Simulation, patient outcomes, and mental health review

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Foreword

In 2014–15 the Department of Health & Human Services, on advice from the Simulation Based Education and Training Expert Advisory Group, commissioned a literature review to be included in the *Simulation and patient safety – the benefits for your organisation* resource.

The review provided an appraisal of the available literature and succinct detail on simulation and its impact on patient outcomes. Based on findings from the review the advisory group advised the department that a publishable systematic scoping review would be valuable. It was agreed that a specific focus on mental health, as identified in the review, would transform the initial literature review into a publishable systematic scoping review that contributes to the evidence base for simulation. The scoping review focusing on mental health has been provided as part 2 of this document.

This review has provided the department and the wider communities of practice with an important resource to better understand the importance of simulation and its impact on mental health outcomes. It can support future strategic planning and assist in better understanding where future research gaps exist within the literature.

The department would like to thank the Simulation Based Education and Training Expert Advisory Group and, in particular, the research subcommittee, which led and contributed to the reviews.

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Part 1: A focused review of simulation to improve patient outcomes – January 2015

Author: Simulation Expert Advisory Group Research Subcommittee (Victoria)
Work led by Lesley McKarney and Stuart Marshall

Introduction

Simulation refers to the replication of all or part of a work setting in order to educate, redesign or investigate the workflow. The technique of simulation has been suggested to improve the safety, efficiency and cost-effectiveness of healthcare delivery (McGaghie et al. 2011). Different techniques can be used from the use of patient 'actors' to skills trainers, mannequins and even virtual reality.

To date, research into the impact of simulation has been focused on educational outcomes, including interpersonal and technical skills. These advances must be linked to education and health outcomes – a discipline known as translational medicine. Translational outcomes of interest include the impact of simulation on:

- educational outcomes (T1)
- patient care practices (T2)
- patient outcomes (T3)
- population-level effects (T4).

This literature review will examine patient and organisational outcomes of simulation interventions resulting from education, redesign and quality improvement programs. This is the T3 level of translational research. Where available, T4 population-level effects are reported.

Measureable outcomes include:

- patient health and safety (near-miss, adverse event reporting, sentinel events and other complications)
- patient mortality
- patient complaints and patient satisfaction
- length of stay, surgical recovery time and productivity effects
- cost-effectiveness, return on investment and population-level effects.

Method

Initial systematic reviews of outcomes measures in simulation education were performed using the MEDLINE, CINAHL, Embase, Informit Health, Cochrane Library, ProQuest Central, AMED, ERIC, Scopus and PsycINFO databases. Among the search terms were 'simulation', 'patient simulation' 'technology', 'patient safety', 'treatment outcomes' and 'quality of healthcare', date limited from 2004 to current. Abstracts were scanned for relevance and the relevant papers included. Additional Google searches were also undertaken to ascertain if there were relevant review articles or primary references in the 'grey literature' (including conference proceedings and online articles).

Twenty-one simulation academics and practitioners from Victorian university and healthcare organisations were asked to provide lists of relevant studies relating to outcome studies from simulation interventions. In addition, the authors had informal discussions with educators and safety experts in specialist areas.

References of the articles discovered were screened to ensure that no other historically relevant references had been missed.

Criteria

- Studies were included if simulation or some form of replication of the environment or work was used.
- Studies looking at measurable patient outcomes (identified above) were included. Studies describing educational outcomes alone or outcomes not tested during clinical practice were excluded.

Articles were classified as coming from 10 areas of practice:

- primary care
- pre-hospital care
- critical care (anaesthetics, emergency medicine, intensive care)
- surgery
- nursing
- obstetrics and neonatal
- paediatrics
- rehabilitation
- mental health
- hospital design.

Results

Difficulty was encountered in performing the searches as the keywords often did not include 'simulation', 'outcome' or 'safety'. Studies also commonly claimed to present patient outcomes but tested performance in simulation settings (T2 level).

The majority of papers described studies using simulation for educational purposes. It is unclear whether more research exists that uses simulation for systems modelling, but the current search did not uncover it.

A total of 52 articles were identified. Nearly all of the patient outcome studies using simulation were published in the past 10 years (50/52, 96 per cent), and over half (31/52, 60 per cent) were published in the past five years (Figure 1.1). These articles were mapped over the 10 areas identified as demonstrated in Table 1.1.

Figure 1.1: Articles using simulation reporting on patient outcomes by year of publication

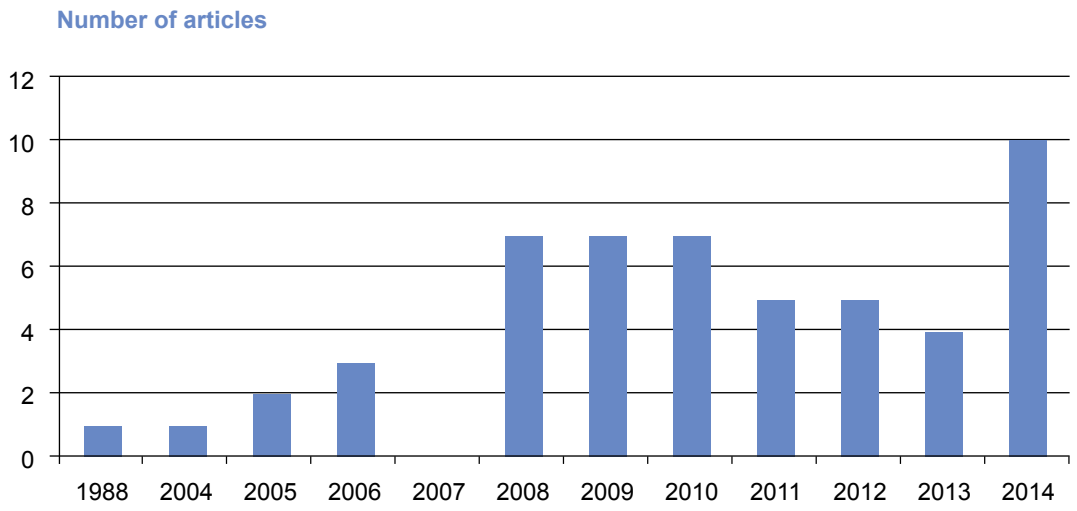

Table 1.1: Matrix summarising the translational effects of simulation: Cell contents describe where the balance of evidence supports a positive effect of simulation

	Patient health and safety (T3)	Patient mortality (T3)	Complaints and satisfaction (T3)	Length of stay, recovery time, cost (T3)	Population effects (T4)
Primary care	Y	N	N	N	Y
Pre-hospital care	Y	N	N	N	N
Critical care	Y	Y	Y	Y	Y
Surgery	Y	N	Y	Y	Y
Nursing	Y	N	N	N	N
Obstetric/neonatal	Y	Y	N	Y	Y
Paediatric	Y	Y	N	N	N
Rehabilitation	Y	N	Y	N	N
Mental health	N	N	N	N	N
Hospital design	Y	N	N	Y	N

Patient health and safety

Many articles claimed improvements in patient safety and patient outcomes related to simulation education, but these were extrapolations from observed performance (T2 outcomes) rather than actual patient outcomes. All areas examined, except for mental health, demonstrated evidence of improved patient health and/or safety using simulation techniques. The majority of the evidence for simulation in patient safety is in the reduction of complications through educating health professionals.

In primary care: The overall health of asthmatics was improved when health professionals were trained using a combination of simulated patients and lecture-based education (Cohen et al. 2014).

In critical care: Initial studies showed a reduction of complications of central venous catheter insertions, especially infection rates, which in one study were reduced by 84.5 per cent (Barsuk et al. 2009). A later meta-analysis showed no significant reduction in adverse events (Madenci, Solis & Moya 2014), but this did not include a recent large study of nearly 10,000 catheter-days showing a 74 per cent reduction of infection rates (Barsuk et al. 2014).

In pre-hospital care: Dosing errors of adrenaline in children were reduced by a factor of three when system redesign and education using simulation were implemented (Kaji et al. 2006).

In obstetric and neonates: A halving of brain injuries caused by hypoxia (Draycott et al. 2006) and a fourfold reduction in neonatal injury from shoulder dystocia were achieved when a structured program of simulation was instituted (Draycott et al. 2008). A 37 per cent reduction in morbidity was achieved with the introduction of in-situ simulation-based training (Riley et al. 2011).

In surgery: A 47 per cent reduction in some complications of cataract surgery was seen when surgeons were trained using simulation (Rogers et al. 2009).

In nursing: A reduction of medication errors by nurses from 30 per cent to 4 per cent was seen in an intensive care unit following simulation-based education (Ford et al. 2010).

In rehabilitation: Treadmill training with virtual reality obstacles significantly improved gait speed for people with Parkinson's disease (Mirelman et al. 2010).

Patient mortality

Fewer examples of simulation reducing patient mortality were found. Unsurprisingly these were found in higher risk areas of clinical practice. The most widely known examples are in obstetrics and paediatrics and relate to training of emergency drills using simulation.

In obstetrics: In third-world countries a reduction of 28 per cent in perinatal mortality (first week of life) and a 36 per cent reduction in neonatal mortality (first month of life) was found when simulation training was introduced (Wall et al. 2009).

In paediatrics: The introduction of simulation-based mock arrest scenarios was correlated with an improvement in cardiac arrest survival in paediatric patients (Andreatta et al. 2011). Similar findings were replicated with simulation-based team training and the introduction of the paediatric medical emergency team (Theilen et al. 2013).

In critical care: Following simulation-based education, teams were over seven times more likely to adhere to guidelines during cardiac arrest events. As a result, the mean survival time in the intensive care unit was doubled following the intervention (Wayne et al. 2008).

Patient complaints and satisfaction

Only two papers described improvements of patient perception as a result of simulation interventions.

In rehabilitation: Patient satisfaction was improved when activities in the home were simulated and the patient wore 'street clothes' (Court 1988).

In critical care: Patient satisfaction was increased when modelling and a real-time display of waiting times was displayed in the waiting room (Santo Dominigo et al. 2008).

In surgery: Trainees using the AccuTouch colonoscopy simulator were 4.53 times more likely to reach the cecum compared with the control group and achieved shorter procedure times with patients experiencing less discomfort (Ahlberg et al. 2009).

Length of stay, recovery time and productivity

Lengths of surgical operating times were commonly quoted as patient outcome measures in diverse procedures such as endoscopies, ultrasound scans and laparoscopies. Length of stay was noted in one surgical study as a possibility if new techniques could be practised before widespread implementation (Gibber & Fried 2009).

In obstetrics: Antenatal ultrasound scans were more accurate and quicker following simulation training (Burden et al. 2013).

In hospital design: Improved design of hospitals and testing using simulation was thought to contribute to reduced times to respond to emergencies (Villamaria et al. 2008).

In surgery: A meta-analysis suggested virtual reality simulator training reduced laparoscopic operation times by up to 50 per cent (Larsen et al. 2012).

In critical care: Trauma resuscitations were found to be 16 per cent quicker and more likely to be complete following simulation training (Steinemann et al. 2011).

Broader population and cost effects

A recent evaluation of simulation-based education effectiveness lamented that few studies examined the cost-effectiveness of the technique. Surprisingly in this review there were several examples of cost savings as a result of simulation being employed. Furthermore, additional population (T4 level) effects were demonstrated including a reduced burden of disease and reduced litigation rates.

In critical care: Cost savings from catheter-related infections were estimated to give a 7:1 return on investment for central venous line simulation training (Cohen et al. 2010).

In primary care: Forty additional safety concerns were identified for critically ill patients in primary care settings (LaVelle & McLaughlin 2008). Management of asthma improved, with 27 per cent versus 15 per cent of patients improving from uncontrolled asthma when simulation was used to train health professionals (Cohen et al. 2014).

In obstetrics: Litigation claim rates for birth injury decreased by 20 per cent following a period of simulation training (Iverson & Heffner 2011).

Discussion

Simulation is becoming more widespread as organisations and professional bodies recognise the benefits of simulation in healthcare at an individual training level.

To date, the use of simulation has focused on these advantages of education. This has recently allowed research and interest to shift towards understanding the downstream benefits of simulation on patient and organisational outcomes.

This focused literature review demonstrates that the direct benefits of simulation to patients have been established in most areas of healthcare. In some areas, such as mental health, there is still a great deal of research to be done, with no evidence of clear value as yet. The literature contains many instances of cost benefit and population benefit of simulation above single patient improvements; however, the number of studies in this area is still relatively small.

Most simulation-based education is evaluated in terms of levels 1 and 2 translational outcomes (transfer of skills to individuals and transfer to clinical practice), with thousands of articles using these lower levels of outcome measure. The fact that so few articles were discovered shows how difficult it is to perform this kind of research. One of the problems is that the patient outcomes are often far 'downstream' from the simulation intervention and difficult to attribute solely to the simulation intervention, particularly when education is used alone. The difficulties of using simulation outcome research has been extensively discussed by McGaghie and colleagues (McGaghie et al. 2011).

As previously noted, the area of patient safety is a difficult area to search because the keywords used are so diverse. Similarly the term 'simulation' is also diverse and includes iterative design, modelling and virtual reality, and many other terms in addition to the commonly understood aspect of simulation-based education. Consequently, we have used a focused literature review in this instance rather than a more systematic approach, although two substantial systematic searches formed the foundation of the original investigation. Despite the lack of a formal systematic approach, we believe this review accurately captures the effects of simulation on patient safety.

There is always the risk of publication bias in a review such as this, where articles showing no benefit have either not been presented or not been accepted for publication. We have not tested for publication bias in the papers referenced, as the review was not systematic; however, we have included existing meta-analyses where available that have taken these potential biases into account.

In areas where there is a substantial number of papers such as duration of surgery and complications of central venous lines, these meta-analyses have generally come out in favour of simulation, although the extent to which simulation-based education reduces central line infection is a topic of debate.

Input from other health professionals without specialist simulation knowledge was invited. We believe this has guarded against the 'cherry picking' of articles from simulation journals known by the authors to show benefit. We believe that any bias from the authors in favour of simulation has been mitigated by this methodology.

Conclusion

Simulation in the form of education and process redesign has the potential to have significant positive effects on patient outcomes. This review outlines the current state of the evidence showing where simulation has already proven to improve the safety and quality of care and improve the cost efficiency of the health system. Further research should be undertaken to determine if simulation could provide broader benefits in efficiency and health spending and in areas where research is sparse such as mental health.

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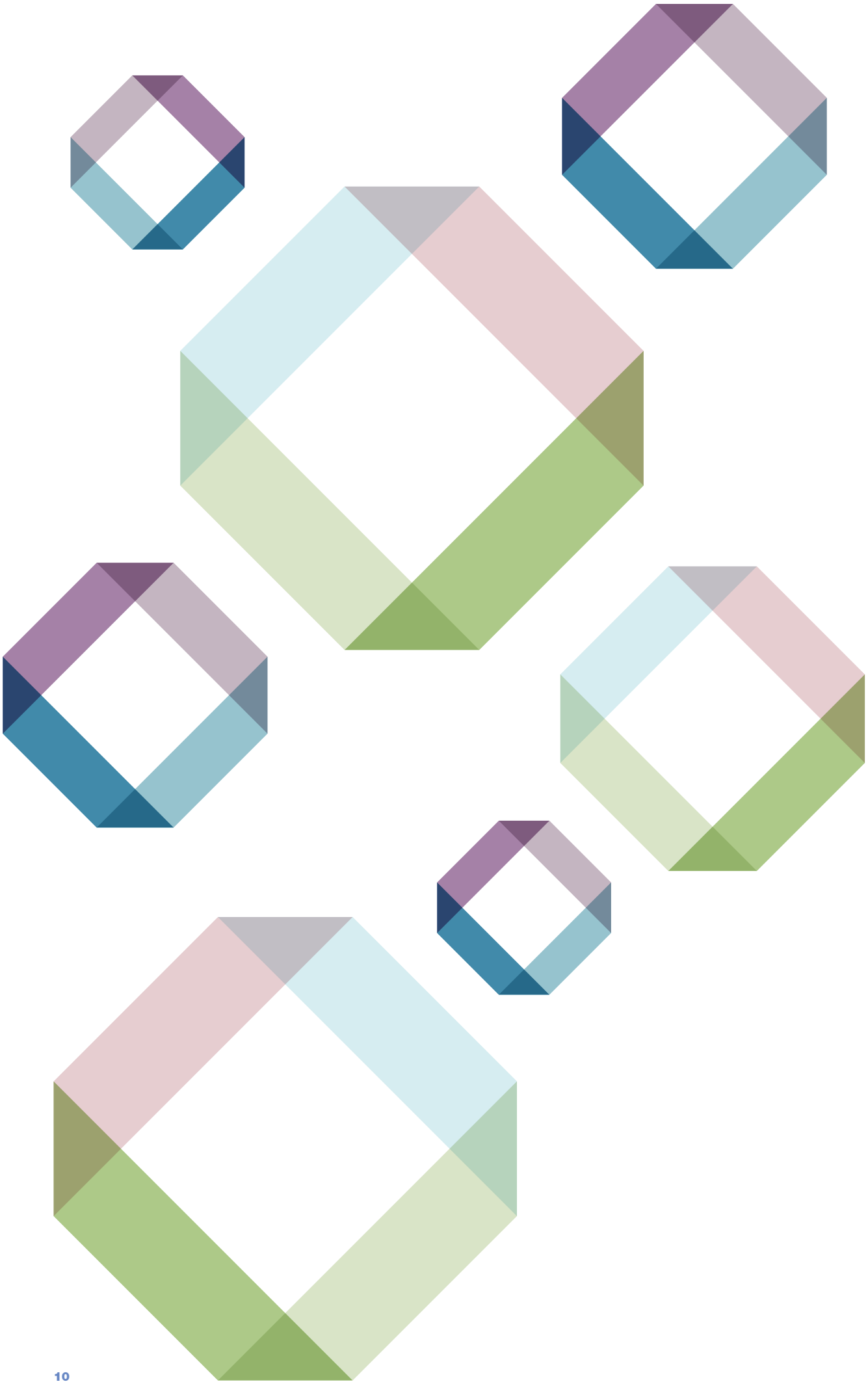

Part 2: Simulation and mental health outcomes: a scoping review – June 2015

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Abstract

Background

An initial literature review was undertaken by several members of the Simulation-Based Education and Training Expert Advisory Group under the auspice of the Department of Health & Human Services (see part 1) to be included in the *Simulation and patient safety benefits kit.* This 'fit-for-purpose' literature review examines the available literature and provides succinct detail on simulation and its impact on patient outcomes; however, an opportunity to extend and formally examine the literature into a publishable systematic scoping review was recommended at the February 2015 advisory group committee meeting.

In advancing and strengthening the search strategy beyond the 'fit for purpose' it became evident that no obvious gaps in the literature were evident. This finding was also supported by the original authors of the fit-for-purpose literature review (except mental health and pre-hospital care). For example, when MeSH and key terms were combined (simulation* and patient outcome* and healthcare professions*), more than 90 meta-analyses and systematic reviews have been undertaken, many in the past three to five years. In an attempt to narrow and increase the yield of publications, a strategy was developed to examine mental health and simulation and patient outcome; this search provided one publication (which was not appropriate). The same outcome was also found when we applied the same strategy with pre-hospital care. In summary, we were unable to find any article that addressed these search 'concepts'; however, we were able to locate more than 65 articles relating to mental health + simulation and more than 80 relating to pre-hospital trauma care + simulation when we removed 'patient outcome' from the search strategy. It was therefore suggested to the department and members of the advisory group to undertake a systematic scoping review of mental health outcomes and simulation. The outcome and benefit of such an approach would broaden the search beyond patient safety, yet provide a narrower focus on simulation's impact on mental health outcomes. These findings will provide key recommendations from the literature search, allowing those involved in mental health policy initiatives and/or educational interventions to better understand what research and project opportunities exist.

Objective

A scoping review was conducted in order to map and determine the gaps in the literature regarding the impact of simulation on mental health outcomes.

Method

This review used Levac, Colquhoun and O'Brien's (2010) five stage scoping methodology. This included the stages: (1) identify the research question; (2) identify relevant studies; (3) study selection; (4) charting the data; and (5) collating, summarising and reporting results.

The online databases searched included CINAHL, ProQuest, PubMed, Ovid MEDLINE, Embase and PsycINFO. These databases were deemed to represent a majority of the literature while accommodating for the particular search strategy used for this review. Websites that provide grey literature (academic literature that is not formally published) were also searched for relevant articles.

Results

Forty-eight articles were included in this review, with a significant portion of studies conducted in the United States and the United Kingdom; others were conducted in an array of locations including Canada, Iran and Taiwan. Of the included articles, seven groups of simulation methods (including virtual reality, manikins as patients and voice simulation) were evident, with simulated patients (actors portraying patients) being most prominent.

Conclusions

There is a lack of literature to evidence the benefit of simulation on mental health outcomes. What evidence is available suggests a variety of simulation-based education and training methods are currently being used. There is an opportunity for further research to be undertaken to determine how simulation might be used to improve mental health outcomes.

Keywords: students, health occupations, patient simulation, mental health, manikin, health occupations.

Introduction

In healthcare education, simulation is used for both the teaching and assessment of students and staff. There are a variety of simulation-based education and training methods, sometimes delivered in combination, dependent on the content and learning outcomes. The levels of difficulty, complexity and challenge can be tailored to suit the context, learning or assessment objectives and the experience level of the students (Doolen et al. 2014). The versatility of simulation allows it to take place in multiple settings including the classroom, clinical setting (such as a consulting room or hospital ward) simulation laboratory or the virtual world (Gaba 2004). Simulation can be used to expose students to clinical situations or events that occur infrequently or pose a high risk in terms of safety or liability (Brown 2008). Based on the versatility of simulation, mental health education may benefit from its use when training health professionals (Edward et al. 2007).

Simulation can be defined as an educational technique or activity that provides participants with an experience in authentic situations without real-world risks (Larew et al. 2006). Gaba (2004), one of the world's experts in simulation, defines it as 'a technique to replace or amplify real experiences with guided experiences, often immersive in nature, that evoke or replicate aspects of the real world in a fully interactive fashion'. Simulation methods are often described as either being 'high-fidelity' – that is, they have a high degree of realism – through to 'low-fidelity', where the level of realism is low (Kameg et al. 2010). They range from rudimentary task trainers, which can be used to teach basic skills (low fidelity), through to sophisticated human patient simulators (HPS) or manikins that are able to replicate a growing range of physiological signs (Kameg et al. 2010). There is limited research on the use of HPS to teach communication skills (Kameg et al. 2009). When teaching CPR, for example, an HPS might be described as being high-fidelity, but in a mental health setting to portray a psychotic patient, HPS would be considered low-fidelity as they cannot provide the emotional interaction and communication of a person.

Simulated patients (SPs) are a good choice when there is a high degree of emotion and/or communication required, as they can provide non-verbal as well as verbal information and responses (Doolen et al. 2014). They may also bring the patient's perspective or voice by including them in a debriefing following the simulation (Nehring & Lashley 2004). An SP is an actor who is trained to portray a person with a particular concern, usually health-related (Brown, Doonan & Shellenberger 2005; Hall et al. 2004; Kelter, Grant & McLernon 2011). For people living with a mental illness there are often additional compounding social, cultural, economic, family or other factors that may form part of their presentation or care. Well-trained and briefed SPs in well-designed simulation scenarios can portray the complexities of mental illness with high-fidelity (Kidd et al. 2007). Simulations may require students to engage with the SP as if they were a real patient in a relevant clinical setting, or students may observe other clinicians or students engaging in a simulated clinical encounter.

Hybrid simulations can involve simulated patients working alongside an HPS or wearing a part-task trainer so that students can practise a particular technical skill while also communicating (Grant, Keltner & Eagerton 2011; Kameg et al. 2010). Role-playing may involve students working together in roles as clinician and patient. Paper-based case studies and technologically based simulations such as virtual worlds and serious games are also used as teaching tools.

Clinical placements are a standard part of healthcare education, with observation of experienced clinicians during clinical placements forming a part of the learning experience. Lave and Wenger (1991) suggest that learners begin by observing the culture of practice and argue that learners need to be able to participate in a legitimately peripheral way in a culture of practice. As well as general difficulty in accessing clinical placement hours, in mental health settings it can be difficult for students to gain access to patients because of patient and student safety (Greaves 1987). Moreover the nature of many mental illnesses and students observing clinical encounters changes the interpersonal dynamics, thus making direct evaluation of outcomes such as communication and mental health assessments very difficult (Kameg et al. 2009; Kidd et al. 2007).

There has been significant investment in recent years by the Australian Government towards expanding the capacity for simulated learning in clinical training through capital and recurrent investments in the public, private, education and non-government sectors (Health Workforce Australia 2015). There is now significant research to show that simulation-based health education promotes learner acquisition and maintenance of clinical knowledge, attitude and skills; however, there are comparatively few studies on the impact of simulation on patient outcomes and the collateral effects at a population level. This is particularly the case in the mental health sector.

Doolen (2014) found student nurses' interview skills and therapeutic communication was promoted when interviewing SPs (Doolen et al. 2014). The evidence also showed nursing students' confidence increased and anxiety decreased through this practice. Simulation can be used to familiarise students with mental illnesses and proper nursing management (Robinson-Smith, Bradley & Meakim 2009). Simulation can help familiarise students with mental illnesses before they encounter them in a clinical setting, increasing the student's ability to appropriately and confidently respond to patient needs.

The literature reveals studies of the application of various simulation techniques for educating healthcare personnel in mental health settings. This includes professions ranging from occupational therapy to nursing and psychiatric staff, although the bulk of literature is generated by the nursing and medical professions (Ballon, Silver & Fidler 2007; Hodges et al. 2008; Merryman 2010; Taverner, Dodding & White 2000). There is a need for mental health education to be provided to clinicians working in all healthcare settings, as people living with mental illness are present across all health settings. Robust evaluation of mental health simulation activities beyond the response of students is needed to determine the impact and value of simulation for people living with mental illness and their carers. Simulation offers many opportunities for developing skills, knowledge and behaviours (technical, non-technical and interprofessional teamwork) for students and clinicians working in mental health settings. Simulation provides opportunities to address the challenges related to stigma, safety and liability present in the psychiatric clinical setting (Brown 2008). The aim of this paper is to undertake a scoping literature review in order to better understand if simulation can improve mental health outcomes.

Methods

Scoping reviews incorporate a variety of literature sources from grey literature sites to peer-reviewed databases to provide an opportunity for researchers to develop a well-rounded understanding of the desired topic (Levac, Colquhoun & O'Brien 2010). This scoping review will use Levac, Colquhoun and O'Brien's (2010) five stage methodology for scoping reviews. These stages are:

1. identify the research question
2. identify relevant studies
3. study selection
4. charting the data
5. collating, summarising and reporting results.

While the scoping methodology states five stages, Levac, Colquhoun and O'Brien's (2010) suggested that a sixth stage, known as 'expert consultation', may be incorporated to provide further depth to the main findings of the review. This stage is considered optional as it allows for key contributors to offer an insight and validates the findings but is often difficult to obtain due to time constraints and making contact with experts.

1. Identify the research question

The mental health sector has been an area of significant research in recent years, with increasing importance being placed on different methods of education. With the incidence of mental illness increasing globally, health occupations require innovative and improved mental health educational methods (Kidd et al. 2015). The breadth of literature available on the use of simulation in medical education has led to the proposal of the research question: 'Can simulation improve mental health outcomes?' The topic was deemed to be focused yet broad enough to conduct an effective scoping review to determine the gaps in the literature regarding the use of simulation and mental health outcomes.

2. Identify relevant studies

A literature search of several online databases was conducted. These included: CINAHL, ProQuest, PubMed, Ovid MEDLINE, Embase and PsycINFO. No restriction was placed on dates or locations of publications. The search strategy can be seen in Table 2.1. For the full search strategies for each database (see Appendix 2.1). A number of grey literature sites were also examined for non-peer reviewed articles, including <ww.greylit.org>, Google Scholar and <www.tripdatabase.com>. Hand searches were also undertaken on full-text articles.

Table 2.1: Key search terms

	Main concepts		
Search terms	**Simulation**	**Mental health**	**Health occupations**
	'mannequin' MH 'patient simulation' MH 'simulations+' 'simulation, medical' 'health personnel as patients+' 'virtual patient' MH 'clinical competence'	exp mental health/ exp mental disorders/ 'mental conditions'	health occupations / allied health personnel / exp primary health care/ exp students, health occupations

3. Study selection

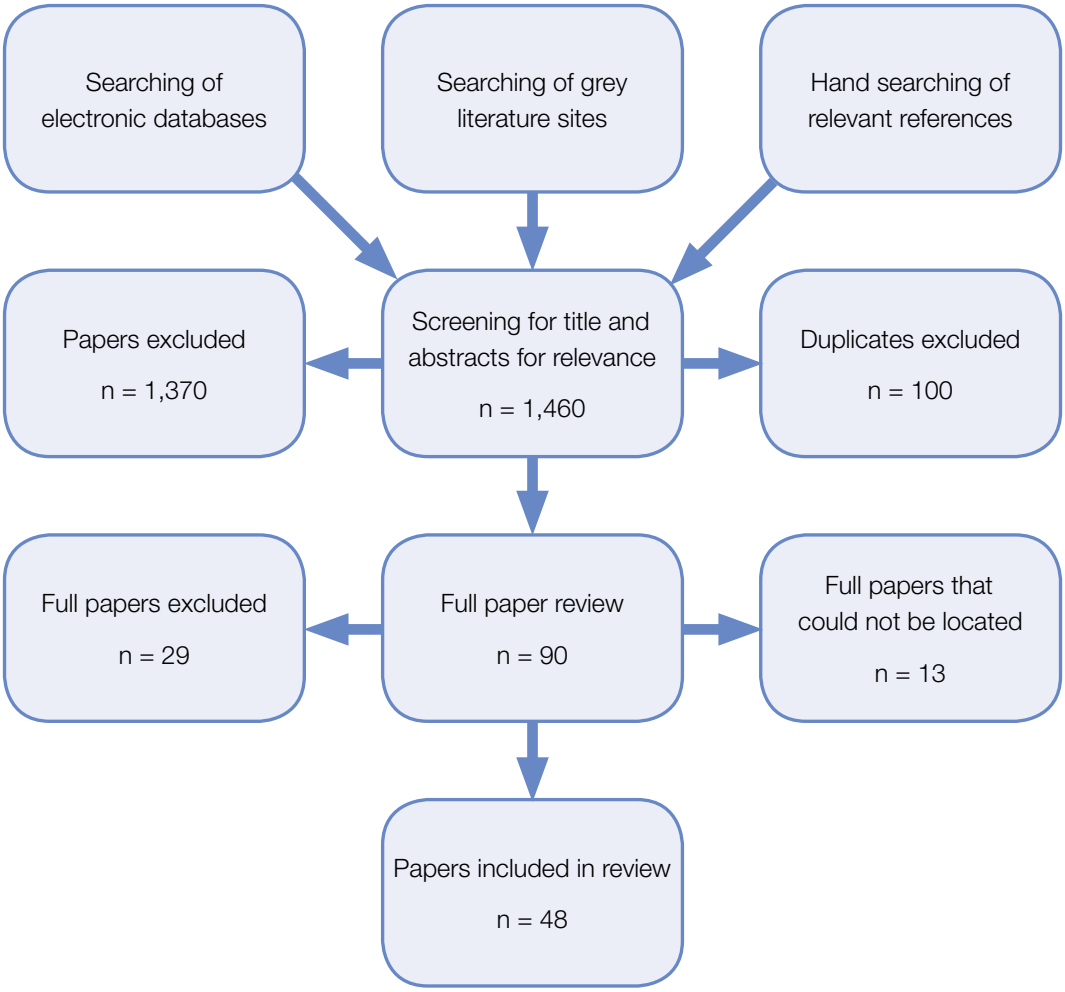
To be included, articles were guided by three inclusion criteria:

- articles incorporating mental health
- articles including simulation educational methods/outcomes
- articles related to health professionals and/or health students.

Articles were excluded if they were not written in English. The search was conducted by one author and ratified by an expert librarian; screening and full-text reviews were completed by two authors. Consensus was reached on all full-text papers and hence a third author was not required.

This initial search yielded 1,460 articles from the online peer-reviewed databases (after eliminating duplicates), while the grey literature sites and hand searches produced no new results. A title and abstract screening located 90 articles that were to be included for the next stage in sorting. Thirteen articles were unable to be located on the university databases and as such were excluded from the review. A further full article review yielded 48 results, which are to be included in this review. (See Figure 2.1 for the search methodology.)

Figure 2.1: Search strategy methodology



4. Charting the data

Charting the data involved synthesising the articles by sorting and grouping the literature according to common themes. Analysis of the included articles determined several different simulation methods used in mental health education for health professionals. It also determined whether the educational intervention was effective or ineffective in improving student knowledge and skill development. No articles were found that measured simulation impact on patient outcomes in mental health settings.

To assist with condensing the literature, the simulation methods were grouped based on key components. These included:

- simulation using people as patients
- simulation using manikins as patients
- simulation using a virtual environment.

5. Collating, summarising and reporting results

Among the 48 articles included for this review, a variety of points were discovered. Among the articles, 29 were conducted in the United States (USA), seven in the United Kingdom (UK), five in Australia, two in Canada and one each in Taiwan, Italy, Malaysia, Iran and Germany.

Of these 48 articles seven different types of simulation methods were incorporated including:

- virtual reality (nine)
- simulated patients and actors (17)
- manikins (four)
- role-play (six)
- computer simulation (four)
- objective structured clinical examination (OSCE) (four)
- voice simulation (which refers to the use of sounds and voice through an electronic medium to portray the sounds encountered by a person with schizophrenia) (four).

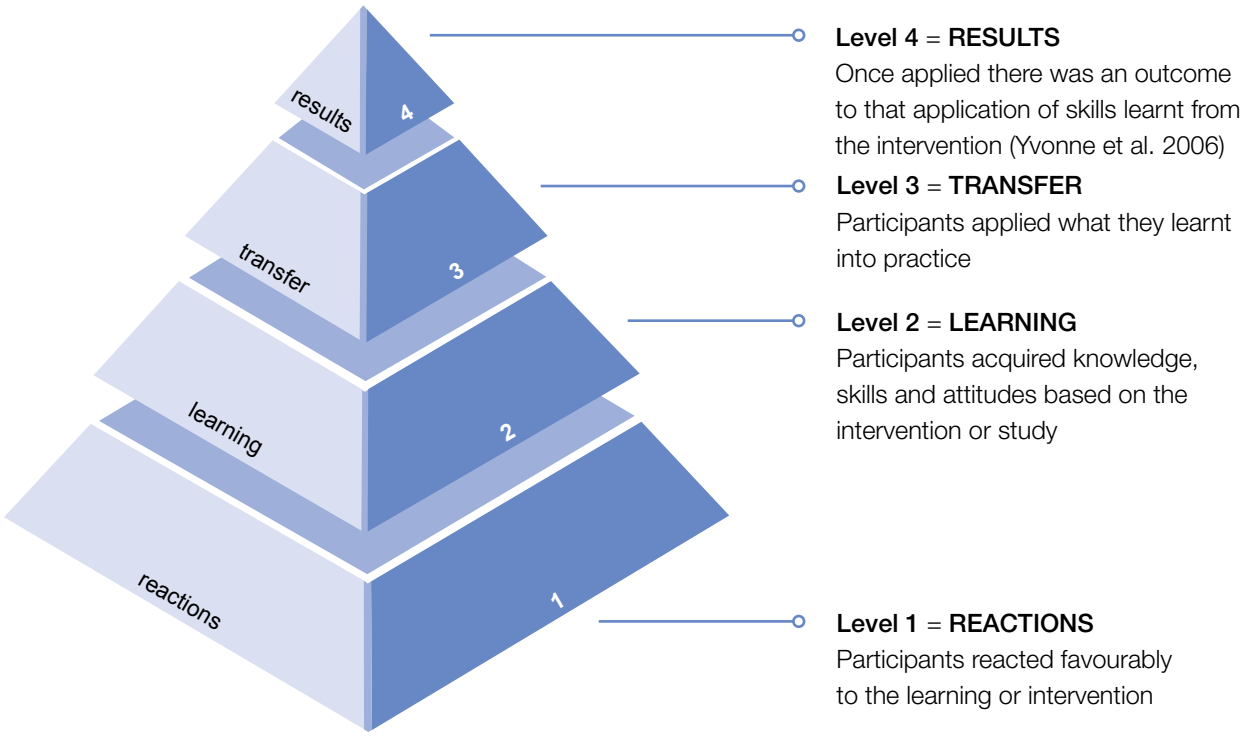
From these articles 39 suggested improvements in mental health education outcomes, while the remaining nine articles either suggested no benefit or used simulation to test clinician knowledge rather than assessing simulation. A full list of publications can be found in Appendix 2.2.

Nineteen of the 48 articles focused on mental health for nursing students, 14 looked at the impact on medical students, eight included psychiatrists and psychiatric students, one looked specifically at occupational therapy students and the remaining six looked at general practitioners (GPs), counsellors and healthcare workers.

Classification of educational outcomes: Kirkpatrick's model

The Kirkpatrick model is a framework created in order to determine the efficacy of a particular intervention, training or study (Yvonne et al. 2006). It allows educators, researchers and teachers to assess and objectively evaluate the effectiveness of the intervention. Its aim is to guide the user on ways and areas of improvement based on participant involvement, achievement and growth (Yvonne et al. 2006). The levels are as follows:

Figure 2.1: Kirkpatrick's four levels of evaluation



Source: Learnnovators 2015

Using this model helped provide strength to the review (see Appendix 2 for the Kirkpatrick ranking of each study). The current literature on mental health education using simulation lacks the patient outcome data and therefore provides an opportunity for future research and evaluation. This lack of patient outcome data is evident in the results of this review, with the vast majority of articles sitting between 2 and 3 on Kirkpatrick's model.

Discussion

Education for mental health is a topic of increasing interest as the incidence of mental illness rises in the general population. As research and technology improves, the understanding of mental illness increases, creating new treatment and education methods for clinicians and university students (Medley & Horne 2005). Among the educational methods seen as a panacea in better care of mental illness is simulation (Ballon et al. 2007). The use of this educationally exciting method has been implemented in medical, nursing and allied healthcare education for decades, with evidence suggesting its benefits to both learners and patients (Cosgray et al. 1990).

The current scoping review was conducted in order to determine whether the use of simulation is effective in improving mental health outcomes. Of the 48 results, 29 were conducted in the USA and seven in the UK, suggesting that, although there was a significant yield for this review, the results may not be readily translatable to an Australian healthcare setting. It also suggests that more research in Australia is required. With only three articles highlighting the impacts in non-Westernised countries, the results cannot be generalised to the wider population (Lin et al. 2012; Shahabudin et al. 1994; Shirazi et al. 2011).

Among the 48 articles, seven simulation types were found (SPs, virtual reality, OCSE, manikins as patients, role-play, voice simulation and computer simulation) using a range of study designs and reviews. Within these different simulation types 17 articles conducted research on the use of SPs, while only four articles examined the use of manikins or voice simulation. These results suggest that a number of simulation types have received very little empirical examination in the mental health sector. The analysis from this review has led to the development of three main themes of discussion:

- simulated patients (SPs)
- manikins as patients
- virtual reality patients.

Simulated patients

The use of actors portraying patients has been thought to be the most effective way to educate health professionals in communication and skills acquisition (Keltner et al. 2011). Non-technical skills are key for all healthcare workers, with the need for developing effective communication techniques a central component in all patient–client interactions (Shawler 2008). Due to the origin and understanding of mental illness being of a non-physical nature, for example, they cannot be seen visually like a traumatic injury may; communication becomes a significant factor in diagnosing and treating mental illness (Shawler 2008). Working with actors to portray patients and using methods such as role-play have been noted to be reliable and effective ways to teach mental health assessment and communication skills (Crider & McNiesh 2011; Fay-Hillier et al. 2012). Hall and colleagues (2012) noted that using actors in place of mental health patients was effective in enhancing the assessment and therapeutic communication skills of nursing students. Of the 112 students who were a part of this pilot study, 80 per cent agreed that the SP accurately portrayed depression, and 100 per cent of the cohort reflected improved communication.

With a study size of 34 paediatric residents (27 of whom completed both before and after testing), Lewy and colleagues (2009) reported that the participants found the mixed-methods study increased their confidence in patient treatment, with 69 per cent stating the intervention was 'extremely helpful'. Shahabudin and colleagues (1994) trained medical students to act as patients presenting with various mental illnesses in order to assess the knowledge and diagnostic abilities of 42 GPs. The findings were grouped into three categories based on the performance of the doctors: group A included 11.9 per cent of the GPs who informed the SPs of the anxiety diagnosis; in group B 28.6 per cent of the GPs prescribed medication for anxiety but did not inform the SP of the diagnosis; and group C consisted of the 59.5 per cent of GPs who did not diagnose nor treat the SP. This study highlighted the lack of training, assessment and treatment flaws in the GPs' management of mental health and highlights an opportunity for future research and investigation.

Fussell et al.'s (2009) study suggested that actors portraying people with substance abuse provided reliable and effective portrayals in educating and assessing substance abuse counsellors. With a sample size of 21 practising clinicians, the study found improved effectiveness and authenticity of SPs using a five-point Likert scale from 1 = strongly agree to 5 = strongly disagree, with the mean score at 1.9 for male and 1.6 for female patients.

Role-play was suggested by Roberts, Wiskin and Roalfe's (2008) randomised controlled trial to be neither effective nor ineffective in improving the assessment skills and views on people living with a mental illness of undergraduate medical students. The study consisted of 332 medical students who scored their perceived stigma associated with mental illness on an attitudinal scale. With a score range of 13 to 35 and a mean of 26, the study suggested that the students had less stigmatising views on mental illness than those in society (Shahabudin et al. 1994). Overall, from these studies there was a positive response to working with people as patients in the mental health education of various health professionals.

Manikins as patients

This review only located four articles that utilised manikins in the mental health setting. All of these articles focused on nursing students, suggested a positive response, and portrayed the effectiveness of using manikins in mental health education. A study by Kameg and colleagues (2013) found that students who were previously at risk of failing were no longer at risk after completing training with the use of high-fidelity manikins. The quasi-experimental study design with a group size of 35 nursing students completed a 30-item Health Education Systems Incorporated (HESI) custom exam pre and post simulation. Although the mean results of the HESI exam saw a decrease after the simulation intervention, an ANOVA found the results to be statistically insignificant ($p = 0.29$) (Kameg et al. 2013). Of the 13 'at-risk' students, 10 improved their category to 'non-risk' level post simulation with a mean of 863.6 from 737.7, with statistically significant results ($p < 0.05$).

Kameg and colleagues (2010) also noted that the use of manikins was an effective approach in teaching communication skills to nursing students. Similarly, Grant et al.'s (2011) review paper noted that high-fidelity manikins, when in combination with OSCEs, were a viable training source to improve therapeutic communication skills. Unsworth, McKeever and Kelleher's (2012) study utilised the SimMan (a medium-fidelity manikin) and found that using manikins was effective in highlighting to students where their areas of weaknesses were, and what needed to be improved for their prospective healthcare careers. The qualitative measures of the study (including focus groups) revealed that the students thought of the intervention as 'bridging the gap' between developing vital skills that are rarely seen in practice but are necessary to understand (Kameg et al. 2013). Manikins have been found to be a positive addition to mental health education for nursing students, but further research needs to be conducted to determine if these findings are generalisable to other professions.

Virtual reality patients

Virtual reality for the purpose of this discussion included computer and voice simulation as well as virtual patients. Seventeen articles were included in the virtual reality patient group, with the spread of occupations incorporating a mix of nursing, medical and psychiatric practitioners. The general consensus between the main findings of the studies is that these methods are effective in mental health education (Heiser et al. 1979). Guise, Chambers and Valimaki (2012) found that virtual patients can be very effective in teaching clinical decision-making skills to nursing students, especially those who are part of distance learning groups. The reduced risk of negative consequences for incorrect diagnosis and treatment assisted students in learning mental health clinical skills.

Lambert and Watkins (2013) found that using an avatar portraying a person living with a mental illness was effective in educating nursing students on appropriate communication methods. A total of 85 mental health nursing students followed the in-hospital journey of the fictional avatar for a two-week period. Although the study did not focus on any form of assessment, it found that the students became more understanding and ethical practitioners at the completion of the study and urged other organisations to follow suit in their training methods. Satter et al.'s (2012) study, which included 14 practising physicians, found that the use of avatars was much more effective when assessing the ability of GPs to diagnose post-traumatic stress disorder (PTSD) when compared with those who used paper-based scenarios. The difference in diagnosing accuracy was evident in the PTSD scenario where those using the text-based scenario had a correct diagnosis rate of mean = 0.28 compared with the avatar intervention group, with a rate of mean = 0.57.

In another study, Heiser (1979) found that psychiatrists had a 50 per cent chance of correctly diagnosing paranoia in a computer-simulated patient compared with a real patient. Given the technology capability in 1979, Heiser's results may not be necessarily compatible with modern-day technology, but the general method of simulation used is still relevant and transferable today.

Voice simulation is effective in portraying the experience of schizophrenia and, as Weiland, Levine and Smith's (2014) qualitative study suggested, this is a valuable tool in increasing patience and empathy in nursing students. With a sample size of 74, the students listened to audio recordings of common voices heard in schizophrenia while attempting to complete certain tasks such as a job application. Based on the reflective evaluations completed by the students post intervention, common themes emerged included feelings of 'frustration' and 'annoyance', leading to increased levels of patience and empathy towards patients with schizophrenia.

Virtual simulation is proving to be a more prominent method for mental health education in today's society, particularly as technology advances. Its effectiveness is yet to be fully determined; however, the indication from the majority of studies is that the virtual world is a positive way to educate health professionals in mental illnesses.

Limitations

Among the main limitations in conducting the review were difficulties in obtaining full-text articles, resulting in the need to exclude them from the review. This may have resulted in useful articles not being included for review, which may affect some of the findings of this paper. Articles not in English were excluded from this review; this is an important limitation and publication bias. The search of grey literature sites yielded only peer-reviewed articles; this suggests the depth of included articles does not incorporate non-peer-reviewed literature, which could bring strength to the findings.

Recommendations for future research

The most significant gap in the current research base is the lack of evidence that mental health simulation directly affects patient outcomes. This scoping review has found several gaps in the current literature that provide researchers, policymakers and educators will a 'roadmap' of future research opportunities. These include:

- interdisciplinary research
- Aboriginal education
- paediatric patients, young adults and the elderly
- patient outcomes
- different methods of simulation (such as DVDs)
- pre-hospital care
- GPs
- SPs.

Further research is needed for professions other than medicine and nursing. Given a large portion of the existing research focused on these professions the findings may not be generalisable to other disciplines. In addition, more focus needs to be given to out-of-hospital care including emergency paramedic clinicians and GPs working with people experiencing acute mental health issues.

A significant gap in the mental health literature relates to indigenous populations including Aboriginal Australians. Similarly, there is minimal amount of literature on the use of simulation in the mental health education for paediatric patients (aged one to 15), young adults (aged 16–21) and the elderly population (65 years or older). With the growing trend of paediatric mental health incidence, developing knowledge for the most effective way to educate paediatric health professionals needs to be addressed. With this in mind the evidence suggests that more research needs to be conducted utilising simulation for paediatric patients to educate mental health professionals.

Although there is an abundance of literature on the use of various types of simulation in mental health education, there is a lack of patient outcome measures linked to simulation-based education. Further research needs to be conducted into how simulation in mental healthcare relates to the patient's outcome in terms of successful or unsuccessful treatment and quality of life. This was supported in the evaluation using Kirkpatrick's model where no level 4 studies were located in any of the 48 articles. Furthermore, research may be conducted into the impact on patient family health that simulation may present. Therefore the lack of evidence strongly recommend further research be conducted in order to determine the possible positive and negative patient outcomes that may arise from using simulation to educate health professionals who require mental health knowledge and skills.

One final recommendation from the evidence is that more research be conducted into the use and success of other forms of simulation, for example, DVDs. The findings of this review indicated that there is a significant amount of literature on working with actors as SPs, but there are minimal articles on the use of manikins, voice and computer simulation, which may reflect on the relative efficacy of these modes in mental health settings. Moreover, greater importance needs to be given to quantitative measures because the predominant findings to the studies included were of a qualitative nature.

The evidence suggests that robust evaluation of simulation programs needs to be undertaken to provide evidence of the impact of simulation in mental healthcare education beyond student reactions. Ideally, evaluation plans would be incorporated at the design phase of new programs and introduced into programs that already exist.

Conclusions

There is no evidence that simulation improves mental health patient outcomes. Evidence that is available suggests a number of simulation methods are currently being used throughout the mental health sector and that this is having some benefit to participants and programs rather than patients. Although the use of simulation in mental health education has proved mostly beneficial, the results are still varied and as such are not necessarily generalisable. Perhaps the nature of mental illness itself, with outcomes that are often less tangible than in other healthcare settings, presents one of the challenges in taking evaluation of simulation in mental healthcare beyond immediate student reactions. Further examination into the impact of simulation in mental healthcare education could highlight possible patient outcomes.

Conflicts of interest

The authors declare no conflict of interest.

Appendix 2.1: Search strategy for each database

	CINAHL	ProQuest	PubMed
Strategy	(all(MH 'Health Occupations+') OR (MH 'Students, Health Occupations+') OR (MH Allied Health Professions+') OR ('Health Personnel') OR (MH 'Allied Health Personnel') OR (MH 'Primary Health Care') OR (MH 'Rural Health Personnel')) AND (all(MH 'Models, Anatomic+') OR 'man*ikin' OR 'mannequin' OR (MH 'Patient Simulation') OR (MH 'Simulations+') OR 'simulation, medical' OR 'Health Personnel as Patients+') OR 'virtual patient' OR (MH 'Clinical Competence)) AND (all(MH 'Mental Health') OR (MH 'Mental Disorders, Chronic') OR (MH 'Mental Disorders') OR 'mental illness'	(all(exp *Allied Health Occupations/) OR all((exp *Primary Health Care/ OR exp *Health Occupations/)) OR all(student*, health occupation*)) AND (all(patient simulation*) OR all((mannequin* OR man*ikin*)) OR all((models, anatomic OR virtual* patient*))) AND (all(exp Mental Health/) OR all(mental disorder*))	((((student*, health occupation*) OR (((exp *Primary Health Care/) OR exp *Health Occupations/) OR exp *Allied Health Occupations/))) AND ((mental disorder*) OR mental health)) AND ((simulat*) OR (((((patient simulation*) OR mannequin*) OR mannikin*) OR manikin*) OR virtual patient*))

	MEDLINE	Embase	PsycINFO
Strategy	((mannequin*mp.) OR (OSCE.mp.) OR (manikin*mp) OR (man*ikin.mp) OR (computer*adj3 interact*) OR (computer*adj3 therap*) OR (clinical skill* adj3 assessment) OR (role adj3 play*) or (patient simulation.mp) OR (simulat*) OR (virtual adj3 patient*)) AND ((exp Mental Health/) OR (exp Mental Disorders/)) AND ((exp Health Occupations/) OR (Allied Health Personnel/) OR (exp Primary Health Care/) OR (exp Students, Health Occupations)	((mannequin*mp.) OR (OSCE.mp.) OR (manikin*mp) OR (man*ikin.mp) OR (computer*adj3 interact*) OR (computer*adj3 therap*) OR (clinical skill* adj3 assessment) OR (haptic*) OR (anatomic model/) OR (patient simulation/)) AND ((exp Mental Health/) OR (exp Mental Disease/)) AND ((health occupations.mp) OR (medical profession/) OR (health care personnel/) OR (paramedical personnel/) OR (allied health professional.mp) OR (primary healthcare/)	((mannequin*mp.) OR (OSCE.mp.) OR (manikin*mp) OR (man*ikin.mp) OR (computer*adj3 interact*) OR (computer*adj3 therap*) OR (clinical skill* adj3 assessment) OR (haptic*) OR (anatomic model/) OR (role adj3 play*) or (patient simulation/)) AND ((exp Mental Health/) OR (exp Mental Disorders/) OR (mental conditions)) AND ((health occupations.mp) OR (medical profession/) OR (healthcare personnel/) OR (Allied Health Personnel) OR (exp Primary Health Care/) OR (students, health occupations) OR (Medical Personnel)

Appendix 2.2: Overview of selected publications

Type	Title	Benefit	Date and location	Occupation type	Kirkpatrick level (1–4)
Virtual reality/ patients	Optimizing clinical training for the treatment of PTSD using virtual patients	Yes, using virtual reality patients undergoing virtual therapy improved interviewing abilities and communication	2009, USA	Mental health clinicians	Level 2
	What can virtual patient simulation offer mental health nursing education?	Yes, suited to teach clinical decision making, especially for online learning	2012, UK	Nursing students	Level 2
	Enhancing intellectual empathy: the lived experience of voice simulation	Yes, the use of voice simulation to depict mental disorders enhanced student empathy	2009, USA	Undergraduate nursing students	Level 3
	Meet Mohammed: using simulation and technology to support learning	Yes, the use of the avatar (Mohammed) to practise clinical communication skills was effective	2013, UK	Mental health nursing students	Level 2
	Effectiveness of a virtual patient program in a psychiatry clerkship	Yes, virtual patients were effective in providing supplemental training in clinical reasoning for psychiatry clerkship	2012, Taiwan	Medical students	Level 3
	Virtual reality training for health-care professionals	Yes, enhanced the learning process by increasing motivation and interest	2003, Italy	Health professionals	Level 2
	Avatar-based simulation in the evaluation of diagnosis and management of mental health disorders in primary care	Yes, those who used avatars were better at diagnosing PTSD and depression than those who used paper-based scenarios	2012, USA	Primary care practitioners	Level 3

Type	Title	Benefit	Date and location	Occupation type	Kirkpatrick level (1–4)
Virtual reality/ patients (continued)	A comparison of psychiatric decision making by trainee general practitioners and trainee psychiatrists using a simulated consultation model (uses video-taped patients)	Looked at assessment and diagnostic abilities of the doctors	1988, UK	GPs and psychiatrists	Level 2
	Virtual standardized patients: an interactive method to examine variation in depression care among primary care physicians	The use of interactive virtual patients for determining physician diagnosis of depression	2008, USA	Primary care physicians	Level 1
Simulated patients/actors	Using children as simulated patients in communication training for residents and medical students: a pilot program	Yes, benefited the students by improving their assessment and interview skills when working with child actors depicting ADHD and mental disorders	2005, USA	Medical students	Level 2
	Using standardized patients to bring case studies to life	Yes, helped enhance and develop assessment skills and therapeutic communication skills	2012, USA	Nursing students	Level 3
	Communication and patient safety in simulation for mental health nursing education	Yes, effectively taught nurse–patient communication using actors as standardised patients	2012, USA	Undergraduate nursing students	Level 2

Type	Title	Benefit	Date and location	Occupation type	Kirkpatrick level (1–4)
Simulated patients/actors (continued)	Use of standardized patients to enhance a psychiatry clerkship	Yes, increased effectiveness in communicating and diagnosing five different mental illnesses using standardised patients	2004, USA	Medical students	Level 3
	Use of actors as standardized psychiatric patients	Yes, actors played the role of grieving parents after the death of the child and staff benefited by improving skills	2011, USA	Physicians, nurses, social workers, grief counsellors and administrators	Level 2
	Adolescent depression: evaluating pediatric residents' knowledge, confidence, and interpersonal skills using standardized patients	No. Residents applied bias due to knowing they were being assessed, therefore it was not a good tool to determine effectiveness	2009, USA	First-year residents	Level 1
	Simulations in drug training	Yes, gained useful information about patient feelings and behaviours	1975, USA	Range of people from different backgrounds including five clinicians	Level 2
	Assessing the competence of general practitioners in diagnosing generalized anxiety disorder using standardized patients	Study was to understand GP knowledge on diagnosing anxiety using medical students as standardised patients	1994, Malaysia	GPs	Level 1

Type	Title	Benefit	Date and location	Occupation type	Kirkpatrick level (1–4)
Simulated patients/actors (continued)	Standardized patients: a creative teaching strategy for psychiatric-mental health nurse practitioner students Making it real: using standardized patients to bring case studies to life	Yes, increases cultural competency and assessment and communication skills	2008, USA	Nursing practitioner students	Level 2
	Training and validation of standardized patients for unannounced assessment of physicians' management of depression	Psychology and nursing students were used as standardised patients to assess GP knowledge and assessment skill when being patients to unaware GPs; did not look at GP skills	2009, Iran	GPs	Level 1
	Working together: a joint initiative between academics and clinicians to prepare undergraduate nursing students to work in mental health settings	Yes, it enhanced clinical skills through workshops that implemented mental health clinicians as actors	2007, Australia	Undergraduate nursing students	Level 3
	End of third-year objective structured clinical examination: boon or bane?	Yes, using standardised patients for OSCEs can improve general skill acquisition but not effective at all for psychiatric problem solving	2008, USA	Medical students	Level 3

Type	Title	Benefit	Date and location	Occupation type	Kirkpatrick level (1–4)
Simulated patients/actors (continued)	Ratings of videotaped simulated patient interviews and four other methods of evaluating a psychiatry clerkship	Yes, after the six-week program the students improved their interviewing skills	1987, USA	Psychiatry clerkships	Level 3
	Portrayal of psychiatric disorders: are simulated patients authentic?	Yes, SPs are effective in teaching psychopathology but not as effective as real patients	2013, Germany	Psychiatrists	Level 1
	Promoting therapeutic communication and patient-centered care using standardized patients	Yes, improved safety and therapeutic communication	2013, USA	Nursing students	Level 2
	An evaluation of mental health simulation with standardized patients	Yes, it improved the interviewing skills of patients with varied mental health issues	2014, USA	Nursing students	Level 2
	Evaluating and training substance abuse counsellors: a pilot study assessing standardized patients as authentic clients	Yes, using actors as SPs is effective	2009, USA	Substance abuse counsellors	Level 2

Type	Title	Benefit	Date and location	Occupation type	Kirkpatrick level (1–4)
Manikins	The impact of high fidelity human simulation on self-efficacy of communication skills	Yes, it is viable in communication training	2010, USA	Nursing students	Level 2
	Simulation to enhance care of patients with psychiatric and behavioral issues: use in clinical settings (also has OSCE)	Yes, high-fidelity manikin and OSCE improve therapeutic communication skills	2011, USA	Nursing students	Level 3
	Fusion of psychiatric and medical high-fidelity patient simulation scenarios: effect on nursing student knowledge, retention of knowledge, and perception	Yes, students who were previously at risk were not at risk after the training with high-fidelity manikins	2013, USA	Nursing students	Level 3
	Recognition of physical deterioration in patients with mental health problems: the role of simulation in knowledge and skill development	Yes, increased confidence and highlighted areas of improvement for students	2012, UK	Nursing students	Level 3

Type	Title	Benefit	Date and location	Occupation type	Kirkpatrick level (1–4)
Role-play	Automating individualized coaching and authentic role-play practice for brief intervention training	Yes, achieved higher scores after participating in online training and role-play	2010, USA	Medical and nursing students	Level 2
	Integrating a professional apprenticeship model with psychiatric clinical simulation	Yes, it enhanced communication abilities for nurses working with patients with schizophrenia through role-play	2011, USA	Undergraduate nursing students	Level 2
	Headspace theatre: an innovative method for experiential learning of psychiatric symptomatology using modified role-playing and improvisational theatre techniques	Yes, it was beneficial as it assisted knowledge/skill development for mental health and addiction	2007, Canada	Medical students, psychiatric students, social workers, nurse, gambling therapists	Level 3
	Effects of exposure to mental illness in role-play on undergraduate student attitudes	Role-play did not improve nor did it diminish student attitude and perception towards mentally ill patients	2008, UK	Medical students	Level 2
	Use of interactive teaching techniques to introduce mental health training to medical schools in a resource poor setting	Yes, after the use of role-play the MCQ and OSCE score improved	2013, UK	Medical students and interns	Level 3
	A day in the life of an inpatient: an experiential game to promote empathy for individuals in a psychiatric hospital	Yes, it improved empathy and changed the way staff treated patients after the simulation games	1990, USA	Psychiatric hospital staff	Level 2

Type	Title	Benefit	Date and location	Occupation type	Kirkpatrick level (1–4)
Computer simulation	Can psychiatrists distinguish a computer simulation of paranoia from the real thing? The limitations of Turing-like test as measures of the adequacy of simulations	Maybe. The computer simulation results in five accurate diagnosis and five inaccurate diagnoses	1979, USA	Psychiatrists	Level 2
	Comparison of methods for teaching clinical skills in assessing and managing drug-seeking patients	No significant difference between exam results for students who were taught by SPs compared with computer	2000, Australia	Medical students	Level 2
	'eSimulation'. Part 1 & 2: Evaluation of an interactive multimedia mental health education program for generalist nurses	Yes, interactive online program allows for mass usage and encourages staff to make choices without fear of incorrectly diagnosing hence increasing confidence	2012, Australia	Generalist nurses	Level 2

Type	Title	Benefit	Date and location	Occupation type	Kirkpatrick level (1–4)
OSCE	Validation of an objective structured clinical examination in psychiatry	Yes, this is a valid form of assessment, using eight stations in the OSCE	1998, Canada	Psychiatry clerkship students	Level 2
	Psychiatry clerkship objective structured clinical examination is here to stay	Yes, OSCE is an effective way to test communication skills but is expensive and should not be the sole assessment method	2008, USA	Medical students	Level 2
	Teaching and assessing residents' skills in managing heroin addiction with objective structured clinical examinations (OSCEs) (also includes standardised patients)	Half-half. Residents had better communication but not as good in management or assessment of risk behaviour in heroin-abusing patients using SPs	2013, USA	Medical residents	Level 2
	Teaching about substance abuse with objective structured clinical exams (also includes standardised patients)	Yes, students' communication skills with substance abuse patients improved while confidence and interest increased	2006, USA	Medical residents	Level 3

Type	Title	Benefit	Date and location	Occupation type	Kirkpatrick level (1–4)
Voice simulation	Simulation in mental health education	Yes, improved confidence and attitude through the use of voice simulation through an MP3 player	2011, Australia	Mental health professionals	Level 2
	Mindful teaching practice: lessons learned through a hearing voices simulation	Yes, listening to an MP3 player while attempting to complete other tasks increased comfort with people who hear voices and increased patience and tolerance	2015, USA	Mental health nursing students	Level 3
	Effects of simulated learning and facilitated debriefing on student understanding of mental illness	Yes, listening to sounds that may be heard by a person with schizophrenia (for example) increased empathy and patient understanding	2010, UK	Occupational therapy students	Level 3
	Hearing distressing voices clinical simulation	Yes, hearing distressing voices and seeing hallucinations made students feel empathetic and understanding	2014, USA	Nursing students	Level 3

NB: Kirkpatrick levels: 1 = reaction, 2 = learning, 3 = behaviour, 4 = results
1 = Participants react favourably to the learning or intervention.
2 = Participants acquired knowledge, skills and attitudes based on the intervention or study
3 = Participants applied what they learnt into practice
4 = Once applied there was an outcome to that application of skills learnt from the intervention Source: Yvonne et al. 2006

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