 and .65, "high-moderate" if it scored between .66 and .79, and "strong" if it scored .80 or higher (Dilig-Ruiz et al., 2018). The methodological quality of the included studies in this review was high, as 50% were considered to be "high-moderate" and the other 50% were scored as "strong" (Tables 4, 5 and 6).

Further, the full itemized critical appraisal scores for each article are presented in Appendix K. These checklists allow for transparency within the included studies to decrease the risk of bias. It is important to note that for the quasi-experimental studies and RCT studies there were some items on the checklist that consistently scored low. In the included quasi-experimental studies, question nine which asked "was appropriate statistical analysis used" was

unclear in 75% of quasi-experimental studies (Tufanaru, 2020, p.3). We decided that when authors treated Likert scales as interval level data without a justification, we would rate it as unclear. This decision was made because of controversy surrounding how these measurements are classified in nursing research (Bishop & Herron, 2015; LoBiondo-Wood et al., 2018; Wu & Leung, 2017). Likert scales are often considered ordinal in nature because they violate some of the statistical assumptions needed to conduct parametric statistical tests (Bishop & Herron, 2015). However, often authors treat them as interval level data because it allows them to conduct more statistical tests (LoBiondo-Wood et al., 2018). Therefore, to ensure consistency across quality appraisal scoring, if no justification was provided from the authors, it was scored unclear, which impacted many of the studies.

Within the RCT studies, question number one "was true randomization used for assignment of participants to treatment groups" (Tufanaru, 2020, p.3). In the Oner et al. (2018) study, the authors did not report the methods for randomization. Further, although an attempt was made, it was extremely unclear how randomization occurred within the Guris et al. (2019) and Friedman (2017) studies.

Table 4

Methodological Ranking for Quasi-Experimental Studies

Citation	Total	Score (x/18)	Ranking
Robb et al. (2015)	13	.72	High-moderate
Roh et al. (2018)	16	.89	Strong
Shanks et al. (2020)	13	.72	High-moderate
Kolbe et al. (2013)	9	.75*	High-moderate

*Three questions were not applicable

Table 5

Methodological Ranking for Randomized Control Trial Studies

Citation	Total	Score (x/26)	Rank
Friedman et al. (2017)	19	.73	High-moderate
Guris et al. (2019)	24	.92	Strong
Oner et al. (2018)	24	.92	Strong

Table 6

Methodological Ranking for an Analytical Cross-Sectional Study

Citation	Total	Score (x/16)	Rank
Henricksen et al. (2017)	14	.88	Strong

Research Question One

The primary research question was to determine what interventions were most effective for establishing and maintaining psychological safety within the three phases of simulation. I first needed to understand what interventions each study used. Using an inductive and deductive approach, I clustered the interventions into two main categories: educational based interventions and facilitator specific interventions. Education based interventions include didactic education, cognitive aids, role play and games. Facilitator specific interventions include the use of frameworks, use of virtual actors (avatars), and fiction contracts.

It was also found that several studies used more than one intervention to promote PS or SU. Articles were categorized into whether they tested a single intervention or if they tested multiple interventions (multi-dimensional). An equal number of studies tested a single intervention versus multiple interventions.

Educational Based Interventions

Didactic Education. The most frequently used intervention, tested in four studies, was didactic education (Friedman et al., 2017; Guris et al., 2019; Oner et al., 2018; D. B. Raemer et al., 2016). The intervention "Education" was exclusively found in studies regarding "speaking up." None of the included studies tested education in relation to the specific variable of psychological safety. The specific topics of education included communication and multitasking during a crisis (Guris et al., 2019), conflict behaviour: assertiveness, submissive, aggressive, and indirect (passive/aggressive) (Oner et al., 2018) and cognitive skills needed to challenge authority (Friedman et al., 2017). Pre-established training programs such as Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS) informed the education sessions discussed in the Friedman et al. (2017), Guris et al. (2019) and the Oner et al. (2018)

articles. Educational training sessions varied in length of time, ranging from 50 minutes (D. B. Raemer et al., 2016) up to 180 minutes (Oner et al., 2018), with the mode time being 60 minutes (Friedman et al., 2017; Guris et al., 2019). In all included articles, these educational training sessions were all implemented within the pre-simulation preparation phase (Friedman et al., 2017; Guris et al., 2019; Oner et al., 2018; Raemer et al., 2016; D. B. Raemer et al., 2016).

Several studies contradicted one another regarding the effectiveness of didactic education for promoting SU. Friedman et al. (2017) found a statistically significant improvement in anesthesia residents' ability to speak up to authority after participating in a 60-minute educational session. On the contrary, three studies found no statistically significant differences in scores between their control groups and the didactic educational intervention groups, therefore suggesting that education regarding speaking up was not effective in these studies (Guris et al., 2019; Oner et al., 2018; D. B. Raemer et al., 2016).

Cognitive Aids. Three of the included studies tested the use of cognitive aids (Guris et al., 2019; Roh et al., 2018). Guris et al. (2019) provided learners with two pre-existing cognitive aids: a checklist and a script for speaking up. The checklist included key patient safety items that the learners should be assessing during the simulation. The simulation covered anesthesia skills, and the checklist asked questions like "Are ventilation and oxygenation adequate?" (p. 769). If any question on the check list was abnormal, the participants were to use the script to help facilitate speaking up. The first line on the script states "Can we regroup for a second? I've noticed that_____" (p.769).

Roh et al. (2018) tested the use of a concept map as a cognitive aid in relation to psychological safety. In this study, learners created their own concept map during the pre-simulation preparation phase and then used the concept map during the participation phase of the

simulation. The concept map contained information regarding specific nursing actions and the rationale in relation to the simulation scenario.

Raemer et al. (2016) provided learners with a speaking up rubric that was informed by the two-challenge rule. This rubric was to be used during the simulation to help facilitate learners to speak up during the simulation session.

The effectiveness of the cognitive aids alone was not measured in any of the studies, as they used cognitive aids in addition to other interventions, such as education and fidelity contract. Therefore, we were unable to determine if the cognitive aid alone was effective for promoting or maintaining PS/SU.

Roleplay. Two studies by Oner et al. (2018); D. B. Raemer et al. (2016), used roleplay and measured the outcome of SU. Oner et al. (2018) had learners participate in scripted roleplay exercises regarding conflict behaviour. Raemer et al. (2016) did not discuss the contents of the roleplay exercise. The effectiveness of the specific intervention "roleplay" was not measured, as both studies used multiple interventions in addition to roleplay exercises.

Game. The study by Oner et al. (2018) incorporated an icebreaker game. The icebreaker game involved asking all participants to state their name. This allowed the entire group to get to know each other. Further, the facilitator asked that the participants call them by their first name only. The specific effectiveness of the use of a game was not measured as this study used multiple interventions in addition to an icebreaker game.

Facilitator Specific Interventions

The development of frameworks designed to support psychological safety were discussed in two articles by (Henricksen et al., 2017; Kolbe, Weiss, et al., 2013). Henricksen et al. (2017) created a psychological safety algorithm designed to help simulation facilitators identify the

different severities of psychological distress and provide guidance on how to mitigate threats to psychological safety using a stepwise approach. This algorithm was informed by the "Psychological First Aid" model and drew on contributions from a sports and pediatric psychologist. This article found that facilitators were statistically significantly better able to identify participants level of psychological distress.

TeamGAINS (Guided team self-correction, Advocacy-Inquiry, Systematic-constructivist) is a debriefing framework informed by crisis resource management principles (Kolbe et al., 2013). In this study, participants were exposed to unexpected anesthesia critical events. Debriefing was completed with a psychologist and an attending anesthesiologist. The authors measured a post-test only score and found that the participants self-reported psychological safety scores statistically significantly increased from before the intervention to post intervention (Kolbe et al., 2013).

Virtual Actors. One study by Robb et al. (2015) tested the use of virtual actors (avatars) within the role of a standardized patient. This study examined whether a virtual actor with high behavioural and visual realism made a difference in participants' ability to speak up in comparison to a human standardized patient. The virtual actor used in the study was able to respond to participants in real time and give realistic responses. This article found that there were no statically significant differences in participant's ability to speak up with virtual actors compared to standardized patients.

Fiction Contract. One study by Roh et al. (2018) used a fiction contract. Participants were asked to sign a fiction contract before beginning the participant phase of the simulation. This intervention was not tested in isolation, so we were unable to determine whether a fidelity contract alone could statically significantly improve psychological safety.

Phases of Simulation

Interventions from each article were further categorised into where they were implemented within the phases of simulation. Figure 2 provides a detailed description of where each articles interventions fit in relation to the phases of simulation.

Pre-Simulation Preparation. Several studies (n = 7) implemented an intervention within the pre-simulation preparation phase of simulation. These interventions included: education (n = 4), roleplay (n = 2), icebreaker game (n=1), the creation of cognitive aids (n = 2) and framework (n = 1) (Friedman et al., 2017; Guris et al., 2019; Oner et al., 2018; D. B. Raemer et al., 2016; Roh et al., 2018). Three studies used multiple interventions within the pre-simulation preparation phase (Guris et al., 2019; Oner et al., 2018; D. B. Raemer et al., 2016). The combination of education, roleplay, and icebreaker games was used in the Oner et al. (2018) study. Raemer et al. (2016) combined two interventions, including education and role play within the presimulation preperation phase. Guris et al. (2019) combined education and cognitive aids.

The studies by (Henricksen et al., 2017; Roh et al., 2018) had one intervention during the pre-simulation preparetion phase. Cognitive aids were developed by the students in the phase in the Roh et al. (2018) study. The psychological safety framework was the only intervtion used in the Henricksen et al. (2017) study.

Pre-Simulation Briefing. The psychological safety framework algorithm and the fiction contract interventions were both implemented during the pre-simulation briefing in two studies by (Henricksen et al., 2017; Roh et al., 2018).

Participation. The participation phase encompassed interventions from five articles (Guris et al., 2019; Henricksen et al., 2017; D. B. Raemer et al., 2016; Robb et al., 2015; Roh et al., 2018). Interventions implemented at the participation phase included cognitive aids (n = 3)

(Guris et al., 2019; D. B. Raemer et al., 2016; Roh et al., 2018), framework (n = 1) (Henricksen et al., 2017) and virtual actors (n = 1) (Robb et al., 2015).

Debriefing. The TeamGAINS and Psychological Safety framework took place during the debriefing phase (Henricksen et al., 2017; Kolbe, Weiss, et al., 2013)

Figure 2

Interventions for Facilitating Psychological Safety Mapped to Phases of Simulation

Author Year	Variable	Intervention	PreSimulation Phase		Participation Phase	Debriefing Phase
			Preparation	***Briefing***		
Guris et al. (2019)	Speaking up	*Multidimensional*: □ Cognitive aid □ Education	□ Training regarding communication and multitasking during a crisis □ Cognitive aids		□ Cognitive aids	
Friedman et al. (2017)	Speaking up	*Single*: □ Education	□ Training regarding cognitive skills needed to challenge authority			
Henricksen et al. (2017)	Speaking up	*Single:* □ Framework	□ Psychological Safety Algorithm	□ Psychological Safety Algorithm	□ Psychological Safety Algorithm	□ Psychological Safety Algorithm
Kolbe et al. (2013)	Speaking up	*Single:* □ Framework				□ Debriefing framework
Roh et al. (2018)	Speaking up	*Multidimensional* □ Cognitive aid □ Fiction contract	□ Cognitive aids	□ Fiction Contract	□ Cognitive aids	
Oner et al. (2018)	Psychological Safety	*Multidimensional:* □ Education □ Game □ Roleplay	□ Training regarding conflict behaviour: assertiveness, submissive, aggressive, and indirect (passive/aggressive) □ Role play □ Icebreaker game			
Raemer et al. (2016)	Psychological Safety	*Multidimensional:* □ Education □ Role play	□ Educational workshop (Didactic Education) □ Role play		□ Cognitive aids	
Robb et al. (2015)	Psychological Safety	*Single:* Virtual actor			□ Virtual humans (Animation)	

Note: Bolded articles were statically significant interventions.

Adaptation form Luctkar-Flude, M. (2020). Simulation approaches. In P. Bradley & K. Page-Cutrara (Eds.). *The Role of the Nurse Educator in Canada.* Canadian Association of Schools of Nursing (CASN): Ottawa

Single vs Multiple Interventions

Due to the nature of how the intervention outcomes were measured, we can only compare effectiveness in relation to whether the study examined one or multiple interventions. We are unable to compare individual interventions, as studies with multiple interventions did not control in order to measure each specific intervention. Table 7 provides an overview of the effectiveness of the interventions discussed in each study and Table 8. Further, a vote count was used to determine the effectiveness of these studies. Using a vote count approach, although somewhat controversial, is an acceptable approach for data analysis and has been used in several systematic review studies (Santos et al., 2022; Squires et al., 2011; Squires et al., 2015; Janet E Squires et al., 2014). Using a vote count approach allowed for an assessment of evidence associated with a single or multidimensional intervention and effectiveness (Dilig-Ruiz et al., 2018). This approach was used to determine the effectiveness of the intervention by counting the percentage of studies that demonstrated or failed to demonstrate statistical significance (Dilig-Ruiz et al., 2018).

The vote count rule used in this study was modified from a previously published systematic review by Dilig-Ruiz et al. (2017). The rules associated with the vote count indicated that an intervention must be assessed in three or more studies to be included in the vote count. An intervention was significant if it showed to be effective in more than 60% of the studies.

The distribution of multidimensional versus single intervention articles is summarized in Table 9. Four of the included articles were multidimensional. Two of the four articles examining multidimensional interventions were found to be effective. This did not meet the vote counts criteria to be considered significant, and as such, it is inconclusive whether a multidimensional approach is effective for promoting PS or SU. The other half of the included studies investigated

single. Three of them found their single intervention to be statistically significant in promoting PS/SU (75% of included studies). Therefore, there is evidence to support that a single intervention can effectively support PS/SU.

Table 7

Effectiveness of Interventions

Study	Intervention Category	Intervention	Dependent Variable	p value	Effectiveness
Friedman et al. (2017)	Single	Education	Speaking up	<.001	Effective
Robb et al. (2015)	Single	Virtual actor	Speaking up	.788	Not effective
Guris et al. (2019)	Multidimensional	Cognitive/ Education	Speaking up	<.001	Effective
Raemer et al. (2016)	Multidimensional	Education/ Role play	Speaking up	.2 – 1.0	Not effective
Oner et al. (2018)	Multidimensional	Education/Game/ Roleplay	Speaking up	P = .06 P =.765	Not effective
Henricksen et al. (2017)	Single	Framework	Psychological safety	<.001	Effective
Kolbe et al. (2013)	Single	Framework	Psychological safety	.028	Effective
Roh et al. (2018)	Multidimensional	Cognitive aid/ Fiction contract	Psychological safety	.008	Effective

Table 8

Reported effect size of single vs multidimensional interventions in included studies

Intervention Target	Study	Single	Multidimensional
Psychological Safety	Henricksen et al. (2017)	*NR	
	Kolbe et al. (2013)	*NR	
	Roh et al. (2018)		*NR
Speaking Up	Guris et al. (2019)		Time (η_p^2 = .25) Group (η_p^2= .15) Time X Group (η_p^2= .08)
	Friedman et al. (2017)	Best challenge[a] (2.0) Number of challenges[a] (1.6)	
	Oner et al. (2018)		*NR
	Robb et al. (2015)	*NR	
	Raemer et al. (2016)		*NR

*NR= not reported

[a=] effect size measured as Cohen's d

Table 9

Distribution of single vs multidimensional interventions in included studies

Intervention Target	Study	Single	Multidimensional
Psychological Safety	Henricksen et al. (2017)	X	
	Kolbe et al. (2013)	X	
	Roh et al. (2018)		X
Speaking Up	Guris et al. (2019)		X
	Friedman et al. (2017)	X	
	Oner et al. (2018)		X
	Robb et al. (2015)	X	
	Raemer et al. (2016)		X

Research Question Two

The second research question was related to how psychological safety and speaking up is measured. The two most common ways that PS and SU were measured in the included studies were self-reported data and observational data.

Self-Reported Data

Self-reported data were used in both articles related to PS and SU. A total of (n = 4) used self-reported data. For the variable psychological safety, modified editions of Amy Edmondson's psychological safety scale were the only tools used. Kolbe et al. (2013) used the Modified German version of Amy Edmondson's psychological safety scale. This scale uses a five-point

Likert scale (1 = strongly disagree, 5 = strongly agree) and has moderate reliability, as the Cronbach alpha score is (α = .69). Participants in this study completed this scale at two time points: before the intervention and after the intervention.

Roh et al. (2018) used the Korean version of Amy Edmondson's psychological safety scale. This scale uses a seven-point Likert scale (1 = strongly disagree, 7 = strongly agree) and has similar reliability to the modified German version, with a Cronbach alpha score of (α = .70). This study used a post-test only design and participants completed this scale after participating in the intervention.

In order to assess speaking up, Guris et al. (2019) used the Intra-Personal Factors Scale, which uses a ten-point Likert scale. This scale measures three components of speaking up: self-efficacy (4 items), social outcome expectation (3 items), and assertive attitude (3 items). The validity of the scales was assessed by their specific outcome: self-efficacy (α = .86), social outcome expectation (α = .86), and assertive attitude (α = .67). The participants completed this scale at three time points: before the intervention, after the intervention, and eight months post-intervention.

In order to assess speaking up, Oner et al. (2018) used two scales. To measure assertiveness, the Rathus Assertiveness Schedule (RAS) and the Gerry Assertiveness scale (GAS) were used. The Cronbach alpha scores were not reported for these scales, but the authors reported the reliability coefficient for RAS (.78) and GAS (.57). The RAS contains 30 items and participants can rank -3 very much unlike me) to +3 (very much like me). The GAS contains 28 items and is assessed using a four-point Likert scale (1 = always, 4 = never).

Observational Data

Observational data was used in (n = 5) studies and was used to measure both variables of PS and SU. Oner et al. (2018) used both self-reported and observational data to evaluate speaking up behaviours. Five different observational assessment tools were used across the five studies.

Guris et al. (2019) and Friedman et al. (2017) both used the advocacy-inquiry rubric to assess the timing and quality of participants speaking up abilities. However, Friedman et al. (2017) modified the original rubric and added another item to the advocacy-inquiry rubric. Both studies had two reviewers who were trained on how to use this rubric. In the Guris et al. (2019) study, the rating was done in real-time, whereas video recordings of learners' performance were assessed later in the Friedman et al. (2017) study. Oner et al. (2018) also completed their ratings in real time. This study used the Modified Pian-Smith Score assess participants' ability to speak up. The modified rubric added an additional assessment regarding the participants' body language and facial expression and was scored from 1-5 (1 = no reaction, 5 = advocates and initiates discussion).

Two of the included studies used video recordings to collect the observational data (Raemer et al., 2016 & Rob et al., 2015). Both studies recorded the simulation sessions, and the videos were then assessed by two trained and blinded investigators. Within the Raemer et al. (2016) study, the video transcripts were transcribed and coded based on participants' responses and then categorized into defined categories. Examples of categories include "Did not ask surgeon if he/she wanted help and did not ask circulating nurse to call for help" and "Asked surgeon if he/she wanted help but did not ask circulating nurse to call for help" (Raemer et al, 2016, p. 535). The frequency of each response across each participant's videos was tallied.

The Robb et al. (2015) study used “post hoc video and transcription coding” (p.16). The researchers did initial coding of the transcripts and then agreed upon five outcomes. Those outcomes were then used to code the transcripts.

Deception

Both Friedman et al. (2017) and Oner et al. (2018) used deception in their studies. Friedman et al. (2017) used deliberate deception whereby the participants were told that the staff physician in the simulation was going to be a staff member that they will be working with outside of the simulation. Oner et al. (2018) used a “secret shopper” method whereby the participants within the study did not know that the situation was not a true event.

Chapter Five: Discussion

This final chapter discusses the findings of the systematic review and is structured around the components of the NLN Jeffries theory, the theoretical foundation that informed this study. As discussed in chapter two, the five main components of the NLN Jeffries theory are context, background, design, experience, and outcome (Cowperthwait, 2020). The chapter concludes with implications for nursing education and suggestions for future research.

Context

Evaluation

The studies included in the systematic review used self-reported and observational data to evaluate psychological safety. Two studies by (Kolbe, Weiss, et al., 2013; Roh et al., 2018) used self-reported data to measure psychological safety using German and Korean translations, respectively, of Amy Edmondson's team psychological safety scale (German and Korean). Amy Edmondson's team psychological safety scale is well known, and it is often used to measure team psychological safety within the literature. The original Cronbach's alpha score for Amy Edmondson's team psychological safety scale is ($\alpha = .82$), demonstrating good reliability (Ramalho & Porto, 2021). However, when this scale was modified and translated into different languages, the Cronbach's alpha scores decreased. The German version Cronbach's alpha (α) decreased to .69 in the Kolbe et al. (2013) study and .70 for the Korean version in the Roh et al. (2019) study. Therefore, the reliability of these translated scales is weak. Further, Amy Edmondson's psychological safety scale was also not developed specifically for measuring psychological safety in simulation or healthcare settings (O'Donovan et al., 2020).

However, Park and Kim (2021b) developed the "psychological safety in high fidelity simulation" scale, which is a more reliable and validated scale that measures psychological

safety specifically in simulation contexts, attaining a Cronbach's alpha score (α) of .91 (Park & Kim, 2021b). Further, this scale was specifically designed for the healthcare population (Park & Kim, 2021b). The Roh et al. (2019) and Kolbe et al. (2013) studies were published before the publication that first reported the "psychological safety in high fidelity simulation" scale. The "psychological safety in high fidelity simulation" scale was published in 2021 which can account for why the Roh et al. (2019) and Kolbe et al. (2013) studies did not utilize this highly reliable psychological safety in simulation scale. Future studies that seek to measure healthcare personal psychological safety in simulation should consider utilizing the "psychological safety in high fidelity simulation" scale.

The studies reviewed also used observational data to measure psychological safety. Two of the observational studies, by (Friedman et al., 2017; Oner et al., 2018), used deception when assessing the participants. Both included articles had appropriate institutional ethical board approval to conduct the study using deception (Friedman et al., 2017; Oner et al., 2018).

Friedman et al. (2017) used deception in their study by telling the study participants that the attending physician in the simulation was there to measure participant behaviour in simulation compared to behaviour in the clinical setting. Further, the attending in the study was also a staff physician that the participants will be soon working with in the professional setting outside of the study context. The researchers argued that deception was necessary in this context and was required to "…preserve the natural hierarchy gradient" (p.815). At the end of the study, all participants were required to participate in a debriefing session. Within the debriefing session, it was disclosed to the participants that the attending physician in the simulation was actually an actor in the study and not a researcher collecting data. The authors stated that supports were

available to participants if needed but did not report what these supports entailed. Participants were also given the opportunity to withdraw from the study after the disclosure of deception.

Oner et al. (2018) used a secret shopper method of deception in their study. The in-situ simulation used real staff physicians at the hospital that the participants worked with on a regular basis. The study participants were individually approached by their physician colleague in the real clinical setting but were not aware that their responses were being evaluated for research purposes. It was not disclosed to the participants that they were a part of an in situ simulation until all participants had been evaluated. Therefore, there was a period between the deception and the disclosure. There was a debriefing session provided to students once all participants had been evaluated.

Other than reporting that debriefing occurred and ethical approval was granted, it was not explicitly stated in either study (Friedman et al., 2017; Oner et al., 2018) how the researcher wes able to maintain psychological safety while conducting a research study with the use of deception.

The use of deception in educational research is highly controversial with arguments to support its usefulness and arguments that believe deception is unethical (Tai, 2012). One perspective is that deception may be required in order to fully understand complex social issues, which would not be possible without the use of deception (Tai, 2012). It is extremely difficult to understand social issues when participants are fully informed about what variable is being measured (Tai, 2012). When the participant is aware of the variable of interest, it could lead to biased research (Tai, 2012). Further, it is also argued that due to strong ethical board requirements, participants do not experience harm from deception studies (Tai, 2012). It is the job of the institutional ethics boards to ensure that deception is conducted ethically with minimal

harm to the participant (Tai, 2012). Therefore, some researchers believe the use of deception in educational research is acceptable.

On the other hand, it can be argued that trust and integrity between the research participant and researcher is an integral component of ethical research, and deception may breach the participant's trust of the researcher (Tai, 2012). Further, if participants become suspicious of deception than they may start to behave differently within the study (Tai, 2012). Although ethics boards make all best efforts to reduce participant harm, they cannot fully eliminate it (Tai, 2012). Therefore, some participants may experience psychological harm from research that uses deception (Tai, 2012).

Simulation Medium

Although the inclusion criteria allowed for studies that investigated in-person, in-situ and VS environments, no eligible studies that empirically tested psychological safety interventions within the VS context were identified. Although some publications discuss VS psychological safety (Dale-Tam et al., 2021b), they rely on anecdotal research and do not evaluate the effectiveness of their described interventions.

As we are seeing a shift towards the use of more VS, research must investigate how we can promote psychological safety within that context (Luctkar-Flude & Tyerman, 2021). Emotionally charged simulations do not just occur during in person or in-situ simulations. For example, Ziegler et al. (2021) developed a sexual orientation and gender identity minority (SOGI) VS series. This SOGI series covers scenarios such as therapeutic communication when working with an older adult gay man grieving the loss of his partner, assessment of a transgender youth experiencing a crisis, and an interaction with a healthcare provider and a transgender person seeking acute care (Henricksen et al., 2017). These simulations could provoke past

trauma for participants who may have experienced similar situations within their own lives. Therefore, the establishment of psychological safety for participants completing these modules is critical. The authors of the SOGI tool kit made reference to the psychological safety to the live actors when filming this series, but did not give tangible strategies for establishing psychological safety for the VS participants completing these scenarios (Ziegler et al., 2021). There is a clear research gap regarding psychological safety and VS. Future research must investigate strategies to support psychological safety for VS and empirically test the effectiveness of interventions in that environment.

Simulation Content

Four categories of simulation content were identified: abnormal vital signs, operating room critical events, medication error, and unprofessional behaviour. Table 9 goes into detail regarding simulation content of each study. All of the simulations covered high acuity situations where psychological safety was paramount for the success of the simulation. For example, a simulation described in the Guris et al. (2019) study focused on a surgeon attempting to operate on the wrong surgical site. The participants had the opportunity to speak up before the surgeon operated on the wrong surgical site at multiple points throughout the simulation. Although psychological safety is paramount in acute medical situations, it is also necessary in all other avenues of healthcare such as chronic care, mental health and working as part of an interdisciplinary team. A facilitator cannot predict what situations may be emotionally charged for students. We know that some situations may be more universally emotionally charged such as suicide and death and dying, but facilitators do not know the intricacies of each participant's life and what could elicit a negative emotional response for all learners. It is because of this that I believe that interventions that establish and maintain psychological safety must be implemented

in all simulations, regardless of the content. It is an unrealistic goal that a facilitator could possibly make every simulation completely psychologically safe for all. Facilitators should strive to implement the best available interventions and aim to make simulation environments psychologically safer. Semantics matter and I suggest that as educators, we move away from using the term psychologically safety and move towards using the terminology psychologically safer learning environments.

Table 9

Summary of Included Study Population and Scenario Topics

Study	Population	Simulation Scenario Topic
Guris et al. (2019)	• PGY-2 Anesthesiology residents (Post Graduate Year 2)	• Bradycardia related to surgical retraction • Incorrect extubating • Medication error
Ginsburg and Bain (2017)	• Frontline clinicians, staff, volunteers who work 2-3 shifts per week in ED or ICU at SRHC	• Unprofessional behaviour within an interprofessional team
Friedman et al. (2017)	• Second year anesthesia residents	• Unexpected critical events: “Can’t intubate, can’t ventilate”
Henricksen et al. (2017)	• Nurses • Medical residents • Medical students • Attending physicians • Respiratory therapists • Patient care technicians • Pharmacists • Social workers • Dental residents	• 9 types: 1. floor nursing 2. complex: emergency department and cardiac, neonatal and pediatric intensive care 3. orientating: new employees and new nurses 4. Medical sessions- fellows, residents, interns and medical students 5. ECMO (Extracorporeal membranous oxygenation), 6. medical transportation 7. Pediatric trauma 8. Mock code sessions 9. Other (dental, oncology, workplace violence, task trainer, operating room.
Kolbe et al. (2013)	• Anesthesia staff • Nurses	• Unexpected critical events: difficult intubation, cardiac arrest, tension pneumothorax

Oner et al. (2018)	• Nurses on labour and delivery and post-partum units	• Obstetrics
Raemer et al. (2016)	• Non-trainee anesthesiologists (attending staff)	• Operating Room: Venus air embolism and unprofessional behaviour
Robb et al. (2015)	• OR Nurses	• Operating Room: High blood loss surgery
Roh et al. (2018)	• Nursing students (4^{th} year)	• Cardiac arrest
Shanks et al. (2020)	• Senior Nursing students	• Medication error: Sound-alike medication

Design

Population. Most of the included studies had small sample sizes, with seven studies having less than 80 participants. One study by Henricksen et al. (2017), did have a much larger sample size (n = 3900). The relatively small sample size used in most of these studies raises questions pertaining to the level of Type II errors contained within the statistical models (Akobeng, 2016). The amount of Type II errors can be measured by evaluating the power of the resulting statical model (Akobeng, 2016). One can calculate the power of each model for the size of the sample obtained such that [power = 1 – Type II error] (Akobeng, 2016).

Health Disciplines. Although the inclusion criteria for this review allowed for studies covering all regulated healthcare professions in Ontario, medicine and nursing were the most represented populations. Within medicine, only anesthesia and surgery were represented, with anesthesia dominating. Anesthesia studies included both residents and attending physicians. The use of simulation training in anesthesiology education is not new and dates back to the 1960s, when an anesthesiologist developed the first simulation mannequin named “Resusci Anne” (Rothkrug & Mahboobi, 2022). Since 1985, the Anesthesia patient safety foundation has

invested money and resources into simulation training in order to prevent anesthesia-related patient harm (Rothkrug & Mahboobi, 2022). The discipline of nursing was also well represented and included both students and licensed nurses. This is not surprising as the use of simulation in nursing training dates back over a century to 1911, when nurses practiced transferring and turning patients with a mannequin doll named Mrs. Chase (Aebersold, 2018a).

Only two of the included articles (Henricksen et al., 2017; Kolbe, Weiss, et al., 2013) covered interprofessional simulation. It is interesting that interprofessional simulation only accounted for 25% of the included studies, as there is a natural hierarchy between health disciplines, making psychological safety within the interprofessional simulation paramount (Friedman et al., 2017). We may see research regarding interprofessional simulation and psychological safety grow as interprofessional education is a requirement for simulation programs to be accredited by the Royal College of Physicians and Surgeons of Canada (RCPSC) (RCPSC, 2019). A commitment to interprofessional education is cited in four of the RCPSC simulation program accreditation standards, including standards numbered:

> 1.1.1 The Program has a mission statement that includes purpose, common goals, and patient safety. This mission statement must support interprofessional education and research (RCPSC, 2019, p. 2).
>
> 1.1.2 Goals: The Program has developed a set of goals that includes a commitment to interprofessional education activities, research and patient safety (RCPSC, 2019, p. 2).
>
> 3.2.1 Diversity of Learners: There are courses which utilize or facilitate learning in an interprofessional environment when appropriate (RCPSC, 2019, p. 3).

> 3.2.2 Diversity of Instructors: Instructors from various health care professions are appropriately utilized during interprofessional learning activities (RCPSC, 2019, p. 4).

A recent systematic review by Heuer et al. (2022) concluded that simulation-based training with healthcare learners' (including allied healthcare professionals) is effective for improving learners confidence and skill enhancement. Therefore, it should be considered that simulation-based training may be effective for allied health care professionals, although more research is needed (Heuer et al., 2022). Outside of interprofessional simulation studies, no allied healthcare professions were represented within this current systematic review. There is a significant research gap regarding psychological safety in simulation within the allied health population. Allied health plays an integral role in healthcare and should be included in future studies regarding psychological safety.

Experience

Interventions. During data analysis, interventions were grouped as either single or multidimensional. Single interventions encompassed studies that only tested the implementation of one intervention, whereas studies that tested the use of two or more interventions were classified as multidimensional. Using the vote counting rule, it was determined that single interventions may be more effective than multidimensional (Table 7). This finding is counter to my original hypothesis that multidimensional interventions would have been more effective than single interventions.

A systematic review by Janet E. Squires et al. (2014) that investigated whether multifaceted interventions were more effective than single interventions were effective at changing healthcare professionals' behaviour found that multidimensional interventions were no

more likely to be effective than single interventions. They suggested that single interventions or less complex multifaceted interventions that are targeted at the desired outcome may be more appropriate for changing behaviour. Cognitive load theory may help to explain why single interventions are more effective. The redundancy of psychological safety interventions such as education regarding psychological safety and the creation of a cognitive aid may be an extraneous load for learners (Josephsen, 2015). The redundancy of the content may split the learner's attention, which may take a toll on the learners' working memory and negatively affect learning (Josephsen, 2015). However, future research is needed to make any conclusions.

Phases of Simulation. Interventions to support psychological safety exist throughout all phases of simulation. The literature suggests that the facilitation of psychologically safer simulation environments is a complex task, which requires more than just verbal announcements and statements. Instead, cultivating a psychologically safe environment requires all team members to be fully invested and engaged throughout the process. The responsibility of creating psychological safety does not fall solely on the shoulders of the facilitator. Students and facilitators must work collaboratively to reach the common goal of creating a psychologically safer learning environment.

The majority of the included studies tested interventions that occurred during the pre-simulation preparation phase. Pre-simulation preparation activities include activities such as education or the creation of cognitive aids. The facilitator must create these tasks for the student, but the learner must participate in these activities.

The Rudolph et al. (2014) study is a seminal study in simulation psychological safety wherein many interventions to facilitate psychological safety are discussed. They discuss fidelity contracts, a widely used intervention within the Pre-simulation briefing phase of simulation.

However, only one article included in the review by (Roh et al., 2018) tested the effectiveness of fidelity contracts. The study tested the fidelity contract with nursing students from a single site. Future research should explore the effectiveness of the fidelity contract with different healthcare disciplines and levels of learners.

Limitations

Although best efforts were made to ensure high quality, rigorous research, there are some limitations to this research. Firstly, due to the highly specific inclusion criteria, only eight articles were included. Secondly, grey literature was not eligible for data extraction, so this dataset may not represent the entire scope of research completed in this area. Lastly, due to the significant heterogeneity of the data, a meta-analysis was not possible, and a vote count approach was used instead. Vote counts have several limitations, such as the effect size not being accounted for, meaning magnitude is not considered and all studies are given equal weight (Janet E. Squires et al., 2014).

Implications for Education and Research

The goal of nursing education is to train the next generation of nurses to be able to safety enter the workforce. Simulation is an educational tool that is extensively used within schools of nursing and other healthcare professional programs. The use of simulation is predicted to continue to increase in future years (Luctkar-Flude & Tyerman, 2021). Studying simulation pedagogy is required to ensure that simulation educators have access to evidenced-based educational strategies. Nurses in Ontario are required by the CNO to participate in creating a psychologically safe learning environment (CNO, 2019). Creating psychological safety in simulation requires both the learner and facilitator to both be invested in working in a psychologically safe learning environment.

Interventions to support psychological safety exist throughout all phases of simulation. However, many empirically tested interventions exist within the pre-simulation preparation phase. Educators should consider reviewing their current simulation practices to ensure that they are supporting a psychologically safer learning environment within all phases of simulation.

Future Research

Although this current study adds to the body of literature, there is still more research that needs to be done. I suggest that future research regarding psychological safety in simulation with healthcare populations should make use of the validated scale developed by (Park & Kim, 2021b). This scale is more specific to psychological safety within the simulation setting and has not been utilized in any psychological safety intervention studies to date.

Additionally, the findings of this study suggested that single interventions were more effective at improving psychological safety than multidimensional interventions. Future research should investigate the effectiveness of single versus multidimensional interventions aimed at improving psychological safety. Additionally, research should investigate what combinations of interventions could be effective for supporting psychological safety in simulation.

We were unable to find any empirically tested interventions that specifically support psychological safety in the VS environment. We must expand our research to include the VS environment. We were also unable to identify studies that investigated psychological safety in simulation with the allied health population. More research is required to evaluate these psychological safety interventions with the allied health population. Studies exploring the establishment of psychological safety when debriefing traditional in person debriefing strategies may serve as a foundation for future studies when using virtual simulation.

Lastly, the transferability of psychologically safe learning environments and patient safety outcomes should be investigated. This study should consider using a longitudinal approach to ascertain the transferability over time.

"Psychological safety in simulation is not an event, it is a continuous practice that occurs at all phases of simulation"
Ashley Jackson

References

Aebersold, M. (2016). The History of Simulation and Its Impact on the Future. *AACN Advanced Critical Care*, *27*(1), 56-61. https://doi.org/10.4037/aacnacc2016436

Aebersold, M. (2018a). Simulation-based learning: No longer a novelty in undergraduate education. *OJIN: The Online Journal of Issues in Nursing*, *23*(2), 1-1.

Aebersold, M. (2018b). Simulation-based learning: No longer a novelty in undergraduate education. *OJIN: The Online Journal of Issues in Nursing*, *23*(2), 1-13.

Akobeng, A. K. (2016). Understanding type I and type II errors, statistical power and sample size. *Acta Paediatrica*, *105*(6), 605-609.

Al Sabei, S. D., & Lasater, K. (2016). Simulation debriefing for clinical judgment development: A concept analysis. *Nurse Educ Today*, *45*, 42-47. https://doi.org/10.1016/j.nedt.2016.06.008

Al-Ghareeb, A. Z., Cooper, S. J., & McKenna, L. G. (2017). Anxiety and Clinical Performance in Simulated Setting in Undergraduate Health Professionals Education: An Integrative Review. *Clinical Simulation in Nursing*, *13*(10), 478-491. https://doi.org/10.1016/j.ecns.2017.05.015

Allen, M. L. (2018). Examining Nursing Students' Stress in an End-of-Life Care Simulation. *Clinical Simulation in Nursing*, *14*, 21-28. https://doi.org/10.1016/j.ecns.2017.10.006

Aromataris, & Munn. (2020). JBI Manual for Evidence Synthesis. *JBI*.

Atthill, S., Witmer, D., Luctkar-Flude, M., & Tyerman, J. (2021). Exploring the Impact of a Virtual Asynchronous Debriefing Method after a Virtual Simulation Game to Support Clinical Decision-Making. *Clinical Simulation in Nursing*, *50*, 10-18. https://doi.org/10.1016/j.ecns.2020.06.008

Barra, M., & Singh Hernandez, S. S. (2019). No room at the inn: Use of maternal-child simulation when hospital clinical is restricted. *Nursing Forum*, *54*(1), 23-29. https://doi.org/10.1111/nuf.12293

Bishop, P. A., & Herron, R. L. (2015). Use and Misuse of the Likert Item Responses and Other Ordinal Measures. *Int J Exerc Sci*, *8*(3), 297-302.

Blum, C. A., Borglund, S., & Parcells, D. (2010). High-Fidelity Nursing Simulation: Impact on Student Self-Confidence and Clinical Competence. *International Journal of Nursing Education Scholarship*, *7*(1). https://doi.org/doi:10.2202/1548-923X.2035

Bracq, M.-S., Michinov, E., & Jannin, P. (2019). Virtual Reality Simulation in Nontechnical Skills Training for Healthcare Professionals. *Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare*, *14*(3), 188-194. https://doi.org/10.1097/sih.0000000000000347

Bradley, C. S., Johnson, B. K., Dreifuerst, K. T., White, P., Conde, S. K., Meakim, C. H., Curry-Lourenco, K., & Childress, R. M. (2019). Regulation of simulation use in United States prelicensure nursing programs. *Clinical Simulation in Nursing*, *33*, 17-25.

Bradley, D. T., Mansouri, M. A., Kee, F., & Garcia, L. M. T. (2020). A systems approach to preventing and responding to COVID-19. *EClinicalMedicine*, *21*, 100325. https://doi.org/10.1016/j.eclinm.2020.100325

Brown, D., & Chronister, C. (2009). The Effect of Simulation Learning on Critical Thinking and Self-confidence When Incorporated Into an Electrocardiogram Nursing Course. *Clinical*

Simulation in Nursing, *5*(1), e45-e52. https://doi.org/https://doi.org/10.1016/j.ecns.2008.11.001

Campbell, M., McKenzie, J. E., Sowden, A., Katikireddi, S. V., Brennan, S. E., Ellis, S., Hartmann-Boyce, J., Ryan, R., Shepperd, S., & Thomas, J. (2020). Synthesis without meta-analysis (SWiM) in systematic reviews: reporting guideline. *Bmj*, *368*.

Cant, R. P., & Cooper, S. J. (2010). Simulation-based learning in nurse education: systematic review. *Journal of advanced nursing*, *66*(1), 3-15.

Cant, R. P., & Cooper, S. J. (2017). Use of simulation-based learning in undergraduate nurse education: An umbrella systematic review. *Nurse Education Today*, *49*, 63-71. https://doi.org/10.1016/j.nedt.2016.11.015

Cantrell, M. A. (2021). Does the Focus of Psychological Safety in Clinical Simulation Research Hinder the Development of Simulation Science? *Clinical Simulation in Nursing*, *56*, 163. https://doi.org/10.1016/j.ecns.2020.11.005

Chan, Z. C., Tong, C. W., & Henderson, S. (2017). Power dynamics in the student-teacher relationship in clinical settings. *Nurse education today*, *49*, 174-179. https://doi.org/10.1016/j.nedt.2016.11.026

CNO. (2019). Practice Standard: Code of Conduct In *Code of Conduct* (pp. 1-13).

Cobbett, S., & Snelgrove-Clarke, E. (2016). Virtual versus face-to-face clinical simulation in relation to student knowledge, anxiety, and self-confidence in maternal-newborn nursing: A randomized controlled trial. *Nurse education today*, *45*, 179-184. https://doi.org/10.1016/j.nedt.2016.08.004

Cowperthwait, A. (2020). NLN/Jeffries Simulation Framework for Simulated Participant Methodology. *Clinical Simulation in Nursing*, *42*, 12-21. https://doi.org/10.1016/j.ecns.2019.12.009

Dale-Tam, J., Thompson, K., & Dale, L. (2021a). Creating Psychological Safety During a Virtual Simulation Session. *Clinical Simulation in Nursing*. https://doi.org/https://doi.org/10.1016/j.ecns.2021.01.017

Dale-Tam, J., Thompson, K., & Dale, L. (2021b). Creating Psychological Safety During a Virtual Simulation Session. *Clinical Simulation in Nursing*, *57*, 14-17. https://doi.org/10.1016/j.ecns.2021.01.017

Davies, H., Sundin, D., Robinson, S., & Jacob, E. (2021). Does participation in extended immersive ward-based simulation improve the preparedness of undergraduate bachelor's degree nursing students to be ready for clinical practice as a registered nurse? An integrative literature review. *Journal of Clinical Nursing*. https://doi.org/10.1111/jocn.15796

De Ponti, R., Marazzato, J., Maresca, A. M., Rovera, F., Carcano, G., & Ferrario, M. M. (2020). Pre-graduation medical training including virtual reality during COVID-19 pandemic: a report on students' perception. *BMC Medical Education*, *20*(1). https://doi.org/10.1186/s12909-020-02245-8

Decker, S., Alinier, G., Crawford, S. B., Gordon, R. M., Jenkins, D., & Wilson, C. (2021). Healthcare Simulation Standards of Best PracticeTM The Debriefing Process. *Clinical Simulation in Nursing*, *58*, 27-32. https://doi.org/10.1016/j.ecns.2021.08.011

Demirtas, A., Guvenc, G., Aslan, Ö., Unver, V., Basak, T., & Kaya, C. (2021). Effectiveness of simulation-based cardiopulmonary resuscitation training programs on fourth-year nursing

students. *Australasian Emergency Care*, *24*(1), 4-10. https://doi.org/10.1016/j.auec.2020.08.005

Dilig-Ruiz, A., MacDonald, I., Varin, M. D., Vandyk, A., Graham, I. D., & Squires, J. E. (2018). Job satisfaction among critical care nurses: A systematic review. *International journal of nursing studies*, *88*, 123-134.

Doody, O., & Condon, M. (2013). Using a simulated environment to support students learning clinical skills. *Nurse education in practice*, *13*(6), 561-566.

Dreifuerst, K. T. (2009). The essentials of debriefing in simulation learning: a concept analysis. *Nurs Educ Perspect*, *30*(2), 109-114.

Dreifuerst, K. T. (2012). Using Debriefing for Meaningful Learning to Foster Development of Clinical Reasoning in Simulation. *The Journal of nursing education*, *51*(6), 326-333. https://doi.org/10.3928/01484834-20120409-02

Edmondson, A. (1999). Psychological Safety and Learning Behavior in Work Teams. *Administrative Science Quarterly*, *44*(2), 350-383. https://doi.org/10.2307/2666999

Edmondson, A. C., Higgins, M., Singer, S., & Weiner, J. (2016). Understanding psychological safety in health care and education organizations: a comparative perspective. *Research in Human Development*, *13*(1), 65-83.

Edmondson, A. C., & Lei, Z. (2014). Psychological Safety: The History, Renaissance, and Future of an Interpersonal Construct. *Annual Review of Organizational Psychology and Organizational Behavior*, *1*(1), 23-43. https://doi.org/10.1146/annurev-orgpsych-031413-091305

Fagan, A., Parker, V., & Jackson, D. (2016). A concept analysis of undergraduate nursing students speaking up for patient safety in the patient care environment. *Journal of Advanced Nursing*, *72*(10), 2346-2357. https://doi.org/10.1111/jan.13028

Feeler, A. (2019). A Systematic Review of the Effectiveness of the NLN Jeffries Simulation Framework.

Fernandez, R., Ellwood, L., Barrett, D., & Weaver, J. (2021). Safety and effectiveness of strategies to reduce radiation exposure to proceduralists performing cardiac catheterization procedures: a systematic review. *JBI Evid Synth*, *19*(1), 4-33. https://doi.org/10.11124/jbisrir-d-19-00343

Fitzpatrick, J. J., & McCarthy, G. Concept Analysis. In J. J. Fitzpatrick & G. McCarthy (Eds.), (pp. 1-6). Springer Publishing Company. https://doi.org/10.1891/9780826126825.0001

Fitzpatrick, J. J., McCarthy, G., & RNYT, R. (2016). *Nursing concept analysis: applications to research and practice*. Springer Publishing Company.

Floridi. (2003). *Chapter 11: Ontology* Oxford: Blackwell.

Foronda, C. L., Fernandez-Burgos, M., Nadeau, C., Kelley, C. N., & Henry, M. N. (2020). Virtual Simulation in Nursing Education: A Systematic Review Spanning 1996 to 2018. *Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare*, *15*(1), 46-54. https://doi.org/10.1097/sih.0000000000000411

Friedman, Z., Perelman, V., McLuckie, D., Andrews, M., Noble, L. M., Malavade, A., & Bould, M. D. (2017). Challenging authority during an emergency—the effect of a teaching intervention. *Critical care medicine*, *45*(8), e814-e820.

Galloway, S. (2009). Simulation techniques to bridge the gap between novice and competent healthcare professionals. *Online Journal of Issues in Nursing*, *14*(2).

Gandhi, S., Glaman, R., Yeager, J., & Smith, M. (2021). Evaluation of Anxiety and Self-Confidence Among Baccalaureate Nursing Students Post Pandemic Simulation Exercise. *Clinical Simulation in Nursing*, *56*, 91-98. https://doi.org/10.1016/j.ecns.2021.04.007

Ganley, B. J., & Linnard-Palmer, L. (2012). Academic Safety during Nursing Simulation: Perceptions of Nursing Students and Faculty. *Clinical Simulation in Nursing*, *8*(2), e49-e57. https://doi.org/10.1016/j.ecns.2010.06.004

Goldweber, A., Waasdorp, T. E., & Bradshaw, C. P. (2013). Examining the link between forms of bullying behaviors and perceptions of safety and belonging among secondary school students. *Journal of school psychology*, *51*(4), 469-485.

Günay İsmailoğlu, E., & Zaybak, A. (2018). Comparison of the Effectiveness of a Virtual Simulator With a Plastic Arm Model in Teaching Intravenous Catheter Insertion Skills. *Comput Inform Nurs*, *36*(2), 98-105. https://doi.org/10.1097/cin.0000000000000405

Guris, R. J. D., Duarte, S. S., Miller, C. R., Schiavi, A., & Toy, S. (2019). Training novice anaesthesiology trainees to speak up for patient safety. *British journal of anaesthesia*, *122*(6), 767-775.

Harder, B. N. (2009). Evolution of Simulation Use in Health Care Education. *Clinical Simulation in Nursing*, *5*(5), e169-e172. https://doi.org/https://doi.org/10.1016/j.ecns.2009.04.092

Harder, N. (2021). Response to the Letter: Does the Focus of Psychological Safety in Clinical Simulation Research Hinder the Development of Simulation Science? *Clinical Simulation in Nursing*, *56*, 164-165. https://doi.org/10.1016/j.ecns.2021.02.005

Hawkins, A., & Tredgett, K. (2016). Use of high-fidelity simulation to improve communication skills regarding death and dying: a qualitative study. *BMJ Supportive & Palliative Care*, *6*(4), 474. https://doi.org/http://dx.doi.org/10.1136/bmjspcare-2015-001081

Hayden, J. K., Smiley, R. A., Alexander, M., Kardong-Edgren, S., & Jeffries, P. R. (2014). The NCSBN national simulation study: A longitudinal, randomized, controlled study replacing clinical hours with simulation in prelicensure nursing education. *Journal of Nursing Regulation*, *5*(2), S3-S40.

Henricksen, J. W., Altenburg, C., & Reeder, R. W. (2017). Operationalizing healthcare simulation psychological safety: a descriptive analysis of an intervention. *simulation in healthcare*, *12*(5), 289-297.

Heuer, A., Bienstock, J., & Zhang, Y. (2022). Simulation-based training within selected allied health professions: an evidence-based systematic review. *Journal of Allied Health*, *51*(1), 59-71.

Hong, Q. N., Pluye, P., Bujold, M., & Wassef, M. (2017). Convergent and sequential synthesis designs: implications for conducting and reporting systematic reviews of qualitative and quantitative evidence. *Systematic Reviews*, *6*(1). https://doi.org/10.1186/s13643-017-0454-2

Houghton, C., Hunter, A., & Meskell, P. (2012). Linking aims, paradigm and method in nursing research. *Nurse researcher*, *20*(2).

INACSL. (2016a). INACSL Standards of Best Practice: SimulationSM Debriefing. *Clinical Simulation in Nursing*, *12*, S21-S25. https://doi.org/10.1016/j.ecns.2016.09.008

INACSL. (2016b). INACSL Standards of Best Practice: SimulationSM Simulation Design. *Clinical Simulation in Nursing*, *12*, S5-S12. https://doi.org/10.1016/j.ecns.2016.09.005

INACSL. (2016c). INACSL Standards of Best Practice: SimulationSM Simulation Glossary. *Clinical Simulation in Nursing*, *12*, S39-S47. https://doi.org/10.1016/j.ecns.2016.09.012

Ingraham, K. C., Davidson, S. J., & Yonge, O. (2018). Student-faculty relationships and its impact on academic outcomes. *Nurse education today*, *71*, 17-21. https://doi.org/10.1016/j.nedt.2018.08.021

Jacobs, S., Taylor, C., Dixon, K. A., & Wilkes, L. M. (2020). The advantages and disadvantages of using High Fidelity Simulation as an environment to observe undergraduate nurses' actions and their alignment with clinical judgement characteristics. *Clinical Nursing Studies*, 15-20.

Janzen, K. J., Jeske, S., MacLean, H., Harvey, G., Nickle, P., Norenna, L., Holtby, M., & McLellan, H. (2016). Handling Strong Emotions Before, During, and After Simulated Clinical Experiences. *Clinical Simulation in Nursing*, *12*(2), 37-43. https://doi.org/https://doi.org/10.1016/j.ecns.2015.12.004

Jeffries, P. R. (2005). A framework for designing, implementing, and evaluating: Simulations used as teaching strategies in nursing. *Nursing education perspectives*, *26*(2), 96-103.

Jeffries, P. R., Rodgers, B., & Adamson, K. (2015). NLN Jeffries simulation theory: Brief narrative description. *Nursing Education Perspectives*, *36*(5), 292-293.

Josephsen, J. (2015). Cognitive load theory and nursing simulation: An integrative review. *Clinical Simulation in Nursing*, *11*(5), 259-267.

Kang, S. J., & Bae, J. A. (2017). Psychological safety in nursing simulation education: a concept analysis. *The Journal of the Korea Contents Association*, *17*(9), 331-340.

Kassem, A. H. (2015). Bullying Behaviors and Self Efficacy among Nursing Students at Clinical Settings: Comparative Study. *Journal of Education and Practice*, *6*(35), 25-36.

Kaushik, V., & Walsh, C. A. (2019). Pragmatism as a Research Paradigm and Its Implications for Social Work Research. *Social sciences (Basel)*, *8*(9), 255. https://doi.org/10.3390/socsci8090255

Keys, E., Luctkar-Flude, M., Tyerman, J., Sears, K., & Woo, K. (2021). The Integration of Virtual Simulation Gaming Into Undergraduate Nursing Resuscitation Education: A Pilot Randomised Controlled Trial. *Clinical Simulation in Nursing*, *54*, 54-61. https://doi.org/10.1016/j.ecns.2021.01.013

Kim, S. H., Issenberg, B., & Roh, Y. S. (2020). The Effects of Simulation-Based Advanced Life Support Education for Nursing Students. *CIN: Computers, Informatics, Nursing*, *38*(5), 240-245. https://doi.org/10.1097/CIN.0000000000000560

Kivunja, C., & Kuyini, A. B. (2017). Understanding and applying research paradigms in educational contexts. *International Journal of higher education*, *6*(5), 26-41.

Kolbe, M., Burtscher, M. J., Wacker, J., Grande, B., Nohynkova, R., Manser, T., Spahn, D. R., & Grote, G. (2013). Speaking Up is Related to Better Team Performance in Simulated Anesthesia Inductions: An Observational Study. *Survey of Anesthesiology*, *57*(3), 114-115.

Kolbe, M., Eppich, W., Rudolph, J., Meguerdichian, M., Catena, H., Cripps, A., Grant, V., & Cheng, A. (2020). Managing psychological safety in debriefings: a dynamic balancing act. *BMJ simulation & technology enhanced learning*, *6*(3), 164-171. https://doi.org/10.1136/bmjstel-2019-000470

Kolbe, M., Weiss, M., Grote, G., Knauth, A., Dambach, M., Spahn, D. R., & Grande, B. (2013). TeamGAINS: a tool for structured debriefings for simulation-based team trainings. *BMJ quality & safety*, *22*(7), 541-553.

Konrad, S., Fitzgerald, A., & Deckers, C. (2021). Nursing fundamentals–supporting clinical competency online during the COVID-19 pandemic. *Teaching and Learning in Nursing, 16*(1), 53-56.

Kostovich, C. T., O'Rourke, J., & Stephen, L.-A. (2020). Establishing psychological safety in simulation: Faculty perceptions. *Nurse Education Today*, *91*, 104468. https://doi.org/10.1016/j.nedt.2020.104468

Lateef, F. (2020). Maximizing learning and creativity: Understanding psychological safety in simulation-based learning. *Journal of emergencies, trauma, and shock*, *13*(1), 5.

Lee, B.-O., Liang, H.-F., Chu, T.-P., & Hung, C.-C. (2019). Effects of simulation-based learning on nursing student competences and clinical performance. *Nurse education in practice*, *41*, 102646.

LoBiondo-Wood, Haber, Cameron, & Singh. (2018). *Nursing research in Canada: Methods, critical appraisal, and utilization* (4 ed.). Mosby.

Luctkar-Flude, M. (2020). *Simulation approaches*. Canadian Association of Schools of Nursing

Luctkar-Flude, M., & Tyerman, J. (2021). The Rise of Virtual Simulation: Pandemic Response or Enduring Pedagogy? *Clinical Simulation in Nursing*, *57*, 1-2. https://doi.org/10.1016/j.ecns.2021.06.008

Luctkar-Flude, M., Tyerman, J., Chumbley, L., Peachey, L., Lalonde, M., & Tregunno, D. (2021). Engaging learners in presimulation preparation through virtual simulation games. *Recent Advances in Technologies for Inclusive Well-Being: Virtual Patients, Gamification and Simulation*, 223-237.

Lynch, A. (2020). Simulation-based acquisition of non-technical skills to improve patient safety. *Seminars in Pediatric Surgery*, *29*(2), 150906. https://doi.org/10.1016/j.sempedsurg.2020.150906

McDonald, E. W., Boulton, J. L., & Davis, J. L. (2018). E-learning and nursing assessment skills and knowledge – An integrative review. *Nurse Education Today*, *66*, 166-174. https://doi.org/10.1016/j.nedt.2018.03.011

McKenzie, J., & Brennan, S. (2019). Chapter 12: Synthesizing and presenting findings using other methods In: Higgins JPT, Thomas J, Chandler J, et al., eds Cochrane Handbook for systematic reviews of interventions version 6.0, 2019. In.

McMahon, E., Jimenez, F. A., Lawrence, K., & Victor, J. (2021). Healthcare Simulation Standards of Best PracticeTM Evaluation of Learning and Performance. *Clinical Simulation in Nursing*, *58*, 54-56. https://doi.org/10.1016/j.ecns.2021.08.016

Molloy, M. A., Holt, J., Charnetski, M., & Rossler, K. (2021). Healthcare Simulation Standards of Best PracticeTM Simulation Glossary. *Clinical Simulation in Nursing*, *58*, 57-65. https://doi.org/10.1016/j.ecns.2021.08.017

Moola S, Munn Z, Tufanaru C, Aromataris E, Sears K, Sfetcu R, Currie M, Qureshi R, Mattis P, Lisy K, & P-F., M. (2020). *Chapter 7: Systematic reviews of etiology and risk* https://synthesismanual.jbi.global

Mulyadi, M., Tonapa, S. I., Rompas, S. S. J., Wang, R.-H., & Lee, B.-O. (2021). Effects of simulation technology-based learning on nursing students' learning outcomes: a systematic review and meta-analysis of experimental studies. *Nurse education today*, *107*, 105127.

Nacioglu, A. (2016). As a critical behavior to improve quality and patient safety in health care: speaking up! *Safety in Health*, *2*(1), 1-25.

Nakayama, N., Arakawa, N., Ejiri, H., Matsuda, R., & Makino, T. (2018). Heart rate variability can clarify students' level of stress during nursing simulation. *PLOS ONE*, *13*(4), e0195280. https://doi.org/10.1371/journal.pone.0195280

Nascimento, J. d. S. G., Costa, A. B. F., Sangiovani, J. C., Silva, T., Regino, D. d. S. G., & Dalri, M. C. B. (2020). Pre-simulation, prebriefing or briefing in nursing simulation: what are the differences. *Rev Eletr Enferm*, *22*, 60171.

Newman, A., Donohue, R., & Eva, N. (2017). Psychological safety: A systematic review of the literature. *Human Resource Management Review*, *27*(3), 521-535. https://doi.org/10.1016/j.hrmr.2017.01.001

Nielsen, B., & Harder, N. (2013). Causes of Student Anxiety during Simulation: What the Literature Says. *Clinical Simulation in Nursing*, *9*(11), e507-e512. https://doi.org/10.1016/j.ecns.2013.03.003

O'Donovan, R., & McAuliffe, E. (2020a). A systematic review exploring the content and outcomes of interventions to improve psychological safety, speaking up and voice behaviour. *BMC Health Services Research*, *20*(1). https://doi.org/10.1186/s12913-020-4931-2

O'Donovan, R., & McAuliffe, E. (2020b). A systematic review of factors that enable psychological safety in healthcare teams. *International Journal for Quality in Health Care*, *32*(4), 240-250. https://doi.org/10.1093/intqhc/mzaa025

O'Donovan, R., Van Dun, D., & McAuliffe, E. (2020). Measuring psychological safety in healthcare teams: developing an observational measure to complement survey methods. *BMC Medical Research Methodology*, *20*(1). https://doi.org/10.1186/s12874-020-01066-z

OMHLTC. (n.d.). *Regulated Health Professions*. https://www.health.gov.on.ca/en/pro/programs/hhrsd/about/regulated_professions.aspx

Oner, C., Fisher, N., Atallah, F., Son, M. A., Homel, P., Mykhalchenko, K., & Minkoff, H. (2018). Simulation-based education to train learners to "speak up" in the clinical environment: results of a randomized trial. *simulation in healthcare*, *13*(6), 404-412.

Ormerod, R. (2006). The history and ideas of pragmatism. *Journal of the Operational Research Society*, *57*(8), 892-909.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., & Brennan, S. E. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Systematic Reviews*, *10*(1), 1-11.

Page-Cutrara, K. (2014). Use of Prebriefing in Nursing Simulation: A Literature Review: [1]. *Journal of Nursing Education*, *53*(3), 136-141. https://doi.org/http://dx.doi.org/10.3928/01484834-20140211-07

Palaganas, J. C., Fey, M., & Simon, R. (2016). Structured Debriefing in Simulation-Based Education. *AACN Adv Crit Care*, *27*(1), 78-85. https://doi.org/10.4037/aacnacc2016328

Park, J. E., & Kim, J.-H. (2021a). Nursing students' Psychological Safety in High fidelity Simulations: Development of a new scale for psychometric evaluation. *Nurse Education Today*, 105017.

Park, J. E., & Kim, J.-H. (2021b). Nursing students' Psychological Safety in High fidelity Simulations: Development of a new scale for psychometric evaluation. *Nurse Education Today*, *105*, 105017. https://doi.org/https://dx.doi.org/10.1016/j.nedt.2021.105017

Persico, L., Belle, A., Digregorio, H., Wilson-Keates, B., & Shelton, C. (2021). Healthcare Simulation Standards of Best PracticeTM Facilitation. *Clinical Simulation in Nursing, 58*, 22-26. https://doi.org/10.1016/j.ecns.2021.08.010

Phillips, E. C., Smith, S. E., Hamilton, A. L., Kerins, J., Clarke, B., & Tallentire, V. R. (2021). Assessing Medical Students' Nontechnical Skills Using Immersive Simulation: What Are the Essential Components? *Simulation in Healthcare*, *16*(2). https://journals.lww.com/simulationinhealthcare/Fulltext/2021/04000/Assessing_Medical_Students__Nontechnical_Skills.4.aspx

Pires, S., Monteiro, S., Pereira, A., Stocker, J., Chaló, D., & Melo, E. (2020). Non-technical skills in nursing education: effectiveness of a high-fidelity simulation-based course. *Rev. Rol enferm*, 464-471.

Polit, & Beck. (2021). *Nursing Research:*
Generating and Assessing Evidence for Nursing Practice (11 ed.). Wolters Kluwer

Pussegoda, K., Turner, L., Garritty, C., Mayhew, A., Skidmore, B., Stevens, A., Boutron, I., Sarkis-Onofre, R., Bjerre, L. M., Hróbjartsson, A., Altman, D. G., & Moher, D. (2017). Identifying approaches for assessing methodological and reporting quality of systematic reviews: a descriptive study. *Systematic Reviews*, *6*(1), 117-117. https://doi.org/10.1186/s13643-017-0507-6

Raemer, Kolbe, M., Minehart, R. D., Rudolph, J. W., & Pian-Smith, M. C. M. (2016). Improving Anesthesiologists' Ability to Speak Up in the Operating Room: A Randomized Controlled Experiment of a Simulation-Based Intervention and a Qualitative Analysis of Hurdles and Enablers. *Academic medicine : journal of the Association of American Medical Colleges*, *91*(4), 530-539. https://doi.org/https://dx.doi.org/10.1097/ACM.0000000000001033

Raemer, D. B., Kolbe, M., Minehart, R. D., Rudolph, J. W., & Pian-Smith, M. (2016). Improving anesthesiologists' ability to speak up in the operating room: a randomized controlled experiment of a simulation-based intervention and a qualitative analysis of hurdles and enablers. *Academic Medicine*, *91*(4), 530-539.

Ramalho, M. C. K., & Porto, J. B. (2021). Validity Evidence of the Team Psychological Safety Survey. *Psico-USF*, *26*, 165-176.

RCPSC. (2019). Simulation Program Accreditation: Accreditation Standards. In (pp. 1-5): Royal College of Physician and Surgeons of Canada

Robb, A., White, C., Cordar, A., Wendling, A., Lampotang, S., & Lok, B. (2015). A comparison of speaking up behavior during conflict with real and virtual humans. *Computers in Human Behavior*, *52*, 12-21.

Roh, Y. S., Ahn, J.-W., Kim, E., & Kim, J. (2018). Effects of prebriefing on psychological safety and learning outcomes. *Clinical Simulation in Nursing*, *25*, 12-19.

Roh, Y. S., Jang, K. I., & Issenberg, S. B. (2021). Nursing students' perceptions of simulation design features and learning outcomes: The mediating effect of psychological safety. *Collegian*, *28*(2), 184-189. https://doi.org/10.1016/j.colegn.2020.06.007

Rothkrug, A., & Mahboobi, S. K. (2022). Simulation training and skill assessment in anesthesiology. In *StatPearls [Internet]*. StatPearls Publishing.

Roussin, C. J., Larraz, E., Jamieson, K., & Maestre, J. M. (2018). Psychological Safety, Self-Efficacy, and Speaking Up in Interprofessional Health Care Simulation. *Clinical Simulation in Nursing*, *17*, 38-46. https://doi.org/10.1016/j.ecns.2017.12.002

Rudolph, J. W., Raemer, D. B., & Simon, R. (2014). Establishing a Safe Container for Learning in Simulation: The Role of the Presimulation Briefing. *Simulation in Healthcare*, *9*(6), 339-349. https://doi.org/10.1097/sih.0000000000000047

Saied, H. (2017). The Impact of Simulation on Pediatric Nursing Students' Knowledge, Self-Efficacy, Satisfaction, and Confidence. *Journal of Education and Practice*, *8*(11), 95-102.

Santos, W. J., Graham, I. D., Lalonde, M., Demery Varin, M., & Squires, J. E. (2022). The effectiveness of champions in implementing innovations in health care: a systematic review. *Implementation Science Communications*, *3*(1). https://doi.org/10.1186/s43058-022-00315-0

Sayre, M. M., McNeese-Smith, D., Leach, L. S., & Phillips, L. R. (2012). An educational intervention to increase "speaking-up" behaviors in nurses and improve patient safety. *Journal of Nursing Care Quality*, *27*(2), 154-160.

Shamseer, L., Moher, D., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., & Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *Bmj*, *349*.

Shinnick, M. A., Woo, M., Horwich, T. B., & Steadman, R. (2011). Debriefing: The Most Important Component in Simulation? *Clinical Simulation in Nursing*, *7*(3), e105-e111. https://doi.org/10.1016/j.ecns.2010.11.005

Soccio, D. A. (2017). Effectiveness of mental health simulation in replacing traditional clinical hours in baccalaureate nursing education. *Journal of psychosocial nursing and mental health services*, *55*(11), 36-43.

Squires, J. E., Estabrooks, C. A., Gustavsson, P., & Wallin, L. (2011). Individual determinants of research utilization by nurses: a systematic review update. *Implementation science*, *6*(1), 1-20.

Squires, J. E., Hoben, M., Linklater, S., Carleton, H. L., Graham, N., & Estabrooks, C. A. (2015). Job satisfaction among care aides in residential long-term care: a systematic review of contributing factors, both individual and organizational. *Nursing research and practice*, *2015*.

Squires, J. E., Sullivan, K., Eccles, M. P., Worswick, J., & Grimshaw, J. M. (2014). Are multifaceted interventions more effective than single-component interventions in changing health-care professionals' behaviours? An overview of systematic reviews. *Implementation Science*, *9*(1). https://doi.org/10.1186/s13012-014-0152-6

Squires, J. E., Sullivan, K., Eccles, M. P., Worswick, J., & Grimshaw, J. M. (2014). Are multifaceted interventions more effective than single-component interventions in changing health-care professionals' behaviours? An overview of systematic reviews. *Implementation science*, *9*(1), 1-22.

Stephen, L.-A., Kostovich, C., & O'Rourke, J. (2020). Psychological Safety in Simulation: Prelicensure Nursing Students' Perceptions. *Clinical Simulation in Nursing*, *47*, 25-31. https://doi.org/10.1016/j.ecns.2020.06.010

Tai, M. C.-T. (2012). Deception and informed consent in social, behavioral, and educational research (SBER). *Tzu Chi Medical Journal*, *24*(4), 218-222.

Tetzlaff, T., Moher. (2009). *Knowledge Synthesis* Wiley-Blackwell.

Tufanaru, Munn, Aromataris, Campbell, & Hopp. (2020). *Chapter 3: Systematic reviews of effectiveness*. JBI.

Tufanaru C, Munn Z, Aromataris E, Campbell J, & L., H. (Eds.). (2020). *Chapter 3: Systematic reviews of effectiveness*. JBI. https://synthesismanual.jbi.global.

Turner, S., & Harder, N. (2018). Psychological Safe Environment: A Concept Analysis. *Clinical Simulation in Nursing*, *18*, 47-55. https://doi.org/10.1016/j.ecns.2018.02.004

Tyerman, J., Luctkar-Flude, M., Graham, L., Coffey, S., & Olsen-Lynch, E. (2019). A Systematic Review of Health Care Presimulation Preparation and Briefing Effectiveness. *Clinical Simulation in Nursing*, *27*, 12-25. https://doi.org/10.1016/j.ecns.2018.11.002

Tyerman, J., Ziegler, E., Carroll, B., & Luctkar-Flude, M. (2021). LGBTQI2S Virtual Simulation: Lessons Learned Using Actors With Lived Experience. *Clinical Simulation in Nursing*, *54*, 40-44. https://doi.org/https://doi.org/10.1016/j.ecns.2021.01.016

VHI. *Covidence systematic review software*. In Veritas Health Innovation (VHI). www.covidence.org

Watts, P. I., Rossler, K., Bowler, F., Miller, C., Charnetski, M., Decker, S., Molloy, M. A., Persico, L., McMahon, E., McDermott, D., & Hallmark, B. (2021). Onward and Upward: Introducing the Healthcare Simulation Standards of Best PracticeTM. *Clinical Simulation in Nursing*, *58*, 1-4. https://doi.org/10.1016/j.ecns.2021.08.006

Weaver, K., & Olson, J. K. (2006). Understanding paradigms used for nursing research. *Journal of Advanced Nursing*, *53*(4), 459-469. https://doi.org/10.1111/j.1365-2648.2006.03740.x

Wong, J. Y. H., Chan, M. M. K., Tsang, V. W. Y., Pang, M. T. H., Chan, C. K. Y., Chau, P. H., & Tiwari, A. (2021). Rubric-based debriefing to enhance nursing students' critical thinking via simulation. *BMJ Simulation and Technology Enhanced Learning*, *7*(1).

Wu, H., & Leung, S.-O. (2017). Can Likert Scales be Treated as Interval Scales?-A Simulation Study. *Journal of social service research*, *43*(4), 527-532. https://doi.org/10.1080/01488376.2017.1329775

Ziegler, E., Luctkar-Flude, M., Carroll, B., Tyerman, J., Chumbley, L., & Shortall, C. (2021). Development of an online educational toolkit for sexual orientation and gender identity minority nursing care. *Revista Latino-Americana de Enfermagem*, *29*. https://doi.org/10.1590/1518-8345.4712.3470

Appendix A

Comprehensive Systematic Review Training Program Certificate

JBI

CERTIFICATE

OF ATTENDANCE

This is to certify that

Ashley
Jackson

attended
Comprehensive Systematic Review Training Program

Module 1:	Introduction to Evidence-Based Healthcare and the Systematic Review of Evidence
Module 2:	Conducting Systematic Reviews of Quantitative Evidence
Module 3:	Conducting Systematic Reviews of Qualitative Evidence and Text and Opinion

Remote attendance
Canada
between
23 April 2021 – 30 April 2021

[redacted]

Appendix B

JBI Title Registration

JOANNA BRIGGS INSTITUTE

JBI Systematic Review Title Registration Form

Once completed, please email to: {removed for privacy}

Title: Facilitating a Psychologically Safer Climate in Simulation-Based Education with Healthcare Learners

Centre: Queen's Collaboration for Health Care Quality: A JBI Centre of Excellence

Primary Reviewer

Name: Ashley Jackson

Email address: {removed for privacy}

Question: What interventions are effective for establishing and maintaining psychological safety within the three phases of simulation with healthcare learners?

PICO

Population: health care learners

In this systematic review, we will consider studies that include all healthcare learners. . A learner, in this case, will consist of students and/or licensed practicing healthcare professionals. Since all healthcare professionals are required to have a commitment to lifelong learning. Therefore, all healthcare professionals are considered learners. It is well known that healthcare is multidisciplinary. The operational definition of a "Healthcare Professional" will be as defined by the Ontario Ministry of Health and Long-Term Care (OMHLTC). The OMHLTC has 26 regulated health professions, which include: audiology and speech-language pathology, chiropody and podiatry, chiropractic, dental hygiene, dental technology, dentistry, denturism, dietetics, homeopathy, kinesiology, massage therapy, medical laboratory technology, medical radiation technology, medicine, midwifery, naturopathy, nursing, occupational therapy, opticianry, optometry, pharmacy, physiotherapy, psychology, psychotherapy, respiratory therapy, traditional Chinese medicine, and acupuncture.

Intervention: (quantitative - effectiveness)

In this systematic review, we will consider any intervention aimed at improving psychological safety or its related components including "speaking- up" / "speaking- out", learning oriented behaviours, risk taking in simulation-based learning environments. Some of the interventions may include but are not limited to establishing a fiction contract, orientation to the simulation

environment, unconditional positive regard, pre-briefing, debriefing, mindfulness, formalized education or cognitive aids.

Comparator: (quantitative – effectiveness)

In this systematic review, we will compare the interventions to alternative interventions or no interventions. Further, this review considers studies that compare the intervention in any SBL environments, including but not limited to in-person simulation, virtual simulation, virtual simulation gaming, escape rooms or VR. Lastly, this review will include studies that compare the intervention to any level of fidelity, including but not limited to low, medium, high, and mixed.

Outcome: quantitative

In this systematic review, we will consider studies that include but are not limited to the following outcomes: psychological safety at any level (individual, team and organizational), learning outcomes, knowledge, learning engagement, learning-oriented behaviours, team cohesiveness, self-confidence, anxiety, skill performance or any other empirically tested reported outcome. However, all author-reported outcomes are included.

Appendix C

TCPS2 Certificate

PANEL ON RESEARCH ETHICS

TCPS 2: CORE

Certificate of Completion

This document certifies that

Ashley Jackson

has completed the Tri-Council Policy Statement:
Ethical Conduct for Research Involving Humans
Course on Research Ethics (TCPS 2: CORE)

Date of Issue: **21 November, 2020**

Appendix D

JBI Systematic Review of Effectiveness Standard Template

Add Title Here

Authors

First author name[1] Second author name[2] Third author name[3] Fourth author name[4] Fifth author name[5] Sixth author name[6]

1. Affiliation
2. Affiliation
3. Affiliation
4. Affiliation
5. Affiliation
6. Affiliation

Abstract

(Maximum - 250 words for Protocols/500 words for Reviews)

Objective: State an overarching review objective structured using the key components of the inclusion criteria (approximately one or two sentences). e.g. The objective of this review was to evaluate the effectiveness of intervention versus comparator on outcome(s) in population

Introduction: Briefly describe the rationale for the review in light of what is already known on the topic (approximately two to three sentences).

Inclusion criteria: Summarize the inclusion criteria and highlight any relevant exclusions in paragraph format. Present the information in one to three sentences – NOT under individual subheadings.

Methods: List the information sources searched (those from which the majority of studies were located), the date (month/year) the search was conducted and any search limits (e.g. language). Briefly describe the approach to study selection, critical appraisal (without naming the actual tool), data extraction (without naming the actual tool), data synthesis and assessing certainty of the evidence. Briefly describe any notable deviations to the methodological approach taken.

Systematic review registration number (For Protocols ONLY): Report the registration number provided following registration of the protocol in PROSPERO.

Results (For Reviews ONLY): The bulk of the abstract should be reserved to convey the main results of the review. Report the number and type of included studies (e.g. 13 RCTs) and sample size, as well as any pertinent study characteristics. Summarize the overall quality of the included studies and notable risk of bias. Report the results for all main outcomes (including the certainty of evidence), ensuring data and statistics are presented, where relevant. Describe the direction of the effect (e.g. lower, fewer, greater, more, etc.) in a way that is understandable to patients and health care

professionals (i.e. which group was favored and the size of the effect) and indicate the measurement scale used, where applicable.

Conclusions (For Reviews ONLY): Provide a conclusion based on a general interpretation of the review findings, considering the methodological quality and heterogeneity of the included studies, and any limitations of the review. Briefly convey key recommendations for practice or policy and research.

Introduction

Describe the rationale for the review in light of what is already known on the topic, including information that supports and justifies the selection of inclusion criteria. Key terms should be defined and operational definitions listed. Some indication that there is evidence available that will meet your inclusion criteria should be provided. (Approximately 1000 words) Note: The introduction must NOT be a verbatim reproduction of the introduction in the corresponding protocol.

Subheading (if required)

Edit set text as appropriate:

A preliminary search of PROSPERO, MEDLINE, the Cochrane Database of Systematic Reviews and the *JBI Evidence Synthesis* was conducted and no current or underway systematic reviews on the topic were identified.

If there are any existing systematic reviews, it should be specified how the proposed review will differ.

Conclude with an overarching review objective that captures and aligns with the core elements/mnemonic of the inclusion criteria.

Review question(s)

The question/s of this review is: what is the effectiveness of state intervention versus state comparator on state outcome in state participant?

Add additional review sub-questions if they expand on the information presented above, or provide further detail on specific elements of the review, such as the specific outcomes being investigated or other aims for your review.

Keywords

Guidance for authors: List a maximum of five keywords in alphabetical order, separated by a semi-colon and a space. Ideally these words should be different to those that appear in the title and abstract. These are for the purposes of meta-data and indexing, and not related to the search strategy. Keywords are not part of the abstract.

Inclusion criteria

Participants

Guidance for authors: Describe/define participants that will be included. Specific exclusion criteria based on any participant characteristics should also be stated.

Intervention(s)

This review will consider studies that will evaluate

describe/define the interventions(s)

Intervention characteristics should be described in detail, particularly if they are multi-faceted. Relevant intervention details such as dosage/intensity, mode of delivery, frequency/duration/timing of delivery, should be considered. Provide examples where applicable.

Comparator(s)

This review will consider studies that compare the intervention to

describe/define the comparator(s)

State whether the comparator (ie, control group) is passive (placebo, no treatment, standard care, or a waiting list control) or active (variation of the intervention, alternate intervention). Provide examples where applicable.

Outcomes

This review will consider studies that include the following outcomes: define/describe the outcomes and how they will be measured and minimum duration of follow-up. *Specify whether all results that are compatible with each outcome in each study will be sought (e.g, for all measures, time points,*

analyses), and if not, the methods used to decide which results to collect.

Types of studies

Edit set text as appropriate:

This review will consider both experimental and quasi-experimental study designs including randomized controlled trials, non-randomized controlled trials, before and after studies and interrupted time-series studies. In addition, analytical observational studies including prospective and retrospective cohort studies, case-control studies and analytical cross-sectional studies will be considered for inclusion. This review will also consider descriptive observational study designs including case series, individual case reports and descriptive cross-sectional studies for inclusion.

Methods

The proposed systematic review will be conducted in accordance with the JBI methodology for systematic reviews of effectiveness evidence. insert a citation to the JBI Manual for Evidence Synthesis or the relevant chapter and add this to the reference list **Note**: if the review title has been registered, report the name of the registry (e.g. PROSPERO) and the registration number.

FOR REVIEWS: This review was conducted in accordance with an *a priori* protocol insert citation to the published or in press protocol and add it to the reference list . Any deviations from the protocol should be reported and justified in the appropriate section of the methods.

Search strategy

Edit set text as appropriate:

The search strategy will aim to locate both published and unpublished studies. A three-step search strategy will be utilized in this review. First an initial limited search of MEDLINE (PubMed) and CINAHL (EBSCO) change as appropriate was undertaken to identify articles on the topic. The text words contained in the titles and abstracts of relevant articles, and the index terms used to describe the articles were used to develop a full search strategy for report the name of the relevant databases/information sources *(see Appendix #*). The search strategy, including all identified keywords and index terms, will be adapted for each included database and/or information source. The reference list of all included sources of evidence will be screened for additional studies. *Specify the types of references examined (eg, references of studies included in the systematic review, or references of systematic reviews on the same or similar topic. Modify if other processes are to be used, eg, Report details of any tools to identify keywords or index terms, any filters, any validation processes, whether search strategy will be peer reviewed.]*

Studies published in any language change as appropriate will be included. Studies published since insert date will be included as

justify date range and any language limitations

List all information sources (eg, electronic databases, conference proceedings, websites, search engines or other online sources, contact with study authors etc. The databases to be searched include insert databases with platforms as appropriate. Sources of unpublished studies and gray literature to be searched include insert text.

Study selection

Edit set text as appropriate:

Following the search, all identified citations will be collated and uploaded into (insert the name of the bibliographic software or citation management system e.g. EndNote insert version /year (Clarivate Analytics, PA, USA) and duplicates removed. Following a pilot test, titles and abstracts will then be screened by two or more independent reviewers for assessment against the inclusion criteria for the review. Potentially relevant studies will be retrieved in full and their citation details imported into the JBI System for the Unified Management, Assessment and Review of Information (JBI SUMARI) (JBI, Adelaide, Australia). insert citation to JBI SUMARI paper (https://bit.ly/2SKmPah) and include in the reference list The full text of selected citations will be assessed in detail against the inclusion criteria by two or more independent reviewers. Reasons for exclusion of papers at full text that do not meet the inclusion criteria will be recorded and reported in the systematic review. Any disagreements that arise between the reviewers at each stage of the selection process will be resolved through discussion, or with an additional reviewer/s. The results of the search and the study inclusion process will be reported in full in the final systematic review and presented in a Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow diagram (insert citation to PRISMA statement and include in the reference list).

Assessment of methodological quality

Edit set text as appropriate:

Eligible studies will be critically appraised by two independent reviewers at the study level modify as appropriate if appraisal will occur at the outcome level for methodological quality in the review using standardized critical appraisal instruments from JBI for experimental, quasi-experimental and observational studies modify as appropriate if additional study designs will be included and cite the tools to be used *If a tool is to be modified, append the tool and refer to the appendix in the text. Briefly describe the domains/items of the tools to be used. If automation tools are to be used in the assessment of methodological quality process report details.* Authors of papers will be contacted to request missing or additional data for clarification, where required. Any disagreements that arise will be resolved through discussion, or with a third reviewer. The results of critical appraisal will be reported in narrative form and in a table.

Indicate what constituted acceptable levels of information for a study to receive a positive, negative or unclear response to a critical appraisal question. Choose from one of the following two options:

All studies, regardless of the results of their methodological quality, will undergo data extraction and synthesis (where possible).

Indicate how the results of the critical appraisal will be incorporated into the review.

Following critical appraisal, studies that do not meet a certain quality threshold will be excluded. This decision will be based on

list decision rules

Data extraction

Edit set text as appropriate:

Data will be extracted from studies included in the review by two independent reviewers using the standardized JBI data extraction tool. modify if other processes will be used for your review, e.g, automation tools and/or software that may be used for translation, data extraction from figures etc cite the tool to be used or append the data extraction tool if an existing tool has been modified or a new tool developed any modifications to existing tools should be described in the text

The data extracted will include specific details about the participants, study methods, interventions, and outcomes of significance to the review objective indicate the specific detailsReport any strategies that were used to minimize errors during data extraction. Any disagreements that arose between the reviewers were resolved through discussion or with a third reviewer. Authors of papers were contacted to request missing or additional data, where required.

Describe any assumptions made about any missing or unclear information.

Data synthesis

Edit set text as appropriate:

Studies will, where possible be pooled in statistical meta-analysis using JBI SUMARI *or details of other software to be used*. Effect sizes will be expressed as either odds ratios (for dichotomous data) and weighted (or standardized) final post-intervention mean differences (for continuous data) and their 95% confidence intervals will be calculated for analysis. modify as appropriate and report any methods required to prepare the data collected from studies for presentation or synthesis, such as handling of missing summary statistics, or data conversionStatistical analyses will be performed using insert model (random or fixed effectsinclude citation to the Tufanaru et al study available here http://bit.ly/2fd9gSv) and add it to the reference list or modify the text as appropriate#, and #specify the statistical method to be used in the analysis, eg, Mantel-Haenszel, inverse-variance. Subgroup analyses will be conducted where there is sufficient data to investigateadd text as appropriate including details of which factors are to be explored. Sensitivity analyses will be conducted to test decisions made regarding add text as appropriateHeterogeneity will be assessed statistically using the standard chi-squared and I squared tests or details of other methods for example, visual inspection, subgroup analyses

A funnel plot will be generated state software to use to assess publication bias if there are 10 or more studies included in a meta-analysis. Statistical tests for funnel plot asymmetry (Egger test, Begg test, Harbord test) will be performed where appropriate.

Where meta-analysis is not possible, describe the synthesis methods or summary approach to be used including any decision rules applied e.g., as the transparent basis for vote countingthe findings will be presented in narrative form including tables and figures to aid in data presentation, where appropriate.

Assessing certainty in the findings

The Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach for grading the certainty of evidence will be followed insert appropriate citation and a Summary of Findings (SoF) will be created using GRADEpro GDT #insert version /year#(McMaster University, ON, Canada). This will be undertaken by two independent reviewers at the outcome level. Any disagreements that arise between the reviewers will be resolved through discussion or with a third reviewer. Authors of papers were contacted to request missing or additional data for clarification, where required.

Modify if other processes were used for your review, eg, automation tools.

The SoF will present the following information where appropriate: absolute risks for the treatment and control, estimates of relative risk, and a ranking of the quality of the evidence based on the risk of bias, directness, heterogeneity, precision and risk of publication bias of the review results. The outcomes reported in the SoF will be:

#insert text as appropriate – list up to seven outcomes for inclusion#

Acknowledgements

Insert the full names and precise contributions of individuals, or institutions, who have not already been listed as co-authors. Specify if this review is to contribute towards a degree award and for which author (initials). For further guidance, please refer to the *JBI Evidence Synthesis* manuscript style and preparation guidelines.

Funding

Guidance for authors: Provide details on sources of funding for the review and explicitly describe the role of funders in the review process. For further guidance, please refer to the *JBI Evidence Synthesis* manuscript style and preparation guidelines.

Declarations

Authors are invited to consider equity, diversity, and inclusion to acknowledge authors who work to improve diversity and inclusion in research and to encourage them going forward. Authors may also choose to highlight their experience related to their topic to further position them within the field (eg, an Indigenous author writing about issues directly related to Indigenous populations).

Author contributions

Detail each author's specific involvement in a manuscript, such as designing the analysis, contributing or collecting the data, performing the analysis or writing the manuscript, to increase the transparency of contributions.

Conflicts of interest

Guidance for authors: Include a statement that describes a potential conflict of interest or any personal, financial, professional, or intellectual bias for any of the authors listed on the manuscript. If no conflict exists, include the following statement: There is no conflict of interest in this project. For further guidance, please refer to the *JBI Evidence Synthesis* manuscript style and preparation guidelines.

References

Appendices

Appendix I: Search strategy

For protocols - present a full search strategy for at least one electronic database including planned limits, such that it can be reviewed and repeated. For systematic reviews all search strategies should be presented.

The search strategy should detail the following information: the name of the information source and the platform/service provider used to search the particular database, eg, CINAHL (via Ovid); all the search terms to be used (both keywords/text words and index terms should be included) and how they are to be combined using Boolean logic; the use of truncation and wildcards; all planned limits (date, language, etc.); and the number of records retrieved by the search.

Insert name of database (insert name of the platform/service provider), e.g. MEDLINE (Ovid)

Search conducted on

month/year

Appendix II: Data extraction instrument

#Only append the JBI or non-JBI data extraction instrument if the standardized tool has been modified in any way, otherwise simply cite the tool used in the text. Any modifications made to the instrument should also be described in the text.#

Appendix E

Initial Medline (OVID) Search Terms

Concept #1: Healthcare Learner

1. Nursing Students/ or Education, Nursing/ or Physicians/ or Medical Students/ or Medical Residency/ or exp Medical Internship/ or Medical Education/ or Nurses/

2. [a](acupuncturist* or allergists or anesthetist* or audiologist* or Cardiolog* or chiropractor* or dental hygienist* or dent* or dermatologist* or Dermatolog* or dietician* or doctor* or endocrinologist* or gastroenterologist* or general practitioner* or geriatrician* or gynecologist* or haematologist* or medic* or hospitalist* or internist* or medical resident* or medical student* or midwife* or midwive* or neonatologist* or nephrologist* or neurolog* or neurosurgeon* or nurs* or nutrition* or nursing student* or Naturopath* or obstetrician* or obstetric* or Oncolog* or ophthalmologist* or optometrist* or otolaryngologist* or orthop* or orthodont* or podiat* or pathologist* or Patholog* or pediatrician* or occupational therap* or physiotherap* or physical therap* or pharmacolog* or phlebotomist* or physician* or podiatrist* or psycholog* or psychiatrist* or pulmonologist* or radiographer or radiologist* or radiolog* or radiotherapist* or Rheumatolog* or rheumatologist* or resp* therapy or social worker* or sonographer* or surg* or surgeon* or therapist* or urologist* or urolog* or Chinese medicine).ti,ab.

3. ((health or health care or healthcare) adj1 (worker* or practitioner* or provider or professional or navigator* or student* or graduate* or undergraduate* or staff or personnel or clerk* or fellow* or internship* or residen* or educat* or train* or novice* or tutor*)).ti,ab.

Concept #2 Simulation

4. Simulation Training/ or High Fidelity Simulation Training/ or Virtual Reality/ or Video Games/

5. (Sim* adj2 (train* or patient* or standardized or learn* or voice* or scenario* or virtual or computer* or prepar* or game*)).ti,ab.

6. (Virtual adj2 (reality* or world* or paradigm* or sim* or game* or patient*)).ti,ab.

7. (manikin* or mannequin or psychomotor skill* or gamification or videogam*).ti,ab.

8. (Fidelity adj2 (high or low or medium or mixed)).ti,ab.

9. (serious adj1 game*).ti,ab.

10. ((prebrief* or brief*) adj2 (synchronous or asynchronous))x.ti,ab.

Concept #3: Psychological Safety

Interpersonal Relations/ or Group Processes/ or stress, psychological/

((Psychologic* or academic*) adj2 safe*).ti,ab.

(Safe* adj1 contain*).ti, ab.

(fiction adj2 contract*).ti, ab.

("speak*out" or "speak* up").ti,ab.

[a]This search box is a modified version of:
Campbell, SM. Filter to Retrieve Studies Related to Health Professionals and Students from the OVID Medline Database. John W. Scott Health Sciences Library, University of Alberta.
https://docs.google.com/document/d/1nHCQviZnTId3uD9Lnv8nTtU231Nioc5eg7wsXGYH_h4/edit

Appendix F

PRESS: Search Submission & Peer Review Assessment

Appendix A

***PRESS Guideline* — Search Submission & Peer Review Assessment**

SEARCH SUBMISSION: THIS SECTION TO BE FILLED IN BY THE SEARCHER

Searcher: Ashley Jackson & Dr. Jane Tyerman	Email: {Removed for Privacy}
Date submitted: December 15th 2021	Date requested by: Jan 15th 2022 *[Maximum = 5 working days]*

Systematic Review Title:

Cultivating Psychological Safety in Simulation Based Learning with Healthcare Learners

This search strategy is …

X	My PRIMARY (core) database strategy — First time submitting a strategy for search question and database
	My PRIMARY (core) strategy — Follow-up review NOT the first time submitting a strategy for search question and database. If this is a response to peer review, itemize the changes made to the review suggestions
	SECONDARY search strategy— First time submitting a strategy for search question and database
	SECONDARY search strategy — NOT the first time submitting a strategy for search question and database. If this is a response to peer review, itemize the changes made to the review suggestions

Database

(i.e., MEDLINE,CINAHL…): *[mandatory]*

Medline

Interface

(i.e., Ovid, EBSCO…): *[mandatory]*

OVID

Research Question

(Describe the purpose of the search) *[mandatory]*

1. What interventions are effective for establishing psychological safety within the three phases of simulation with healthcare learners?
    a. How is psychological safety being measured?
    b. What are the outcomes of psychological safety in SBL?

PICO Format

(Outline the PICOs for your question — i.e., Patient, Intervention, Comparison, Outcome, and Study Design — as applicable)

P	The population will include any healthcare learners. A learner, in this case, will consist of students and/or licensed practicing healthcare professionals. Healthcare professionals are required to have a commitment to lifelong learning. Therefore, all healthcare professionals are considered learners. It is well known that healthcare is multidisciplinary. The operational definition of a "Healthcare Professional" will be as defined by the Ontario Ministry of Health and Long-Term Care (OMHLTC). The OMHLTC has 26 regulated health professions, which include: audiology and speech-language pathology, chiropody and podiatry, chiropractic, dental hygiene, dental technology, dentistry, denturism, dietetics, homeopathy, kinesiology, massage therapy, medical laboratory technology, medical radiation technology, medicine, midwifery, naturopathy, nursing, occupational therapy, opticianry, optometry, pharmacy, physiotherapy, psychology, psychotherapy, respiratory therapy, traditional Chinese medicine, and acupuncture.
I	This review will consider any intervention aimed at improving psychological safety or its related components including "speaking- up" / "speaking- out", learning oriented behaviours, risk taking in SBL environments. Some of the interventions may include but are not limited to establishing a fiction contract, orientation to the simulation environment, unconditional positive regard, pre-briefing, debriefing or mindfulness.
C	This review will consider studies that compare the interventions to alternative interventions or no interventions. Further, this review will consider studies that compare the intervention in any SBL environments, including but not limited to in-person simulation, virtual simulation, virtual simulation gaming, escape rooms or virtual reality. Lastly, this review will include studies that compare the intervention to any level of fidelity, including but not limited to low, medium, high, and mixed.
O	This review will consider studies that include but are not limited to the following outcomes: psychological safety at any level (individual, team and organizational), learning outcomes, knowledge, learning engagement, learning-oriented behaviours, team cohesiveness, self-confidence, anxiety, skill performance or any other empirically tested reported outcome. However, all author-reported outcomes will be included.
S	This review will consider all quantitative studies. This may be demonstrated within both experimental and quasi-experimental study designs, including randomized controlled trials, non-randomized controlled trials, before and after studies, pre-test/post-test studies, interrupted time-series studies. In addition, analytical observational studies including prospective and retrospective cohort studies, case-control studies and analytical cross-sectional studies will be considered for inclusion. This review will also consider descriptive observational study designs, including case series, individual case reports and descriptive cross-sectional studies for inclusion.

Inclusion Criteria

(List criteria such as age groups, study designs, etc., to be included) *[optional]*

- All languages
- All ages
- Both students and practicing healthcare learners
- Published articles

Exclusion Criteria

(List criteria such as study designs, date limits, etc., to be excluded) *[optional]*

- Date range: 2011-Current
- Literature reviews, qualitative studies, conference proceedings, study protocols, theoretical articles, commentaries, editorials, letters to the editor, Concept Analysis, thesis documents,

☐ Grey literature

Was a search filter applied?

No ■

If YES, which one(s) (e.g., Cochrane RCT filter, PubMed Clinical Queries filter)? Provide the source if this is a published filter. *[mandatory if YES to previous question — textbox]*

No filter applied

Other notes or comments you feel would be useful for the peer reviewer? ***[optional]***

Please copy and paste your search strategy here, exactly as run, including the number of hits per line. ***[mandatory] See attached document.***

(Add more space, as necessary.)

PEER REVIEW ASSESSMENT: THIS SECTION TO BE FILLED IN BY THE REVIEWER

Reviewer: Lindsey Sikora	Email: {Removed for Privacy}	Date completed: January 18, 2022

1. TRANSLATION

A ---No revisions	☒
B --- Revision(s) suggested	☐
C --- Revision(s) required	☐

If "B" or "C," please provide an explanation or example:

2. BOOLEAN AND PROXIMITY OPERATORS

A ---No revisions	☐
B --- Revision(s) suggested	☐
C --- Revision(s) required	☒

If "B" or "C," please provide an explanation or example:

Line 3:
((health or health care or healthcare) adj1 (worker* or practitioner* or provider or professional or navigator* or student* or graduate* or undergraduate* or staff or personnel or clerk* or fellow* or internship* or residen* or educat* or train* or novice* or tutor*)).ti,ab.

I would suggest changing to:
((health or health care or healthcare) adj1 (worker* or practitioner* or provider* or professional* or personnel)).ti,ab.
((health or health care or healthcare) adj2 (navigator* or student* or graduate* or undergraduate* or staff or clerk* or fellow* or intern* or residen* or educat* or train* or novice* or tutor*)).ti,ab.

3. SUBJECT HEADINGS

A ---No revisions	☐
B --- Revision(s) suggested	☐
C --- Revision(s) required	☒

If "B" or "C," please provide an explanation or example:

As you have decided to do all registered healthcare personnel, you need to include the MeSH for these workers as well:

Health Personnel/
exp Physicians/
exp Anesthetists/
Audiologists/
exp Dentists/
exp Dental Auxiliaries/
exp Nurses/
Nutritionists/
Optometrists/
Pharmacists/
Physical Therapists/
Psychotherapists/
Occupational Therapists/
Acupuncture/
Chiropractic/
Hospitalists/
Social Workers/

For your concept on Simulation, I would strong suggest the following MeSH:

Gamification/

4. TEXT WORD SEARCHING

A ---No revisions	☐
B --- Revision(s)suggested	☐
C --- Revision(s) required	☐

If "B" or "C," please provide an explanation or example:

Line 3:
((health or health care or healthcare) adj1 (worker* or practitioner* or provider or professional or navigator* or student* or graduate* or undergraduate* or staff or personnel or clerk* or fellow* or internship* or residen* or educat* or train* or novice* or tutor*)).ti,ab.

I would suggest changing to:
((health or health care or healthcare) adj1 (worker* or practitioner* or provider* or professional* or personnel)).ti,ab.
((health or health care or healthcare) adj2 (navigator* or student* or graduate* or undergraduate* or staff or clerk* or fellow* or intern* or residen* or educat* or train* or novice* or tutor*)).ti,ab.

Line 8
(manikin* or mannequin* or psychomotor skill* or gamif* or videogam* or video gam*).ti,ab.

Line 17:
("speak* out" or "speak* up").ti,ab.

5. SPELLING, SYNTAX, AND LINE NUMBERS

A ---No revisions	☐
B --- Revision(s)suggested	☐
C --- Revision(s) required	☐

If "B" or "C," please provide an explanation or example:

Line 2: add paediatrician*

6. LIMITS AND FILTERS

A ---No revisions	☐
B --- Revision(s) suggested	☐
C --- Revision(s) required	☐

If "B" or "C," please provide an explanation or example:

OVERALL EVALUATION (Note: If one or more "revision required" is noted above, the response below must be "revisions required".)

A ---No revisions	☐
B --- Revision(s) suggested	☐
C --- Revision(s) required	☐

Additional comments:

Appendix G

Medline Initial Search, November 16th, 2021

Ovid: Search Form

Medline 2021-11-16, 8:54 PM

Ovid® Wolters Kluwer

My Account | Support & Training | Help | Feedback | Logged in as Ashley Jackson | Logoff

Ask a Question

Search | Journals | Books | My Workspace | Visible Body | EBP Tools | Multimedia | What's New

▼ **Search History** (20) View Saved

# ▼	Searches	Results	Type	Actions	Annotations
20	limit 19 to yr="2011 -Current"	0f	Advanced	Display Results | More	
19	4 and 12 and 18	733	Advanced	Display Results | More	
18	13 or 14 or 15 or 16 or 17	213679	Advanced	Display Results | More	
17	("speak*out" or "speak* up").ti,ab.	904	Advanced	Display Results | More	
16	(fiction adj2 contract*).ti,ab.	2	Advanced	Display Results | More	
15	(Safe* adj1 contain*).ti,ab.	163	Advanced	Display Results | More	
14	((Psychologic* or academic*) adj2 safe*).ti,ab.	793	Advanced	Display Results | More	
13	Interpersonal Relations/ or Group Processes/ or stress, psychological/	211963	Advanced	Display Results | More	
12	5 or 6 or 7 or 8 or 9 or 10 or 11	153861	Advanced	Display Results | More	
11	((prebrief* or brief*) adj2 (synchr onous or asynchr onous)).ti,ab.	28	Advanced	Display Results | More	
10	(serious adj1 game*).ti,ab.	807	Advanced	Display Results | More	
9	(Fidelity adj2 (high or low or medium or mixed)).ti,ab.	11679	Advanced	Display Results | More	
8	(manikin* or mannequin or psychomotor skill* or gamification or videogam*).ti,ab.	7452	Advanced	Display Results | More	
7	(Virtual adj2 (reality* or world* or paradigm* or sim* or game* or patient*)).ti,ab.	16049	Advanced	Display Results | More	
6	(Sim* adj2 (train* or patient* or standar dized or learn* or voice* or scenario* or virtual or computer* or pr epar* or game*)).ti,ab.	116834	Advanced	Display Results | More	
5	Simulation Training/ or High Fidelity Simulation Training/ or Virtual Reality/ or Video Games/	14979	Advanced	Display Results | More	
4	1 or 2 or 3	7206630	Advanced	Display Results | More	
3	((health or health car e or healthcare) adj1 (worker* or practitioner* or pr ovider or professional or navigator* or student* or graduate* or under graduate* or staff or personnel or clerk* or fellow* or inter nship* or resident* or educat* or train* or novice* or tutor*)).ti,ab.	120363	Advanced	Display Results | More	
2	(acupuncturist* or aller gists or anesthetist* or audiologist* or Car diolog* or chiropractor* or dental hygienist* or dent* or dermatologist* or Dermatolog* or dietician* or doctor* or endocrinologist* or gastr oenterologist* or general practitioner* or geriatrician* or gynecologist* or haematologist* or medic* or hospitalist* or inter nist* or medical resident* or medical student* or midwife* or midwive* or neonatologist* or nephr ologist* or neurolog* or neurosurgeon* or nurs* or nutrition* or nursing student* or Natur opath* or obstetrician* or obstetric* or Oncolog* or ophthalmologist* or optometrist* or otolaryngologist* or orthop* or orthodont* or podiat* or pathologist* or Patholog* or pediatrician* or occupational therap* or physiotherap* or physical therap* or pharmacolog* or phlebotomist* or physician* or podiatrist* or psycholog* or psychiatrist* or pulmonologist* or radiographer or radiologist* or radiolog* or radiotherapist* or Rheumatolog* or rheumatologist* or r esp* therapy or social worker* or sonographer* or sur g* or surgeon* or therapist* or ur ologist* or urolog* or Chinese medicine).ti,ab.	7065161	Advanced	Display Results | More	
1	Nursing Students/ or Education, Nursing/ or Physicians/ or Medical Students/ or Medical Residency/ or Medical Inter nship/ or Medical Education/ or Nurses/	315639	Advanced	Display Results | More	

Contract

Combine with:

Save All | Edit | Create RSS | Create Auto-Alert | View Saved | Email All Search History | Copy Search History Link | Copy Search History Details

Appendix H

Medline Final Search, May 10th, 2022

Ovid® Wolters Kluwer

My Account | Support & Training | Help | Feedback | Logged in as Ashley Jackson | Logoff

Ask a Question

Search | Journals | Books | My Workspace | Visible Body | EBP Tools | Multimedia | What's New

▼ Search History (21) View Saved

# ▼	Searches	Results	Type	Actions	Annotations
21	limit 20 to yr="2011 -Current"		Advanced	Display Results | More	
20	5 and 13 and 19	802	Advanced	Display Results | More	
19	14 or 15 or 16 or 17 or 18	217975	Advanced	Display Results | More	
18	("speak* out" or "speak* up").ti,ab.	1992	Advanced	Display Results | More	
17	(fiction adj2 contract*).ti,ab.	2	Advanced	Display Results | More	
16	(Safe* adj1 contain*).ti,ab.	171	Advanced	Display Results | More	
15	((Psychologic* or academic*) adj2 safe*).ti,ab.	904	Advanced	Display Results | More	
14	Interpersonal Relations/ or Group Processes/ or stress, psychological/	215100	Advanced	Display Results | More	
13	6 or 7 or 8 or 9 or 10 or 11 or 12	162591	Advanced	Display Results | More	
12	((prebrief* or brief*) adj2 (synchronous or asynchronous)).ti,ab.	29	Advanced	Display Results | More	
11	(serious adj1 game*).ti,ab.	908	Advanced	Display Results | More	
10	(Fidelity adj2 (high or low or medium or mixed)).ti,ab.	12362	Advanced	Display Results | More	
9	(manikin* or mannequin* or psychomotor skill* or gamif* or videogam* or video gam*).ti,ab.	12492	Advanced	Display Results | More	
8	(Virtual adj2 (reality* or world* or paradigm* or sim* or game* or patient*)).ti,ab.	17428	Advanced	Display Results | More	
7	(Sim* adj2 (train* or patient* or standardized or learn* or voice* or scenario* or virtual or computer* or prepar* or game*)).ti,ab.	120892	Advanced	Display Results | More	
6	Simulation Training/ or High Fidelity Simulation Training/ or Virtual Reality/ or Video Games/ or Gamification.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	17186	Advanced	Display Results | More	
5	1 or 2 or 3 or 4	7545884	Advanced	Display Results | More	
4	((health or healthcare or healthcare) adj2 (navigator* or student* or graduate* or undergraduate* or staff or clerk* or fellow* or intern* or resident* or educat* or train* or novice* or tutor*)).ti,ab.	101013	Advanced	Display Results | More	
3	((health or healthcare or healthcare) adj1 (worker* or practitioner* or provider* or professional* or personnel)).ti,ab.	178110	Advanced	Display Results | More	
2	(acupuncturist* or allergists or anesthetist* or audiologist* or Chiropractic* or chiropractor* or dental hygienist* or dent* or dermatologist* or Dermatolog* or dietician* or doctor* or endocrinologist* or gastroenterologist* or general practitioner* or geriatrician* or gynecologist* or haematologist* or medic* or hospitalist* or internist* or medical resident* or medical student* or midwife* or midwive* or neonatologist* or nephrologist* or neurolog* or neurosurgeon* or nurs* or nutrition* or nursing student* or Naturopath* or obstetrician* or obstetric* or Oncolog* or ophthalmologist* or optometrist* or otolaryngologist* or orthop* or orthodont* or podiat* or pathologist* or Patholog* or pediatrician* or paediatrician* or occupational therap* or physiotherap* or physical therap* or pharmacolog* or phlebotomist* or physician* or podiatrist* or psycholog* or psychiatrist* or pulmonologist* or radiographer or radiologist* or radiolog* or radiotherapist* or Rheumatolog* or rheumatologist* or resp* therapy or social worker* or sonographer* or surg* or surgeon* or therapist* or urologist* or urolog* or Chinese medicine).ti,ab.	7285021	Advanced	Display Results | More	
1	Nursing Students/ or Education, Nursing/ or Physicians/ or Medical Students/ or Medical Residency/ or exp Medical Internship/ or Medical Education/ or Nurses/ or Health Personnel/ or exp Physicians/ or exp Anesthetists/ or Audiologists/ or exp Dentists/ or exp Dental/ or Auxiliaries/ or exp Nurses/ or Nutritionists/ or Optometrists/ or Pharmacists/ or Physical Therapists/ or Psychotherapists/ or Occupational Therapists/ or Acupuncture/ or Chiropractic/ or Hospitalists/ or Social Workers/	532880	Advanced	Display Results | More	

Contract

Combine with:

Save All | Edit | Create RSS | Create Auto-Alert | View Saved

Email All Search History | Copy Search History Link | Copy Search History Details

Appendix I

Inter-rater Reliability Scores

Inter-rater Reliability for Title and Abstract Screening

Reviewer A	Reviewer B	A Yes, B Yes	A Yes, B No	A No, B Yes	A No, B No	Proportionate Agreement	Yes Probability	No Probability	Random Agreement Probability	Cohen's Kappa
Ashley Jackosn	Laura Killam	69	67	99	1023	0.86804	0.01444	0.77278	0.78722	0.37985

Inter-rater Reliability for Full Text Screening

Reviewer A	Reviewer B	A Include, B Include	A Include, B Exclude	A Exclude, B Include	A Exclude, B Exclude	Proportionate Agreement	Yes Probability	No Probability	Random Agreement Probability	Cohen's Kappa
Ashley Jackosn	Laura Killam	6	12	15	68	0.73267	0.03706	0.65092	0.68797	0.14326

Appendix J

JBI Critical Appraisal Tools

JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer_____Date_____

Author_____Year_____ Record Number_____

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☐	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☐	☐	☐	☐
5. Were confounding factors identified?	☐	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
8. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

_____

_____

_____

JBI CRITICAL APPRAISAL CHECKLIST FOR QUASI-EXPERIMENTAL STUDIES

Reviewer_____Date_____

Author_____Year_____ Record Number_____

	Yes	No	Unclear	Not applicable
1. Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)?	☐	☐	☐	☐
2. Were the participants included in any comparisons similar?	☐	☐	☐	☐
3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	☐	☐	☐	☐
4. Was there a control group?	☐	☐	☐	☐
5. Were there multiple measurements of the outcome both pre and post the intervention/exposure?	☐	☐	☐	☐
6. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	☐	☐	☐	☐
7. Were the outcomes of participants included in any comparisons measured in the same way?	☐	☐	☐	☐
8. Were outcomes measured in a reliable way?	☐	☐	☐	☐
9. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

JBI CRITICAL APPRAISAL CHECKLIST FOR RANDOMIZED CONTROLLED TRIALS

Reviewer_____Date_____

Author_____Year_____ Record Number_____

		Yes	No	Unclear	NA
1.	Was true randomization used for assignment of participants to treatment groups?	☐	☐	☐	☐
2.	Was allocation to treatment groups concealed?	☐	☐	☐	☐
3.	Were treatment groups similar at the baseline?	☐	☐	☐	☐
4.	Were participants blind to treatment assignment?	☐	☐	☐	☐
5.	Were those delivering treatment blind to treatment assignment?	☐	☐	☐	☐
6.	Were outcomes assessors blind to treatment assignment?	☐	☐	☐	☐
7.	Were treatment groups treated identically other than the intervention of interest?	☐	☐	☐	☐
8.	Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	☐	☐	☐	☐
9.	Were participants analyzed in the groups to which they were randomized?	☐	☐	☐	☐
10.	Were outcomes measured in the same way for treatment groups?	☐	☐	☐	☐
11.	Were outcomes measured in a reliable way?	☐	☐	☐	☐
12.	Was appropriate statistical analysis used?	☐	☐	☐	☐
13.	Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

_____

_____

_____

Appendix K

Critical Appraisal Results

Table 1: Quasi-Experimental Study

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Robb et al. (2015).	Y	U	Y	Y	N	U	Y	U	Y
Roh et al. (2018).	Y	Y	Y	Y	Y	U	Y	Y	U
Shanks et al. (2020)	Y	Y	Y	Y	N	U	Y	U	U
Kolbe, et al. (2013)	Y	N/A	N/A	N	Y	Y	N/A	Y	U
%	100.0	60.0	60.0	80.0	40.0	40.0	80.0	40.0	20.0

Table 2: Randomized Controlled Trial

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
Friedman et al. (2017)	U	U	Y	U	N	Y	U	U	Y	Y	Y	Y	Y
Guris et al. (2019).	U	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	Y	Y
Oner et al. (2018)	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
%	0.0	66.66	100.0	66.66	66.66	100.0	66.66	33.33	100.0	100.0	100.0	100.0	100.0

Table 3: Analytical Cross-Sectional Study

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Henricksen, et al. (2017)	Y	U	Y	Y	Y	U	Y	Y
%	100.0	00.0	100.0	100.0	100.0	00.0	100.0	100.0

Appendix L

Excluded Full Text Rationale

Number	Citation	Exclusion Reason
1	Daniels, A. L. (2018). *Clinical Simulation in Pre-licensure Nursing Students: Improving Learning Outcomes in Psychologically Safe Learning Environments* (Doctoral dissertation, University of Maryland, Baltimore).	Psychological safety was not addressed
2	Guris, R. J. D., Miller, C. R., Schiavi, A., & Toy, S. (2021). Examining novice anaesthesia trainee simulation performance: a tale of two clusters. *BMJ simulation & technology enhanced learning*, *7*(6), 548.	Psychological safety was not addressed
3	Stevens, L. M., Cooper, J. B., Raemer, D. B., Schneider, R. C., Frankel, A. S., Berry, W. R., & Agnihotri, A. K. (2012). Educational program in crisis management for cardiac surgery teams including high realism simulation. *The Journal of thoracic and cardiovascular surgery*, *144*(1), 17-24.	Psychological safety was not addressed
4	Goodwin, C. D., Velasquez, E., Ross, J., Kueffer, A. M., Molefe, A. C., Modali, L., ... & Hannenberg, A. A. (2021). Development of a Novel and Scalable Simulation-Based Teamwork Training Model Using Within-Group Debriefing of Observed	Psychological safety was not addressed

Number	Citation	Exclusion Reason
	Video Simulation. *The Joint Commission Journal on Quality and Patient Safety, 47*(6), 385-391.	
5	LeVan, J., Gonzaba, G., Solis, S., & Seitz, R. (2019). Utilizing Rapid Cycle Deliberate Practice Simulation to Improve NICU Resuscitation Medication Safety. *Pediatrics, 144*(2_MeetingAbstract), 161-161.	Abstract only
6	Riskin, A., Bamberger, P., Erez, A., Riskin-Guez, K., Riskin, Y., Sela, R., ... & Bamberger, E. (2019). Expressions of gratitude and medical team performance. *Pediatrics, 143*(4).	Psychological safety was not addressed
7	Kim, M. Y., & Park, S. (2018). Associations of stress, self-esteem, and collective efficacy with flow in simulation among nursing students: A descriptive cross-sectional study. *Nurse Education Today, 71*, 193-197.	Psychological safety was not addressed
8	St Pierre, M., Gall, C., Breuer, G., & Schüttler, J. (2017). Does annual simulation training influence the safety climate of a university hospital?: Prospective 5-year investigation using dimensions of the safety attitude questionnaire. *Der Anaesthesist, 66*(12), 910-923.	Psychological safety was not addressed

Number	Citation	Exclusion Reason
9	Fukushima, Y., Yamada, A., Imoto, N., & Iba, T. (2019). Does TeamSTEPPS affect psychological status?. *International Journal of Health Care Quality Assurance*.	Psychological safety was not addressed
10	Reime, M. H., Johnsgaard, T., Kvam, F. I., Aarflot, M., Breivik, M., Engeberg, J. M., & Brattebø, G. (2016). Simulated settings; powerful arenas for learning patient safety practices and facilitating transference to clinical practice. A mixed method study. *Nurse Education in Practice*, *21*, 75-82.	Psychological safety was not addressed
11	McNaughten, B., Junk, C., Diamond, C., Bourke, T., & Thompson, A. (2019). SC36 Teaching new staff to raise concerns using the PACE approach and high fidelity simulation. *BMJ Simulation & Technology Enhanced Learning*, *5*(Suppl 2), A40.	Abstract only
12	Logan, A. A., Rao, M., Cornia, P. B., Hagan, S. L., Newman, T. A., Redinger, J. W., ... & Albert, T. J. (2021). Virtual Interactive Case-Based Education (VICE): A Conference for Deliberate Practice of Diagnostic Reasoning. *MedEdPORTAL*, *17*, 11159.	No simulation
13	Fernandez, R., Pearce, M., Grand, J. A., Rench, T. A., Jones, K. A., Chao, G. T., & Kozlowski, S. W. (2013). Evaluation of a computer-based educational intervention	Psychological safety was not addressed

Number	Citation	Exclusion Reason
	to improve medical teamwork and performance during simulated patient resuscitations. *Critical care medicine*, *41*(11), 2551-2562.	
14	Katakam, L. I., Trickey, A. W., & Thomas, E. J. (2012). Speaking up and sharing information improves trainee neonatal resuscitations. *Journal of patient safety*, *8*(4), 202.	Psychological safety was not addressed
15	Bracq, M. S., Michinov, E., Le Duff, M., Arnaldi, B., Gouranton, V., & Jannin, P. (2021). "Doctor, please": Educating Nurses to Speak Up With Interactive Digital Simulation Tablets. *Clinical Simulation in Nursing*, *54*, 97-104.	No intervention
16	Jones, M., Scarduzio, J., Mathews, E., Holbrook, P., Welsh, D., Wilbur, L., ... & Ballard, J. A. (2019). Individual and team-based medical error disclosure: Dialectical tensions among health care providers. *Qualitative Health Research*, *29*(8), 1096-1108.	Psychological safety was not addressed
17	Menon, V., Bhoja, R., Reisch, J., Kosemund, M., Hogg, D., & Ambardekar, A. (2021). Acquisition of Teamwork and Communication Skills Using High-	Psychological safety was not addressed

Number	Citation	Exclusion Reason
	Technology Simulation for Preclerkship Medical Students. *Simulation in Healthcare*, *16*(6), e181-e187.	
18	Weiss, M., Kolbe, M., Grote, G., Dambach, M., Marty, A., Spahn, D. R., & Grande, B. (2014). Agency and communion predict speaking up in acute care teams. *Small Group Research*, *45*(3), 290-313.	No intervention
19	Columbus, A. B., Castillo-Angeles, M., Berry, W. R., Haider, A. H., Salim, A., & Havens, J. M. (2018). An evidence-based intraoperative communication tool for emergency general surgery: a pilot study. *Journal of Surgical Research*, *228*, 281-289.	No simulation
20	Mukerji, S. (2021). Medical simulation and the holy grail of psychological safety. *Emergency Medicine Australasia*, *33*(2), 362-366.	No intervention
21	Chan, A. K. M., Rudolph, J. W., Lau, V. N. M., Wong, H. M. K., Wong, R. S. L., Lo, T. S., ... & Joynt, G. M. (2020). Rapid cycle system improvement for COVID-19 readiness: integrating deliberate practice, psychological safety and vicarious learning. *BMJ simulation & technology enhanced learning*.	No intervention

Number	Citation	Exclusion Reason
22	Aldridge, M., Miles, E., Cairns, T., & Owen, O. (2019). P86 Developing a near-peer simulation faculty: our experiences. *BMJ Simulation & Technology Enhanced Learning*, *5*(Suppl 2), A99.	Abstract only
23	Calhoun, A., Pian-Smith, M., Shah, A., Levine, A., Gaba, D., DeMaria, S., ... & Meyer, E. C. (2020). Exploring the boundaries of deception in simulation: A mixed-methods study. *Clinical Simulation in Nursing*, *40*, 7-16.	Wrong study design
24	Allen, M. L., Groll, M., Emlund, M., King, D. E., Sonnichsen, J., Bayer, K., & Echeverria, G. (2020). Healthcare Students' Psychological Well-Being in a Diabetic Ketoacidosis Simulation. *Clinical Simulation in Nursing*, *39*, 1-6.	No intervention
25	Chou, C. L., Masters, D. E., Chang, A., Kruidering, M., & Hauer, K. E. (2013). Effects of longitudinal small-group learning on delivery and receipt of communication skills feedback. *Medical education*, *47*(11), 1073-1079.	Wrong study design
26	Riskin, A., & Bamberger, P. (2014). Developing team reflexivity as a learning and working tool for medical teams. *Harefuah*, *153*(3-4), 206-9.	Not empirical research

Number	Citation	Exclusion Reason
27	Clapper, T. C., Ching, K., Lee, J. G., Mauer, E., Gerber, L. M., Sobin, B., ... & DiPace, J. I. (2019). A TeamSTEPPS® implementation plan for recently assigned interns and nurses. *Journal of Interprofessional Care*.	Wrong study design
28	Baylis, J., Innes, K., Roos, J., McFetridge, C., McSweeney, C., & Holm, N. (2021). Simulation curriculum evaluation and development in a postgraduate emergency medicine programme: a 2-year logic model follow-up. *BMJ Simulation & Technology Enhanced Learning*, *7*(1), 47-49.	No intervention
29	Douch, C., Thomson, J., Patel, M., Pal, C., Sini, J., & Driscoll, J. (2019). SC35 Paediatric in-situ simulation curriculum–building multi-professional engagement from student to registrar. a report on the concept, challenges and causes for celebration of the homerton paediatric simulation team. *BMJ Simulation & Technology Enhanced Learning*, *5*(Suppl 2), A39.	Abstract only
30	Dube, M., Kessler, D., Huang, L., Petrosoniak, A., & Bajaj, K. (2020). Considerations for psychological safety with system-focused debriefings. *BMJ Simulation & Technology Enhanced Learning*, *6*(3), 132.	Not empirical research

Number	Citation	Exclusion Reason
31	Levesque, L. L. (2021). Trust in Classroom-as-Organization Simulations: Parallel Experiences of Participants and Facilitators. *Simulation & Gaming*, *52*(3), 333-345.	Not empirical research
32	Calhoun, A. W., Boone, M. C., Porter, M. B., & Miller, K. H. (2014). Using simulation to address hierarchy-related errors in medical practice. *The Permanente Journal*, *18*(2), 14.	Not empirical research
33	Guinea, S., Andersen, P., Reid-Searl, K., Levett-Jones, T., Dwyer, T., Heaton, L., ... & Bickell, P. (2019). Simulation-based learning for patient safety: The development of the Tag Team Patient Safety Simulation methodology for nursing education. *Collegian*, *26*(3), 392-398.	Not empirical research
34	Kaminsky, M. V. (2018). *Collaboration on Root-cause Analysis During an Interprofessional Simulated Morbidity and Mortality Conference* (Doctoral dissertation, Rosalind Franklin University of Medicine and Science).	A thesis/dissertation
35	Tanoubi, I., Bélanger, M. È., Georgescu, L. M., Perron, R., Germain, J. F., Robitaille, A., & Drolet, P. (2016). Identification tags and learners' situational	Not empirical research

Number	Citation	Exclusion Reason
	awareness during high-fidelity simulation. *International Journal of Medical Education, 7,* 93.	
36	Baylis, J., Roos, J., McFetridge, C., Camorlinga, P., & Holm, N. (2019). Simulation curriculum evaluation and development in a postgraduate emergency medicine programme. *BMJ Simulation & Technology Enhanced Learning*, *5*(4), 246-247.	Not empirical research
37	Picketts, L., Warren, M. D., & Bohnert, C. (2021). Diversity and inclusion in simulation: addressing ethical and psychological safety concerns when working with simulated participants. *BMJ Simulation & Technology Enhanced Learning*, *7*(6), 590.	Not empirical research
38	St Pierre, M., Gall, C., Breuer, G., & Schüttler, J. (2017). Beeinflusst jährliches Simulationstraining das Sicherheitsklima einer universitären Klinik?. *Der Anaesthesist, 66*(12), 910-923.	Psychological safety not addressed
39	Hughes, P. G., & Hughes, K. E. (2019). Briefing prior to simulation activity.	Not empirical research

Number	Citation	Exclusion Reason
40	Muckler, V. C. (2017). Exploring suspension of disbelief during simulation-based learning. *Clinical Simulation in Nursing*, *13*(1), 3-9.	Not empirical research
41	Dale-Tam, J., Thompson, K., & Dale, L. (2021). Creating Psychological Safety During a Virtual Simulation Session. *Clinical Simulation in Nursing*, *57*, 14-17.	Not empirical research
42	Douros, G. (2021). Learning means changing: What's changed?. *Emergency medicine Australasia: EMA*, *33*(5), 928-929.	Not empirical research
43	Christodoulides, N., Duggan, W. P., & Dalrymple, K. R. (2021). COVID-SIM: building testing capacity through public engagement with healthcare simulation. *BMJ Simulation & Technology Enhanced Learning*, *7*(1), 52-53.	Not empirical research
44	Houzé-Cerfon, C. H., Boet, S., Saint-Jean, M., Cros, J., Vardon-Bounes, F., Marhar, F., ... & Geeraerts, T. (2020). Efecto de un debriefing (reunión informativa) combinado en los participantes en cursos de simulación interprofesional para la gestión de recursos de crisis: un estudio aleatorio, controlado y multicéntrico. *Emergencias (Sant Vicenç dels Horts)*, 111-117.	Psychological safety was not addressed

Number	Citation	Exclusion Reason
45	Judd, B. K., Currie, J., Dodds, K. L., Fethney, J., & Gordon, C. J. (2019). Registered nurses psychophysiological stress and confidence during high-fidelity emergency simulation: Effects on performance. *Nurse Education Today*, *78*, 44-49.	Psychological safety was not addressed
46	Pennington, K. M., Dong, Y., Coville, H. H., Wang, B., Gajic, O., & Kelm, D. J. (2018). Evaluation of TEAM dynamics before and after remote simulation training utilizing CERTAIN platform. *Medical education online*, *23*(1), 1485431.	Psychological safety was not addressed
47	Ganley, B. J., & Linnard-Palmer, L. (2012). Academic safety during nursing simulation: Perceptions of nursing students and faculty. *Clinical Simulation in Nursing*, *8*(2), e49-e57.	No intervention
48	Kukko, P., Silén-Lipponen, M., & Saaranen, T. (2020). Health care students' perceptions about learning of affective interpersonal communication competence in interprofessional simulations. *Nurse education today*, *94*, 104565.	Psychological safety was not addressed
49	Persico, L. (2017). *A Comparison of Two Debriefing Methods on Clinical Reasoning Outcomes, Learner Satisfaction with Debriefing and Reflection, Clinical Learning*	A thesis/dissertation

Number	Citation	Exclusion Reason
	and Clinical Reasoning, and Psychological Safety of Nurse Orientees in Simulation-Based Education (Doctoral dissertation, Molloy College).	
50	Crescentini, C., Chittaro, L., Capurso, V., Sioni, R., & Fabbro, F. (2016). Psychological and physiological responses to stressful situations in immersive virtual reality: Differences between users who practice mindfulness meditation and controls. *Computers in Human Behavior*, *59*, 304-316.	Psychological safety was not addressed
51	Ignacio, J., Dolmans, D., Scherpbier, A., Rethans, J. J., Lopez, V., & Liaw, S. Y. (2016). Development, implementation, and evaluation of a mental rehearsal strategy to improve clinical performance and reduce stress: A mixed methods study. *Nurse education today*, *37*, 27-32.	Psychological safety was not addressed
52	Boostel, R., Felix, J. V. C., Bortolato-Major, C., Pedrolo, E., Vayego, S. A., & Mantovani, M. D. F. (2018). Stress of nursing students in clinical simulation: a randomized clinical trial. *Revista Brasileira de Enfermagem*, *71*, 967-974.	Psychological safety was not addressed

Number	Citation	Exclusion Reason
53	Goldberg, M. B., Mazzei, M., Maher, Z., Fish, J. H., Milner, R., Yu, D., & Goldberg, A. J. (2018). Optimizing performance through stress training—an educational strategy for surgical residents. *The American Journal of Surgery*, *216*(3), 618-623.	Psychological safety was not addressed
54	Murugavadigal, N., Pal, B., Thein, A. W., Soe, H. H. K., & Pal, S. (2020). The impact of stressors on the learning outcome of high-fidelity patient simulation in undergraduate medical students. *Med J Malaysia*, *75*(3), 209.	Psychological safety was not addressed
55	Bhoja, R., Guttman, O. T., Fox, A. A., Melikman, E., Kosemund, M., & Gingrich, K. J. (2020). Psychophysiological stress indicators of heart rate variability and electrodermal activity with application in healthcare simulation research. *Simulation in Healthcare*, *15*(1), 39-45.	Psychological safety was not addressed
56	Perry, M. F., Seto, T. L., Vasquez, J. C., Josyula, S., Rule, A. R., Rule, D. W., & Kamath-Rayne, B. D. (2018). The influence of culture on teamwork and communication in a simulation-based resuscitation training at a Community Hospital in Honduras. *Simulation in Healthcare*, *13*(5), 363-370.	Psychological safety was not addressed

Number	Citation	Exclusion Reason
57	Bauer, C., Rimmele, T., Duclos, A., Prieto, N., Cejka, J. C., Carry, P. Y., ... & Lehot, J. J. (2016). Anxiety and stress among anaesthesiology and critical care residents during high-fidelity simulation sessions. *Anaesthesia Critical Care & Pain Medicine*, *35*(6), 407-416.	Psychological safety was not addressed
58	Ghazali, D. A., Darmian-Rafei, I., Ragot, S., & Oriot, D. (2018). Performance under stress conditions during multidisciplinary team immersive pediatric simulations. *Pediatric Critical Care Medicine*, *19*(6), e270-e278.	Psychological safety was not addressed
59	Peifer, C., Sauer, J., & Antoni, C. H. (2020). Effects of social stress on performance and strain in complex multiple task environments. *Ergonomics*, *63*(9), 1088-1100.	Psychological safety was not addressed
60	Madhavanprabhakaran, G., Al-Khasawneh, E., & Wittmann, L. (2015). Perceived benefits of pre-clinical simulation-based training on clinical learning outcomes among Omani undergraduate nursing students. *Sultan Qaboos University Medical Journal*, *15*(1), e105.	Psychological safety was not addressed

Number	Citation	Exclusion Reason
61	Fraser, K., Huffman, J., Ma, I., Sobczak, M., McIlwrick, J., Wright, B., & McLaughlin, K. (2014). The emotional and cognitive impact of unexpected simulated patient death: a randomized controlled trial. *Chest*, *145*(5), 958-963.	Psychological safety was not addressed
62	Robertiello, G., Genee, J., & Marrera, A. (2021). Escape the sim! An escape room innovation to orient learners to the simulation environment. *Nursing Education Perspectives*, *42*(3), 195-196.	Not empirical research
63	Rudolph, J. W., Raemer, D. B., & Simon, R. (2014). Establishing a safe container for learning in simulation: the role of the presimulation briefing. *Simulation in Healthcare*, *9*(6), 339-349.	Wrong study design
64	Gray, W. A., Kesten, K. S., Hurst, S., & Anderko, L. (2012). Using clinical simulation centers to test design interventions: a pilot study of lighting and color modifications. *HERD: Health Environments Research & Design Journal*, *5*(3), 46-65.	Psychological safety was not addressed

Number	Citation	Exclusion Reason
65	Gurnáková, J., & Gröpel, P. (2019). Prior participation in simulation events is associated with insimulation team performance among emergency medical services professionals. *Simulation in Healthcare*, *14*(4), 235-240.	Psychological safety was not addressed
66	Bender, J., Kennally, K., Shields, R., & Overly, F. (2014). Does simulation booster impact retention of resuscitation procedural skills and teamwork?. *Journal of Perinatology*, *34*(9), 664-668.	Psychological safety was not addressed
67	Wanless, S., & Winters, D. (2018). A welcome space for taking risks.The Learning Professiomal, 39(4), 41-44.	Wrong population
68	Marr, M., Hemmert, K., Nguyen, A. H., Combs, R., Annamalai, A., Miller, G., ... & Cohen, S. M. (2012). Team play in surgical education: a simulation-based study. *Journal of surgical education*, *69*(1), 63-69.	Psychological safety was not addressed
69	Clark, A., Buckley, A., & Trippick, S. (2016). 107 Psychological safety in emergency department in-situ simulation training. *BMJ Simulation & Technology Enhanced Learning*, *2*, A61.	Abstract only

Number	Citation	Exclusion Reason
70	Rezmer, J., Begaz, T., Treat, R., & Tews, M. (2011). Impact of group size on the effectiveness of a resuscitation simulation curriculum for medical students. *Teaching and Learning in Medicine, 23*(3), 251-255.	Psychological safety was not addressed
71	Beament, T., & Mercer, S. (2014). 0188 Speak Up! What Are The Barriers To Challenging Seniors?. *BMJ Simulation & Technology Enhanced Learning*, *1*(Suppl 1), A21.	Abstract only
72	Eady, J., Martin, C., & Montgomery, C. (2019). P24 So you think you can sim? Realist evaluation of an introductory ENT in-situ simulation. *BMJ Simulation & Technology Enhanced Learning*, *5*(Suppl 2), A70.	Abstract only
73	Morse, C. J. (2012). *The effect of debriefing with good judgment on acute care nurse practitioner students' reflective ability and perspective transformation* (Doctoral dissertation, Villanova University).	A thesis/dissertation
74	Mills, B., Carter, O., Rudd, C., Claxton, L., & O'Brien, R. (2016). An experimental investigation into the extent social evaluation anxiety impairs performance in	Psychological safety was not addressed

Number	Citation	Exclusion Reason
	simulation-based learning environments amongst final-year undergraduate nursing students. *Nurse Education Today, 45*, 9-15.	
75	Judd, B. K., Alison, J. A., Waters, D., & Gordon, C. J. (2016). Comparison of psychophysiological stress in physiotherapy students undertaking simulation and hospital-based clinical education. *Simulation in Healthcare, 11*(4), 271-277.	Psychological safety was not addressed
76	Thidemann, I. J., & Söderhamn, O. (2013). High-fidelity simulation among bachelor students in simulation groups and use of different roles. *Nurse education today, 33*(12), 1599-1604.	Psychological safety was not addressed
77	Young, J. E., Williamson, M. I., & Egan, T. G. (2016). Students' reflections on the relationships between safe learning environments, learning challenge and positive experiences of learning in a simulated GP clinic. *Advances in Health Sciences Education, 21*(1), 63-77.	Wrong study design
78	Hanlon, F., Fish, R., & Suckling, E. (2020). PG37 Simulate to resuscitate: using multi-professional point-of-care simulation to educate staff on the updated covid-19	Abstract only

Number	Citation	Exclusion Reason
	paediatric cardiac arrest algorithm. *BMJ Simulation & Technology Enhanced Learning*, *6*(Suppl 1), A48-A49.	
79	Kostovich, C. T., O'Rourke, J., & Stephen, L. A. (2020). Establishing psychological safety in simulation: faculty perceptions. *Nurse education today*, *91*, 104468.	Wrong study design
80	Park, J. E., & Kim, J. H. (2021). Nursing students' Psychological Safety in High fidelity Simulations: Development of a new scale for psychometric evaluation. *Nurse Education Today*, *105*, 105017.	No intervention
81	Houzé-Cerfon, C. H., Boet, S., Saint-Jean, M., Cros, J., Vardon-Bounes, F., Marhar, F., ... & Geeraerts, T. (2020). Effect of combined individual-collective debriefing of participants in interprofessional simulation courses on crisis resource management: a randomized controlled multicenter trial. *Emergencias: Revista de la Sociedad Espanola de Medicina de Emergencias*, *32*(2), 111-117.	Psychological safety was not addressed
82	Roh, Y. S., Jang, K. I., & Issenberg, S. B. (2021). Nursing students' perceptions of simulation design features and learning outcomes: The mediating effect of psychological safety. *Collegian*, *28*(2), 184-189.	Wrong outcome

Number	Citation	Exclusion Reason
83	Hémon, B., Michinov, E., Guy, D., Mancheron, P., & Scipion, A. (2020). Speaking up about errors in routine clinical practice: a simulation-based intervention with nursing students. *Clinical Simulation in Nursing*, *45*, 32-41.	No intervention
84	Madsgaard, A., Røykenes, K., Smith-Strøm, H., & Kvernenes, M. (2022). The affective component of learning in simulation-based education–facilitators' strategies to establish psychological safety and accommodate nursing students' emotions. *BMC nursing*, *21*(1), 1-10.	Wrong study design
85	Purdy, E., Borchert, L., El-Bitar, A., Isaacson, W., Bills, L., & Brazil, V. (2022). Taking simulation out of its "safe container"—exploring the bidirectional impacts of psychological safety and simulation in an emergency department. *Advances in Simulation*, *7*(1), 1-9.	Wrong study design
86	Klenke-Borgmann, L., Digregorio, H., & Cantrell, M. A. (2022). Role clarity and interprofessional colleagues in psychological safety: a faculty reflection. *Simulation in Healthcare*, 10-1097.	Wrong study design

Number	Citation	Exclusion Reason
87	Menon, V., Bhoja, R., Reisch, J., Kosemund, M., Hogg, D., & Ambardekar, A. (2021). Acquisition of Teamwork and Communication Skills Using High-Technology Simulation for Preclerkship Medical Students. *Simulation in Healthcare*, *16*(6), e181-e187.	Psychological safety was not addressed
88	Kuo, S. Y., Wu, J. C., Chen, H. W., Chen, C. J., & Hu, S. H. (2020). Comparison of the effects of simulation training and problem-based scenarios on the improvement of graduating nursing students to speak up about medication errors: A quasi-experimental study. *Nurse Education Today*, *87*, 104359.	Wrong study design
89	Appelbaum, N. P., Lockeman, K. S., Orr, S., Huff, T. A., Hogan, C. J., Queen, B. A., & Dow, A. W. (2020). Perceived influence of power distance, psychological safety, and team cohesion on team effectiveness. *Journal of interprofessional care*, *34*(1), 20-26.	No intervention
90	Ramos Cuadra, Y. (2018). El entrenamiento procedimental integrado con foco completo en simulación clínica. *Archivos venezolanos de farmacología y terapéutica*, *37*(2), 67-72.	Psychological safety was not addressed

Number	Citation	Exclusion Reason
91	Da Silva, C., Peisachovich, E., Anyinam, C. K., Coffey, S., Graham, L., & Tavangar, F. (2020). Speaking Up Against Hierarchy: A Simulation Geared Towards Nursing Students. *Cureus*, *12*(12).	Psychological safety was not addressed
92	Shanks, L. C., Chiu, S. H., Zelko, M. I., Fleming, E., & Germano, S. (2020). Speaking up to authority in a simulated medication error scenario. *Clinical Simulation in Nursing*, *45*, 28-31.	Wrong outcome
93	Ginsburg, L., & Bain, L. (2017). The evaluation of a multifaceted intervention to promote “speaking up” and strengthen interprofessional teamwork climate perceptions. *Journal of Interprofessional Care*, *31*(2), 207-217.	Wrong outcome

Appendix M

Modified JBI Data Extraction Tool

Article Title	
Article #	
Authors	
Publication Year	
Appraisal Tool	
Country	
Research Aim/Question	
Participants	
Study Design	
Sample Size	
Intervention	
Simulation Type	
Simulation Phase	
Outcomes	
Measurement Tool and Cronbach Alpha score	
Data Analysis Level of significance	
Conclusions	
Limitations	
Future Research	

Appendix N

Preferred Reporting Items for Systematic Reviews and Meta-Analyses Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	p.1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	p.7
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	p.43
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	p.44
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	p.52-53
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	p.53-55
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	p.54
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	p.55
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	p.56
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	p.53,58
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	p.52
Study risk of bias	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of	p.56

Section and Topic	Item #	Checklist item	Location where item is reported
assessment		automation tools used in the process.	
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	p.56
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	p.55
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	p.58
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	p.63-67
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	p.58
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	NA
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	NA
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	NA
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	NA
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	p. 60
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	p. 137-158
Study characteristics	17	Cite each included study and present its characteristics.	p. 63-67
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	NA
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	p.58-62

Section and Topic	Item #	Checklist item	Location where item is reported
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	p. 63-67
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	p.61-62
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	p.58
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	p.58
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	p.91
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	p.91
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	p.83-91
	23b	Discuss any limitations of the evidence included in the review.	p.91
	23c	Discuss any limitations of the review processes used.	p.91
	23d	Discuss implications of the results for practice, policy, and future research.	p.91-92
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	p.51
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	p.51
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NA
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	p.9
Competing interests	26	Declare any competing interests of review authors.	NA
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	NA

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

Appendix O

Synthesis Without Meta-Analysis (SWiM) in Systematic Reviews: Reporting Guideline

SWiM is intended to complement and be used as an extension to PRISMA			
SWiM reporting item	**Item description**	**Page in manuscript where item is reported**	**Other***
Methods			
1 Grouping studies for synthesis	1a) Provide a description of, and rationale for, the groups used in the synthesis (e.g., groupings of populations, interventions, outcomes, study design)	p. 70	
	1b) Detail and provide rationale for any changes made subsequent to the protocol in the groups used in the synthesis	NA	
2 Describe the standardised metric and transformation methods used	Describe the standardised metric for each outcome. Explain why the metric(s) was chosen, and describe any methods used to transform the intervention effects, as reported in the study, to the standardised metric, citing any methodological guidance consulted	p.76	
3 Describe the synthesis methods	Describe and justify the methods used to synthesise the effects for each outcome when it was not possible to undertake a meta-analysis of effect estimates	p. 58	
4 Criteria used to prioritise results for summary and synthesis	Where applicable, provide the criteria used, with supporting justification, to select the particular studies, or a particular study, for the main synthesis or to draw conclusions from the synthesis (e.g., based on study design, risk of bias assessments, directness in relation to the review question)	p.76	
SWiM reporting item	**Item description**	**Page in manuscript where item is reported**	**Other***

5 Investigation of heterogeneity in reported effects	State the method(s) used to examine heterogeneity in reported effects when it was not possible to undertake a meta-analysis of effect estimates and its extensions to investigate heterogeneity	p. 61-62	
6 Certainty of evidence	Describe the methods used to assess certainty of the synthesis findings	p.68	
7 Data presentation methods	Describe the graphical and tabular methods used to present the effects (e.g., tables, forest plots, harvest plots). Specify key study characteristics (e.g., study design, risk of bias) used to order the studies, in the text and any tables or graphs, clearly referencing the studies included	p.82	
Results			
8 Reporting results	For each comparison and outcome, provide a description of the synthesised findings, and the certainty of the findings. Describe the result in language that is consistent with the question the synthesis addresses, and indicate which studies contribute to the synthesis	p.69-81	
Discussion			
9 Limitations of the synthesis	Report the limitations of the synthesis methods used and/or the groupings used in the synthesis, and how these affect the conclusions that can be drawn in relation to the original review question	p.91	

PRISMA=Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Campbell M, McKenzie JE, Sowden A, Katikireddi SV, Brennan SE, Ellis S, Hartmann-Boyce J, Ryan R, Shepperd S, Thomas J, Welch V, Thomson H. Synthesis without meta-analysis (SWiM) in systematic reviews: reporting guideline BMJ 2020; 368:l6890 http://dx.doi.org/10.1136/bmj.l6890