

Simulation-based education for teaching aggression management skills to healthcare providers in acute healthcare settings: A systematic review



Marijke Mitchell^{a,b,c,e,*}, Fiona Newall^{b,c,d}, Charmaine Bernie^{a,c,d,f}, Amanda Brignell^{a,d,e}, Katrina Williams^{a,c,d,e}

^a Department of Paediatrics, Monash University, Clayton, Melbourne, Australia

^b Royal Children's Hospital, Parkville, Melbourne, Australia

^c Department of Paediatrics, The University of Melbourne, Parkville, Melbourne, Australia

^d Murdoch Children's Research Institute, Parkville, Melbourne, Australia

^e Monash Children's Hospital, Clayton, Melbourne, Australia

^f Southern Cross University, Bilinga, Queensland, Australia

ARTICLE INFO

Article history:

Received 22 March 2023

Received in revised form 31 May 2024

Accepted 10 June 2024

Available online xxxx

Keywords:

Aggression
Dangerous behaviour
Disruptive behaviour
Health personnel
Hospitals
Simulation training
Systematic review

ABSTRACT

Background: Behavioural emergencies involving aggression in acute care hospitals are increasing globally. Acute care staff are often not trained or confident in their prevention or management. Of available training options simulation-based education is superior for clinical medical education and is gaining acceptance for teaching clinical aggression management skills.

Objective: The aim of this study was to conduct a systematic review of the effectiveness of simulation-based education for teaching aggression management skills for health professionals working in acute healthcare settings.

Methods: The study protocol was prepared in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) statement, registered (27/02/2020) and published. We included randomised controlled trials, non-randomised controlled trials, quasi-experimental studies, and observational studies involving healthcare professionals in acute hospital settings or trainee health professionals who received simulation-based training on managing patient aggression. Comprehensive searches were conducted in PubMed, Ovid MEDLINE, PsycINFO, CINAHL and The Cochrane Library. Two reviewers independently screened all records, extracted data and assessed risk of bias. The primary outcomes included patient outcomes, quality of care, and adverse effects. Secondary outcomes included workplace resource use, healthcare provider related outcomes, knowledge (de-escalation techniques), performance, attitudes, and satisfaction. A narrative synthesis of included studies was performed because substantial variation of interventions and outcome measures precluded meta-analyses.

Results: Twenty-five studies were included with 2790 participants, 2585 (93%) acute care hospital staff and 205 (7%) undergraduate university students. Twenty-two studies combined simulation-based education with at least one other training modality. Three studies were randomised controlled trials, one was a pilot and feasibility cluster randomised controlled trial, one was a three-group post-test design and twenty were pre-/post-test design. Twenty-four studies were deemed to be high/critical or serious risk of bias. Four studies collected primary outcome data, all using different methods and with inconsistent findings. Twenty-one studies assessed performance in the test situation, seven studies provided objective ratings of performance and eighteen provided self-report data. Twenty-three studies reported objective or subjective improvements in secondary outcomes.

Conclusions: Acute healthcare staff who completed simulation-based education on managing clinical aggression showed statistically significant improvements in knowledge and self-reported confidence. However, there is a lack of evidence about the magnitude of these improvements and impact on patient outcomes.

Registration: PROSPERO Registration Number CRD42020151002.

Tweetable abstract: Simulation-based education improved acute healthcare clinician knowledge and confidence in managing aggression.

© 2024 The Author(s). Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

* Corresponding author at: Department of Paediatrics, Monash University, Monash Children's Simulation, Monash Children's Hospital, Level 5, 246 Clayton Road, Clayton, Victoria 3168, Australia.

E-mail address: marijke.mitchell@monash.edu (M. Mitchell).

What is already known

- Aggression initiated by patients in acute care settings is increasing globally with clinicians reporting a lack of confidence in preventing and managing behavioural emergencies.

- Simulation-based education has been used in the acute care setting to train staff to manage patient deterioration, resuscitation and improve interpersonal and team communication.
- Simulation-based education may improve acute care clinician confidence and skills in de-escalation and aggression management, yet quality evidence is lacking.

What this paper adds

- Staff working in acute care settings who completed simulation-based training on managing aggression showed statistically significant improvements in knowledge and self-reported confidence.
- Further evidence is required on the magnitude of these improvements and the impact on patient outcomes.

1. Background

Aggression demonstrated by patients in hospital has been a longstanding and costly issue and is of increasing concern (Aljohani et al., 2021; Ramacciati et al., 2016; Zhang et al., 2017). The healthcare industry has been described as one of the most violent industries in which to work (D'Ettorre et al., 2018; Grossman and Choucair, 2019). The problem is not unique to adult acute care settings with increasing incidents of aggression demonstrated by children and young people in hospitals (Carison et al., 2020; Carubia et al., 2016; Malas et al., 2017; Mitchell et al., 2022).

Behavioural emergencies caused by young people in paediatric hospitals are sufficiently frequent to require prioritisation as a global child health hazard (Benton et al., 2021). Children with additional needs, including autism, account for nearly half of all incidents in one Australian tertiary hospital (Mitchell et al., 2022). In addition, presentations to paediatric emergency departments for behavioural crises in Australia have increased since the onset of the COVID-19 pandemic (Carison et al., 2020; Lovett et al., 2022). The costs and time-burden of managing behavioural emergencies are high, with one institution calculating 3000 h of direct staff time each year (Mitchell et al., 2022). Other costs include injuries to patients, families and staff, and behaviour changes in staff and patients due to stress, with reduced work attendance and healthcare presentations, respectively (Stewart and Reeves, 2021; Zhang et al., 2018).

Individuals admitted to hospital, and their carers, experience increased stress because of their health concerns, the unfamiliar nature of situations, and medical procedures that can cause pain (Abuatiq, 2015; Alzahrani, 2021). Even short periods of hospitalisation can have negative effects for individuals and their carers and families, resulting in reduced use of health care when needed (Alzahrani, 2021). Individuals with more complex needs, communication challenges, fewer resources, and a limited range of coping behaviours can display aggression to communicate fear and frustration. Consequently, they are at increased risk for prolonged or abandoned investigations or treatments, poorer health outcomes and psychological trauma from hospital management processes and use of restraint (Croen et al., 2006; Iacono et al., 2014).

Staff in acute care hospitals are often not trained in the prevention and management of aggression (Chang et al., 2022; Croen et al., 2006; Hazen et al., 2020; Malas et al., 2017). Mandatory training, such as managing the deteriorating patient, is often focussed on the management of physical deterioration and key clinical competencies. The same attention is not devoted to behavioural emergencies. This disparity is concerning given that violence in hospitals is a complex problem which requires a confident, well-trained workforce and can result in serious health implications, potential long-term trauma for patients, families and staff and delayed or repeated episodes of care (Woodman et al., 2014). In addition, acute care staff who regularly experience aggression are at high risk for burnout (Converso et al., 2021).

Behavioural emergencies in hospitals often trigger a team response utilising staff from a range of clinical areas and roles (Mitchell et al., 2020b). Multidisciplinary training should replicate the clinical experience and provide repetitive practice of de-escalation without patient or staff risk (Krull et al., 2019; Vestal et al., 2017). Coupled with this, reflective debriefing and feedback on performance are important adjuncts to promote deeper learning (Krull et al., 2019; Rudolph et al., 2008, 2007; Vestal et al., 2017). Simulation-based education brings together these training opportunities and uses an established evidence base in medical education to accelerate the speed of learning, amount of information retained, and capability for deliberate practice (Bilotta et al., 2013). Group training with simulation provides experiential learning, allows participants to practice clinical skills in a risk-free environment and improves their situation awareness, leadership (Lewis et al., 2012), communication (Johnson et al., 2017) and teamwork skills (Siassakos et al., 2011). Simulation-based education, which utilises deliberate practice and reflection on performance, is thought to be more effective than traditional teaching formats in medical education (McGaghie et al., 2011).

Simulation-based education has potential to be a very effective training modality for teaching acute care clinical teams to prevent and de-escalate aggression. Aggression management training programmes using simulation-based education have been developed and evaluated in psychiatric and mental health settings (Cowin et al., 2003; Livingston et al., 2010). Recently, the use of simulation-based education in the acute healthcare setting for the prevention and management of clinical aggression is gaining momentum. However, an overall synthesis or examination of the efficacy of these programmes has not been undertaken.

This review will provide a valuable contribution to what is known about the effectiveness of simulation-based education for acute care clinicians on preventing and managing clinical aggression. We have used the term 'acute care setting' in preference to 'hospital', acknowledging that not all hospitals provide acute care.

The aim of this review was to explore if:

1. Simulation-based education is an acceptable format of training for teaching management of clinical aggression strategies to health professionals working in acute care settings;
2. Simulation-based education increases participants' knowledge, skills, and confidence in managing clinical aggression;
3. Participants are able to apply their learnings from simulation-based education to the work setting and reduce episodes of aggression and associated clinical interventions and sequelae.

2. Methods

The study protocol (registered on 27/02/2020 with PROSPERO: CRD42020151002) was prepared using a recognised reporting guideline and has been published (Mitchell et al., 2020a). Inclusion criteria were randomised controlled trials (RCTs), non-randomised controlled trials, quasi-experimental studies, and observational studies involving healthcare professionals in acute care settings or trainee health professionals who received simulation-based education on managing patient aggression. Only studies which used live, face-to-face simulation-based education with participants actively managing patient aggression were included. Exclusion criteria were studies conducted in mental health settings in non-acute care hospitals.

Selection of outcome measures was based on the Kirkpatrick Model (Kirkpatrick, 2006; Kirkpatrick and Kirkpatrick, 2007), a 4-level model which evaluates training according to (1) reaction; (2) learning; (3) behaviour and (4) results. Training that is evaluated according to this model provides insights into not only the acceptability and effectiveness for participants but also patient and organisational effects (Smidt et al., 2009) and has been used in other systematic reviews of simulation-based education for communication skills training (Blackmore et al., 2018). Primary outcomes of

interest (Review Aim 3; Kirkpatrick Level 4) were incidences of aggression/frequency of behavioural emergencies, use of chemical, physical and mechanical restraint and incidences of patient and staff harm. Secondary outcomes (Review Aims 2, 3; Kirkpatrick Level 3) were workplace resource use (activation of emergency response, use of skills taught in the simulation) and effects on healthcare providers (Kirkpatrick Levels 3, 4) including workload, work morale, stress, burnout and sick leave. Additional secondary outcomes (Kirkpatrick Level 2) included knowledge (de-escalation techniques) and performance in the test situation (objective assessment and self-reported confidence levels). Kirkpatrick Level 1 evaluation outcomes (Review Aim 1) included attitudes to and satisfaction with the training (Supplementary material Tables 1 and 2). Comprehensive searches (last search in March 2024) were conducted in the following databases (from January 1980 onwards): PubMed Central, MEDLINE (Ovid), Cochrane Library (Cochrane Central Register of Controlled Trials (CENTRAL) and Cochrane Database of Systematic Reviews), PsychINFO (Ovid), and CINAHL (EBSCO). Search strategy terms and search strategies for each database are included as Supplementary material (Table 3 and Additional file 1). The reference lists of selected studies, trial registers and leading journals including *Advances in Simulation*; *Clinical Simulation*; *Simulation in Healthcare* and *International Journal of Healthcare Simulation*, were searched. Two independent reviewers independently screened all records. MM screened all records independent of CB and AB who also screened all records. Similarly, two independent reviewers (MM and either CB or AB) judged risk of bias using the appropriate tool: Cochrane Risk-of-Bias tool for randomised trials (RoB 2) (Sterne et al., 2019), Cochrane Risk of Bias tool for cluster randomised trials (RoB2-CRT) (Eldridge et al., 2016) and the Risk Of Bias In Non-randomised Studies of Interventions (ROBINS-I) tool (Sterne et al., 2016). Risk of bias scoring for any studies published by an author of this review (MM, FN or KW) was screened by two independent reviewers (CB and AB). Data extraction from each included study was undertaken independently by two reviewers (MM and either CB or AB) and entered into Microsoft Excel™. Conflicts between two reviewers were resolved by a third author (KW) for all screening and data extraction processes. A qualitative synthesis of included studies was conducted as data were too heterogenous to be included in meta-analysis.

3. Results

3.1. Study selection

The initial search strategy was conducted in February 2019. An updated search was conducted in January 2022 and March 2024. The total yield from our search strategy was 20,728 articles following exclusion of duplicates. Title and abstract screening removed an additional 20,597 articles with 131 remaining. Full text review resulted in the exclusion of a further 106 articles for the reasons shown in Fig. 1. Twenty-five publications reporting 25 studies met the inclusion criteria and were included.

3.2. Study characteristics

Characteristics of included studies are presented in Table 1. All studies included live simulation-based education and used people as simulated patients to teach prevention and management of aggression to healthcare professionals or trainees.

3.3. Study design

Studies were published from 1992 (Paterson et al., 1992) until 2024 with twenty-one of the twenty-five studies published from 2017. Three of the studies were RCTs (Abraham et al., 2001; Vestal et al., 2017; Williams et al., 2019), one a pilot and feasibility cluster RCT (Mitchell et al., 2021), one a three-group post-test design (Emmerling et al.,

2024), with the remainder employing a one group pre-/post-test design. Fifteen of the twenty-five (60 %) studies were conducted in the United States of America (USA), four in Australia, three in Taiwan, and single studies in the United Kingdom (UK), China and Germany. Sample sizes ranged from 15 to 589.

3.4. Participant characteristics

A total of 2790 participants, of which 2585 (93 %) were acute care hospital staff (22 studies) and 205 (7 %) were undergraduate university students (3 studies) were included in this review. Seventeen studies were conducted in acute care hospitals, three studies were conducted in a paediatric hospital (Abraham et al., 2001; Mitchell et al., 2020b, 2021) and two in acute psychiatric teaching hospitals (Paterson et al., 1992; Williams et al., 2019). Participants included doctors, nurses, administrative staff, mental health workers, social workers, physicians and patient care attendants, technicians, security officers and undergraduate medical and nursing students. Eleven studies described the level of clinical experience of the participants which included trainee doctors, medical and nursing clinicians, patient care assistants/technicians, and security and social services staff with <1 year to 20+ years' experience. Three studies reported participants to have previous simulation experience (Wong et al., 2018; Wu et al., 2019; Young et al., 2022).

3.5. Training programme design

Training programme composition was variable. Three studies used simulation-based education as a single training modality however seven studies in total evaluated the effect of simulation-based education as a standalone intervention (Emmerling et al., 2024; Liu et al., 2022; Mitchell et al., 2020b; Stewart and Reeves, 2021; Williams et al., 2019; Wong et al., 2018; Young et al., 2022). Four studies combined simulation-based education with web-based training only (Christensen et al., 2021; Krull et al., 2019; Martinez, 2017; Mitchell et al., 2021). Sixteen studies evaluated simulation-based education combined with a lecture or workshop (Abraham et al., 2001, Brown et al., 2018, Duncan et al., 2021, Emmerling et al., 2024, Lee et al., 2017, Liu et al., 2022, Ming et al., 2019a, Ming et al., 2019b, Mitchell et al., 2020b, Nau et al., 2010, Paterson et al., 1992, Schwartz and Bjorklund, 2019, Stewart and Reeves, 2021, Vestal et al., 2017, Wong et al., 2015, Wu et al., 2019). Two studies combined simulation-based education with two or more teaching modalities (Kunst et al., 2017; Sanky, 2023).

3.6. Simulation-based education component characteristics

The simulation training components varied in length from 15 min (Wong et al., 2018) to 4 h (Liu et al., 2022; Martinez, 2017; Nau et al., 2010; Schwartz and Bjorklund, 2019). The simulation-based education component accounted for at least 50 % of the training duration for nine studies (Brown et al., 2018; Duncan et al., 2021; Liu et al., 2022; Martinez, 2017; Mitchell et al., 2021; Schwartz and Bjorklund, 2019; Williams et al., 2019; Wong et al., 2018, 2015). The length of the simulation training was unclear in sixteen studies. Nineteen of the twenty-five studies described the inclusion of reflective debriefing as a component of the simulation-based education. Each simulation scenario was unique to each study and was designed to represent situations commonly experienced by the study's participants. Three studies used simulation scenarios exploring aggression demonstrated by a simulated adolescent patient (Abraham et al., 2001; Mitchell et al., 2020b, 2021), with all other studies utilising scenarios depicting aggressive incidents involving adult patients.

3.7. Risk of bias

Risk of bias was assessed using the RoB2 for the RCTs and is presented in Table 2 (Sterne et al., 2019). All three RCTs were judged

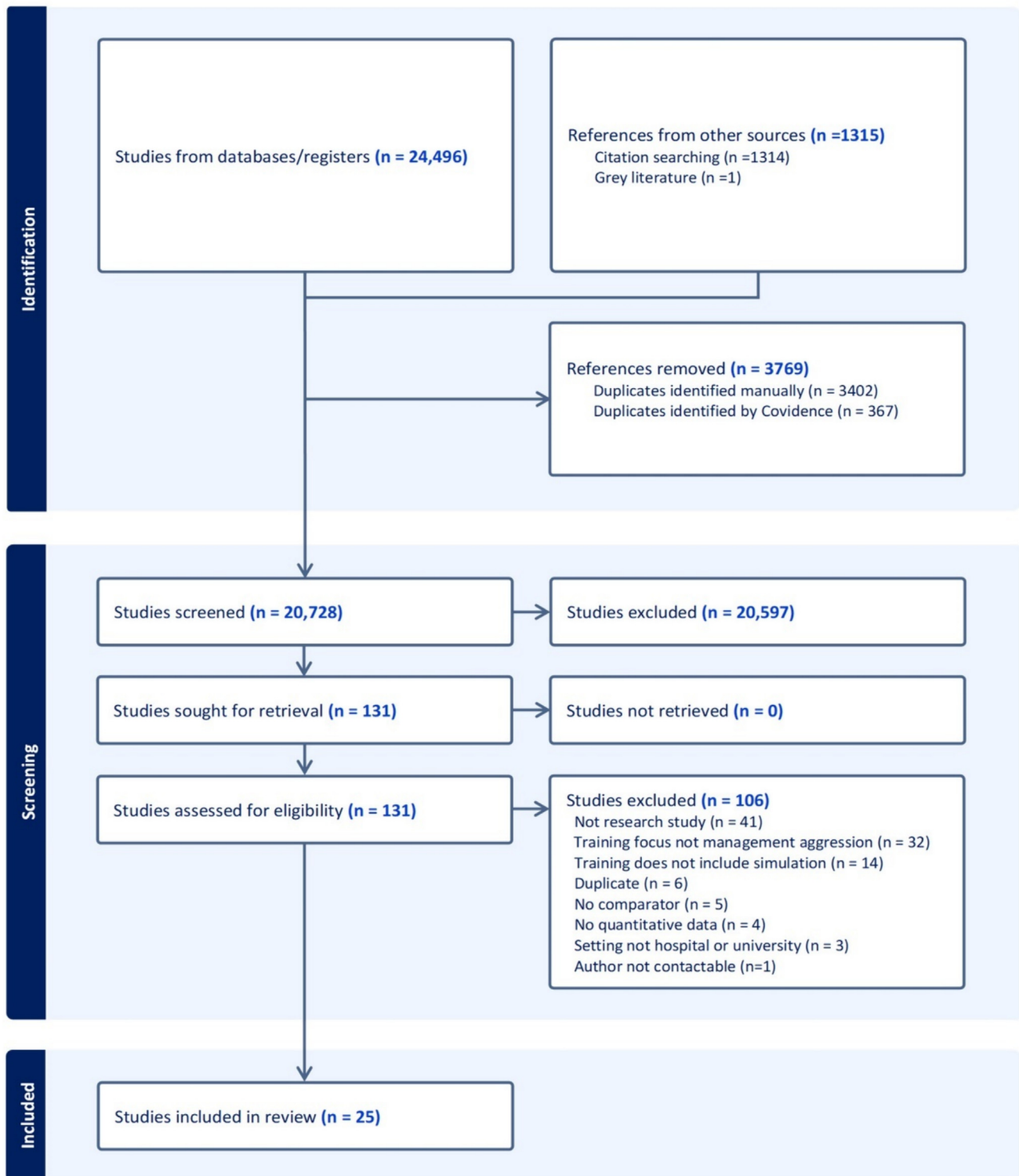


Fig. 1. PRISMA flow diagram.

to be high risk due to use of unvalidated tools as outcome measurements and missing outcome data. The cluster RCT was assessed using the RoB2-CRT (Eldridge et al., 2016) and judged to have some concerns (Table 3). Non-RCT studies were assessed using the ROBINS-I tool as presented in Table 4 (Sterne et al., 2016). The risk level for the twenty-one pre-/post-test cohort studies was judged to be serious to critical. Bias in measurement outcomes was the main source of bias.

3.8. Main outcomes

The outcomes evaluated in each of the included studies are summarised in Table 5. The tools used to measure the outcomes were largely self-report measures developed for the research. Some tools established content, construct or criterion validity (Heale and Twycross, 2015) as shown in Supplementary material Table 4. Most measures were not assessed for reliability with only the De-escalating Aggressive

Table 1
Characteristics of included studies.

Study, year, country	Study design N (int, control)	Setting, participants	Intervention, duration	Comparator	Simulation scenario	Simulation duration Reflective debrief (yes/no/unknown)	Measurement type	Follow-up
Emmerling et al., 2024, USA	Three group post-design (total enrolled 829) 589 (338, 195, 56)	Large healthcare system, Midwestern USA Clinical nurses, adult care	Aggressive Patient Behaviour Management Program 1. Standard education 2. In situ simulations	No training	Not described	Not described Unknown	Post-training survey Confidence in Coping with Patient Aggression	No
Sanky, 2023, USA	One group pre-/post-design 25 (25, 0)	Urban academic medical centre Emergency medicine residents	Emergency Department Violence curriculum 1. Introduction to improvisation, workplace violence, simulation 2. Institutional/government policies, reporting protocols, evidence-based practice for managing violence 3. Follow-up resources, assessments 4. Workshops to work through and re-enact critical scenarios	None	Not described	Not described Unknown	Pre-/post-training survey	No
Liu et al., 2022, China	Quasi-experimental design 190 (64, 66, 60)	Medical university Medical residents	Coping with Violence in the Workplace 1. Simulation-based medical education (SBME) – Group B, 4 h 40 min 2. Behavioural economics of workplace violence education (BE) + SBME – Group A, 3 h 3. Workplace Violence Prevention training – Group C, 3 h, 20 m	Workplace Violence Prevention training – Group C	1. Human relation skills training 2. Workplace violence prevention 3. Evacuation skills for workplace violence 4. Disposal skills for injured medical workers	Group A: 3 h Group B: 4 h 40 min Unknown	Perception of Aggression Scale (POAS) Management of aggression & Violence Attitude Scale (MAVAS) General Self-efficacy Scale (GSES)	No
Young et al., 2022, Australia	Quasi-experimental design 122 (122, 0)	Mental health wards at two major teaching acute care hospitals Nursing, medical, allied health clinical staff	Mental Health Emergency Response Program 1. Simulation-based education scenario to address behavioural disturbance, violence and aggression and clinical deterioration	None	Not described in detail	Not described Yes	Pre-/post-training survey Self-efficacy tool	3 months
Christensen et al., 2021, USA	One group pre-/post-design 43 (43, 0)	Neurology and Internal Medicine wards, urban acute care hospital, Nurses	Behavioural Emergency Response Team (BERT) programme Bedside nursing group: 1. Computer-based learning module 2. Simulation-based education session (1 h) – patient aggression	None	Not described	60 min Yes	Pre-/post-training survey	No
Duncan et al., 2021, USA	One group pre-/post-design 75 (75, 0)	Medical/surgical unit, urban academic acute care hospital Nurses, patient support associates, protective services officers	Verbal De-escalation Training 1. Didactic lecture (30 min) 2. Simulation (1 h)	None	Patient becomes agitated after transitioning from intravenous to oral pain medications	1 h: 10 min sim, 50 min debrief Yes	Pre-/post-training: Management of aggression & Violence Attitude Scale (MAVAS)	No

(continued on next page)

Table 1 (continued)

Study, year, country	Study design N (int, control)	Setting, participants	Intervention, duration	Comparator	Simulation scenario	Simulation duration Reflective debrief (yes/no/unknown)	Measurement type	Follow-up
Mitchell et al., 2021, Australia	Pilot & feasibility RCT 18 (10, 8)	General medical and general surgical ward, paediatric quaternary acute care urban hospital Clinical nurses	Simulation based education – de-escalation of a young person with autism and aggressive or high-risk behaviours 1. Web-based module 2. Simulation-based education session (1.5 h)	Web-based education	Adolescent patient with autism displays aggressive or high-risk behaviours in ward	1.5 h: 10 min sim + 30 m debrief × 2 Same scenario repeated, increased intensity Yes	Pre-/post-training survey Confidence in Coping with Patient Aggression De-escalating Aggressive Behaviour Scale- English Modified (EMDABS) Record of ward patient aggression Code Grey activations	3 months
Stewart and Reeves, 2021, USA	One group pre-/post-design 137 (137, 0)	Acute care urban hospital Mental health workers, psychiatry centre	Psychiatric simulation-based education (part of a multilevel approach): Rapid cycle deliberate practice simulation	None	Patient displays low level anxiety and agitation, progresses to assaultive, threatening behaviour	Unknown Yes	Pre-/post-training survey	No
Mitchell et al., 2020b, Australia	One group pre-/post-design 140 (140, 0)	Paediatric acute care urban hospital Nursing, medical, allied health, security staff	Management of Clinical Aggression Training (7.5 h): 1. Workshop 2. Simulation	None	1. 15 y old female patient with history of mental health difficulties, admitted with abdominal pain becomes distressed and aggressive during interaction with nurse. 2. Same scenario, increased difficulty due to escalating aggression	2 h total: 10 min with 50 min debrief × 2 Yes	Pre-/post-training survey	3–6 months
Krull et al., 2019, USA	One group pre-/post-design 96 (96, 0)	Emergency Dept, Medical Centre Interprofessional staff	Verbal de-escalation and restraint application simulation-based education for ED staff (1 h): 1. Computer based learning module 2. Simulation	None	Patient with chronic low back pain presents to ED. Patient becomes agitated when narcotics restricted	20 min sim × 1 Yes	NLN Simulation Design Scale NLN Student Satisfaction and Self Confidence in Learning- revised	No
Ming et al., 2019a, Taiwan	One group pre-/post-design 66 (66, 0)	Emergency, medical, surgical wards, urban acute care hospital Nurses	Workplace Violence Simulation-based education (3 h): 1. Workshop 2. Simulation	None	Not described	50 min total Yes	Perception of Aggression Scale (POAS) Confidence in Coping with Patient Aggression	No
Ming et al., 2019b, Taiwan	Quasi-experimental design 400 (200, 200)	Urban hospital Nursing staff	Workplace Violence Clinical Situational Simulation Teaching Training Course (3 h): 1. Lecture/workshops 2. Simulation exercises	None	Not described	50 min total Yes	Perception of Aggression Scale (POAS) Measure of Aggression and Violence Attitude Scale (MAVAS) Confidence in Coping with Patient Aggression	3 months
Schwartz and Bjorklund, 2019, USA	One group pre-/post-design 93 (93, 0)	Medical unit, large teaching hospital Medical unit staff (nurses; patient care attendants)	Violence management training programme (6 h): 1. Education sessions 2. Simulation	None	Based on actual unit episodes: no detail available	4 h Yes	Staff Observation Assessment Scale Revised (SOAS-R)	3 months (post-test)
Williams et al., 2019, USA	RCT 23 (12, 11)	Psychiatric hospital Psychiatric residents	Simulation-based training for management of acute agitation on inpatient psychiatric unit (1.5 h)	Booklet: On-call Psychiatry Guide: Guidelines for acute agitation management	Patient with psychotic illness displays increasing agitation	1 h Yes	Pre-/post-training self-confidence assessment Pre-/post-knowledge assessment	No

Wu et al., 2019, Taiwan	One group pre-/post-design 34 (34, 0)	ED in teaching hospitals Physicians, registered nurses, security guards, social workers	ED Violence Management course: Preventative training workshops 1. Lectures 2. Simulation	None	Pt in ED is "obnoxious, has been drinking, has a bad attitude and constantly urging the staff to hurry and requested the physician to come as soon as possible"	3 × sim per participant. Length unknown Yes	Assessment of Healthcare Providers' Response to Workplace Violence Healthcare Providers Self-efficacy when responding to Workplace Violence	2 weeks post-intervention
Brown et al., 2018, USA	One group pre-/post-design 196 (196, 0)	Hospital Nursing and ancillary staff from a nursing unit	Workplace Violence Training (4 h): 1. Classroom learning 2. Simulation 3. Hands on defence skills practice	None	1. Husband of patient who has died becomes angry, pulls out a gun. Scenario is conducted prior to classroom training. 2. Patient upset that she is not receiving proper pain relief, calls husband and becomes aggressive. 3. Husband of wife with terminal illness arrives agitated, leaves, then returns and begins to shoot his simulated firearm. 4. Same as Scenario 1.	5 min sim × 4 (2.5 h in total) Yes	Pre-/post-training survey Observation tool	No
Wong et al., 2018, USA	Mixed methods – One group pre-/post-design; focus group interviews 57 (57, 0)	Two hospital Emergency Departments Emergency medicine residents; attending physicians; physician assistants; advanced practice registered nurses; ED nurses, technicians, security officers	Team based simulation for agitation management in the Emergency Department (15 min): 1. Simulation-based education	None	Agitated patient in ED who displays entire spectrum of agitation behaviours: verbal harassment, physical threat, sexual harassment, physical assault.	15 min No	KidSIM ATTITUDES Questionnaire Focus group interviews	No
Kunst et al., 2017, Australia	Mixed methods – One group pre-/post-design; focus group interviews 112 (112, 0)	University Undergraduate nursing students	Using simulation to improve the capability of undergraduate nursing students in mental health care (4.5–5.5 h): 1. Simulation 2. Online pre-learning 3. Classroom activity	None	Evolving scenarios 1. Demonstration of communication with patient with personality disorder. 2. Patient presents to ED with wound from self-harm. 3. Patient escalates with challenging communication and agitation.	Sim 20–30 min × 2 (2 h in total) Yes	Pre-/post-survey Post-training survey – Mental Health Related Learning Needs of ED Nurses Focus group interviews	No
Lee et al., 2017, USA	One group pre-/post-design 68 (68, 0)	Adult medical unit, urban acute care hospital Nurses	Nurse Education Program for Managing Disruptive Patient Behaviours (2 h): 1. Instruction 2. Role-play 3. Reflective practice	None	Disruptive behaviours: 1. Patient with chronic pain demonstrates anger and mistrust to nurse. 2. Patient has psychiatric history, displays paranoid thoughts, delusions, fear of nurses. 3. Family member impairs care delivery and is critical of care provided.	Sim × 3 Length not described Yes	Pre-/post-training survey – self-assessment of knowledge, attitudes, confidence in caring for patients with disruptive behaviours	3, 12 months
Martinez, 2017, USA	One group pre-/post-design 15 (15, 0)	University – urban, public Undergraduate psychiatric nursing students	Workplace Violence Simulation for undergraduate nursing students (4 h +): 1. Computer-based learning 2. Simulation	None	One-on-one or two-on-one simulation. Simulated patient displayed symptoms of schizophrenia, anxiety, tension, aggression, challenging behaviours.	4 h in total: 5-min sim Yes	Mental Health Nursing Clinical Confidence Scale Knowledge questionnaire	No
Vestal et al., 2017, USA	RCT 26 (15, 11)	General Hospital with psychiatric unit Resident doctors	Management of acute agitation programme: 1. Lecture 2. Simulation	Simulation unrelated to agitation.	Agitation sim: Male with stimulant-induced mania with psychotic features becomes progressively more agitated requiring restraint and intramuscular medication.	1 h: Sim × 1 (10 min) Yes	Pre-/post-training self-report survey Pre-/post-training knowledge assessments Objective assessment of performance in a simulation 1-week post-intervention	No

(continued on next page)

Table 1 (continued)

Study, year, country	Study design N (int, control)	Setting, participants	Intervention, duration	Comparator	Simulation scenario	Simulation duration Reflective debrief (yes/no/unknown)	Measurement type	Follow-up
Wong et al., 2015, USA	One group pre-/post-design 106 (106, 0)	Acute care hospital Emergency medicine residents, nurses, hospital police officers	A simulation enhanced interprofessional curriculum to coordinate a team response to behavioural emergencies in ED (3 h): 1. Lecture 2. Simulation	None	1. Intoxicated patient with head trauma who becomes angry and threatening. 2. Psychiatrically ill patient becomes physically and verbally aggressive.	Sim × 2 (2.5 h) Yes	Management of Aggression and Violence Attitudes Scale (MAVAS)	No
Nau et al., 2010, Germany	One group pre-/post-design 78 (78, 0)	University – School of Nursing Undergraduate nursing students	Aggression Management Training Program (24 h): Sessions delivered over 1 week: 1. Lectures 2. Group work 3. Skills training 4. Simulation-based education (4 h)	None	1. Young woman angry about doctor's order to not leave hospital. 2. Elderly man enraged about hemiparesis, grabs nurse's wrist and throws away medication.	2 h × 2 Unknown	De-escalating Aggressive Behaviour Scale (DABS)	No
Abraham et al., 2001, USA	RCT 56 (26, 30)	Outpatient's Dept, tertiary paediatric hospital 2nd year residents, 3rd year medical students	Improve Physician Violence Screening Skills Workshop (3 h): 1. Lecture 2. Panel discussion 3. One on one role play	Standard ambulatory clinic manual – violence prevention articles	1. 16 y male, angry, was involved in fight, wants to retaliate. 2. 17 y female, difficulty sleeping, history of date rape	Length not described One on one role plays × 1 Yes	Pre-/post-training survey Interview and examination of patient (SP) SP evaluation of participant performance: National Medical Board of Examiners' Patient Perception Scale	No
Paterson et al., 1992, UK	One group pre-/post-design 25 (25, 0)	Psychiatric hospital Mental health nurses	Short term Management of Violence Training course (10-day course): 1. Lectures 2. Skills training/role play 3. Escape skills training 4. Restraint skills training	None	1. De-escalation role play. 2. Control and restraint of patient, relocate to another area to administer medication.	Not described No	Questionnaires, observer ratings of video recorded role plays	No

Abbreviations: ED: emergency department; Pt: patient; RCT: randomised controlled trial; SP: simulated patient; y: year; h: hour(s); min: minutes.

Table 2
Risk of Bias tool for randomised trials (RoB2).

Record	Overall judgement	Randomisation process	Deviations from intended interventions	Missing outcome data	Measurement of outcome	Selection of reported result
Williams et al., 2019	High	Some concerns	Some concerns	Some concerns	High	Some concerns
Vestal et al., 2017	High	Some concerns	Some concerns	Some concerns	High	Some concerns
Abraham et al., 2001	High	Some concerns	Some concerns	High	Some concerns	Some concerns

Risk level

Low	Some concerns	High
-----	---------------	------

Behaviour Scale (DABS) addressing all three constructs for reliability: homogeneity, stability and equivalence (Heale and Twycross, 2015) (Supplementary material Table 4).

There was substantial variation in outcome measures used and little data presented for our primary outcomes which focussed on patient outcomes and quality of care. Most studies presented secondary outcomes pertaining to changes in knowledge, performance and confidence as a result of the training, and reactions to the training format. A summary of study outcomes is outlined in Supplementary material Table 5 and described below.

3.9. Primary outcomes

The primary outcomes examined in this review include the incidences of aggression, the use of restraint and patient/staff harm. Four studies collected data on the three primary outcomes however data report completion rates were low and insufficient to establish the effect of the simulation-based education (Christensen et al., 2021; Lee et al., 2017; Mitchell et al., 2021; Schwartz and Bjorklund, 2019). Data about discreet episodes of aggression pre- and post-intervention, using the Staff Observation Assessment Scale Revised (SOARS-R) was collected by Schwartz and Bjorklund (2019). Completion rates for this scale were low, with one aggressive episode reported pre-intervention and five reported post-intervention.

The number of Code Grey activations per 1000 patient bed days was recorded by Lee et al. (2017) as a measure of patient outcomes.

Numbers of Code Grey incidents were low with a decline from two incidents per quarter to zero over a one-year period before returning to 1–2 incidents per quarter for the following year. The number of Code Grey incidents per 1000 bed days was reported to decrease from 0.78 to 0.39 two years post-training. Code Grey data was collected pre- and post-training by Mitchell et al. (2021) with nil events recorded in the intervention and control wards pre-training. Ten (intervention ward) and four (control ward) Code Grey activations were recorded post-training however none of these involved young people with autism which was the focus of the simulation training.

Evaluation of the incident reports of patient aggression in the pilot areas of an acute care hospital for one year pre- and post-intervention was conducted by Christensen et al. (2021). There were 27 episodes of patient aggression reported at baseline and 34 episodes during the year following initiation of the training intervention. Using patient days as a denominator, the rates were 0.11 % at baseline and 0.14 % post-intervention.

3.10. Secondary outcomes

3.10.1. Workplace resource use and effects on healthcare providers

Data on the effect of the training intervention on workplace resource use was provided by one study (Christensen et al., 2021). In this study, data was collected pre- and post-training for the number of emergency response team activations. The Behavioural Emergency Response Team (BERT) response was activated only three times post-training intervention

Table 3
Risk of Bias tool for cluster-randomised trials (RoB2 CRT).

Record	Overall judgement	Randomisation process	Timing of identification or recruitment of participants	Deviations from intended interventions (effect of assignment)	Deviations from intended interventions (effect of adhering to intervention)	Missing outcome data	Measurement of outcome	Selection of reported result
Mitchell et al., 2021	Some concerns	Some concerns	Some concerns	Some concerns	Some concerns	Some concerns	Some concerns	Some concerns

Risk level

Low	Some concerns	High
-----	---------------	------

Table 4
Risk of Bias In Non-randomised Studies of Interventions (ROBINS-1).

Record	Overall judgement	Confounding	Selection of participants	Classification of interventions	Deviations from intended interventions	Missing data	Measurement of outcomes	Selection of reported results
Emmerling et al., 2024	Low	Moderate	Low	Low	Moderate	Moderate	Moderate	Low
Sanky, 2023	Critical	Moderate	Moderate	Low	Moderate	Moderate	Critical	Moderate
Liu et al., 2022	Moderate	Low	Low	Low	Moderate	Moderate	Moderate	Low
Young et al., 2022	Moderate	Low	Low	Low	Moderate	Moderate	Moderate	Low
Christensen et al., 2021	Critical	Moderate	Moderate	Critical	Moderate	Critical	Moderate	Moderate
Duncan et al., 2021	Critical	Critical	Moderate	Low	Moderate	Moderate	Moderate	Moderate
Stewart & Reeves, 2021	Critical	Critical	Critical	Moderate	Critical	Moderate	Moderate	Moderate
Mitchell et al., 2020	Moderate	Moderate	Low	Low	Moderate	Moderate	Moderate	Low
Krull et al., 2019	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate
Ming, Huang et al., 2019	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Ming, Tseng et al., 2019	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Low
Schwartz & Bjorklund, 2019	Critical	Moderate	Moderate	Moderate	Moderate	Moderate	Critical	Moderate
Wu et al., 2019	Critical	Moderate	Moderate	Critical	Moderate	Moderate	Critical	Low
Brown et al., 2018	Critical	Moderate	Moderate	Low	Moderate	Critical	Moderate	Moderate
Wong, Auerbach et al., 2018	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low
Kunst et al., 2017	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Lee et al., 2017	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Martinez, 2017	Critical	Moderate	Low	Moderate	Moderate	Moderate	Critical	Low
Wong, Wing et al., 2015	Critical	Moderate	Moderate	Moderate	Moderate	Moderate	Critical	Low
Nau et al., 2010	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low
Paterson et al., 1992	Critical	Moderate	Moderate	Critical	Moderate	Moderate	Moderate	Moderate

Risk level

Low	Moderate	Serious	Critical	No Information
-----	----------	---------	----------	----------------

despite security officers identifying 41 potentially disruptive patients in the year following implementation of the training.

3.10.2. Knowledge

Data on knowledge gained after simulation-based education was collected by eleven studies with all reporting improvements (Krull et al., 2019; Kunst et al., 2017; Lee et al., 2017; Liu et al., 2022; Martinez, 2017; Paterson et al., 1992; Sanky, 2023; Schwartz and Bjorklund, 2019; Vestal et al., 2017; Williams et al., 2019; Young et al., 2022). Of these, five collected objective assessments of knowledge (Martinez, 2017; Paterson et al., 1992; Schwartz and Bjorklund, 2019; Vestal et al., 2017; Williams et al., 2019). Vestal et al. (2017) conducted a RCT and reported a statistically significant improvement in knowledge ($p = .007$) for the intervention group in clinical vignette scores from baseline compared with controls. Paterson et al. (1992) reported a statistically significant increase in group total scores at follow-up on a knowledge questionnaire compared with baseline scores ($p < .01$). A knowledge questionnaire administered by Martinez (2017) resulted in improvements in knowledge for five questions, no change in knowledge for five questions and a decrease in knowledge for three questions. A 5-question, Knowledge about Violence Management Questionnaire, administered by Schwartz and Bjorklund (2019), reported statistically significant increases in knowledge for three questions relating to precipitating factors for violence, the purpose of a supportive stance and keys to setting limits. Knowledge about levels of aggressive behaviour and appropriate therapeutic response was not significantly improved at three months post-training. Williams et al. (2019) used a knowledge assessment written test consisting of multiple choice and open text questions relating to a clinical case vignette to evaluate changes in knowledge for specific learning objectives. Participants in the simulation group had a statistically significant increase in knowledge-based

scores pre- to post-intervention. There was also a statistically significant improvement in knowledge in the simulation group compared to the comparator group (Williams et al., 2019). Three of the five studies (60%) which measured objective changes in knowledge reported statistically significant improvements with a further two studies reporting improvements in some areas of knowledge (Supplementary material Table 5).

Self-report data on changes in knowledge in managing aggression was collected by six studies with all reporting improvements post-training (Krull et al., 2019; Kunst et al., 2017; Lee et al., 2017; Liu et al., 2022; Sanky, 2023; Young et al., 2022). Lee et al. (2017) presented proportions of responses to a 4-point Likert scale survey statement about self-perceived knowledge and skills to intervene with patients/families displaying challenging or disruptive behaviours with knowledge increasing from baseline and at 1-year follow-up. Similarly, Krull et al. (2019) asked participants to rate their knowledge of managing violent or aggressive behaviour using a 5-point Likert scale with statistically significant changes in ratings from strongly disagree/disagree/neutral to agree/strongly agree. Participants in the Kunst et al. (2017) study rated their knowledge in the provision of mental health care in acute care environments. Mean post-intervention scores increased with a t -value > 1 and $p < .001$ indicating a statistically significant difference.

Participants in the Sanky (2023) study completed a 3-point Likert response to a self-report statement about their knowledge of how to manage a workplace violence crisis situation. Sixty-five percent of participants agreed that they knew how to manage behavioural crises post-training compared to 20% pre-training. Two groups in the Liu et al. (2022) study, which received simulation training, scored significantly higher in post-test scores for perception of workplace violence on the validated perception of aggression scale (POAS), compared to the group which received lectures only. Self-report of knowledge of

Table 5
Outcome measures.

Author	Primary outcomes (Kirkpatrick Level)			Secondary outcomes (Kirkpatrick Level)						Kirkpatrick Level
	Incidences of aggression (L.4)	Use of restraint (L.4)	Patient/staff harm (L.4)	Workplace resource use (L.3)	Effects on health care providers (L.3)	Knowledge (L.2)	Performance in test situation (L.2)	Attitudes (L.1)	Satisfaction (L.1)	
Emmerling et al., 2024				√ Self	√ Self		√ Self			3,2
Sanky, 2023						√ Self			√ Self	2,1
Liu et al., 2022						√ Self	√ Self	√ Self		2,1
Young et al., 2022						√ Self	√ Self			2
Christensen et al., 2021	√	√		√			√ Self			2
Duncan et al., 2021								√ Self	√ Self	2,1
Mitchell et al., 2021	√	√	√	√			√ Self, Obj		√ Self	4,3,2,1
Stewart & Reeves, 2021							√ Self			2
Mitchell et al., 2020							√ Self		√ Self	2,1
Krull et al., 2019						√ Self	√ Self		√ Self	2,1
Ming Huang et al., 2019							√ Self	√ Self		2,1
Ming, Tseng et al., 2019							√ Self	√ Self		2,1
Schwartz & Bjorklund, 2019	√	√	√			√ Obj				4,2
Williams et al., 2019						√ Obj	√ Self			2
Wu et al., 2019							√ Self, Obj			2
Brown et al., 2018							√ Self, Obj			2
Wong, Auerbach et al., 2018								√ Self	√ Self	2,1
Kunst et al., 2017						√ Self	√ Self			2
Lee et al., 2017	√					√ Self	√ Self			4,2
Martinez, 2017						√ Obj	√ Self		√ Self	2,1
Vestal et al., 2017						√ Obj	√ Self, Obj		√ Self	2,1
Wong, Wing et al., 2015								√ Self		1
Nau et al., 2010							√ Obj			2
Abraham et al., 2001							√ Self, Obj	√ Self		2,1
Paterson et al., 1992						√ Obj	√ Obj			2
Total	4	3	2	3	1	11	20	7	8	

√ included outcome measure.
Self: self-reported outcome measure.
Obj: Objective rating including observer rating/assessment test.

crisis resource management principles increased significantly ($p = .000$) for participants in the Young et al. (2022) study.

Overall, simulation-based education had positive effects on objective and self-reported measures of knowledge with gains similar across settings. However, with the absence of validated tools to assess knowledge, effect size was unable to be calculated.

3.10.3. Performance in test situation

Performance in the test situation or confidence in managing aggression was assessed by twenty-one studies (Abraham et al., 2001; Brown et al., 2018; Christensen et al., 2021; Duncan et al., 2021; Emmerling et al., 2024; Krull et al., 2019; Kunst et al., 2017; Lee et al., 2017; Liu et al., 2022; Martinez, 2017; Ming et al., 2019a; Ming et al., 2019b; Mitchell et al., 2021; Mitchell et al., 2020b; Nau et al., 2010; Paterson et al., 1992; Stewart and Reeves, 2021; Vestal et al., 2017; Williams et al., 2019; Wu et al., 2019; Young et al., 2022). All reported improvements post-training except Emmerling et al. (2024) who reported that

in situ simulation training did not significantly improve performance. Mitchell et al. (2021) were unable to calculate changes in performance post-intervention as participants did not accurately record their unique identifier on all surveys.

3.10.4. Objective ratings of performance

Objective ratings of performance were assessed by seven studies (Abraham et al., 2001; Brown et al., 2018; Mitchell et al., 2021; Nau et al., 2010; Paterson et al., 1992; Vestal et al., 2017; Wu et al., 2019) and were collected via multiple methods. Two studies provided objective assessments of performance using the validated De-escalating Aggressive Behaviour Scale (DABS) (Mitchell et al., 2021; Nau et al., 2010). Participants in the Nau et al. study demonstrated statistically significant performance improvements for all criteria on the scale. A pilot and feasibility study by Mitchell et al. (2021) reported low levels of performance across four simulations with participants demonstrating positive de-escalation skills in 29 % of items. An unvalidated rating scale

assessing multiple domains was used by Vestal et al. (2017) with the intervention group scoring significantly higher than the control ($p = .001$). In the study by Paterson et al. (1992), video analysis of de-escalation, disengagement and control and restraint skills was scored by trained assessors with a statistically significant change ($p < .01$) in each skill demonstrating greater competence. Trained simulated patients completed a 14-item evaluation of participant performance in the Abraham et al. (2001) study with the intervention groups recording statistically significant higher scores for interpersonal skills ($p < .04$). Response to workplace violence was assessed by observers in the study by Wu et al. (2019), with statistically significant improvement from pre-test to post-test ($p < .01$). Brown et al. (2018) collected objective performance data on a subset of participants with statistically significant improvements in four of seven critical actions from the first to the fourth simulation. Five of the six studies (83 %) reported statistically significant improvements in performance with the sixth study reporting significant improvements in over 50 % of domains examined.

3.10.5. Self-reported ratings of confidence

Self-reported changes in confidence were reported by eighteen studies (Abraham et al., 2001, Brown et al., 2018, Christensen et al., 2021, Emmerling et al., 2024, Krull et al., 2019, Kunst et al., 2017, Lee et al., 2017, Liu et al., 2022, Martinez, 2017, Ming et al., 2019a, Ming et al., 2019b, Mitchell et al., 2021, Mitchell et al., 2020b, Stewart and Reeves, 2021, Vestal et al., 2017, Williams et al., 2019, Wu et al., 2019, Young et al., 2022) with five studies providing both self-report and objective data (Abraham et al., 2001; Brown et al., 2018; Mitchell et al., 2021; Vestal et al., 2017; Wu et al., 2019). The eighteen studies used several different self-reported measures of confidence in managing aggression with all reporting improvements. Four studies (Emmerling et al., 2024; Ming et al., 2019a, 2019b; Mitchell et al., 2021) used the Confidence in Coping with Patient Aggression Scale developed by Thackrey (1987) to measure self-reported changes in confidence post-training. The 10-item scale has good internal reliability and uses an 11-point Likert-scale. Statistically significant increases in self-confidence in coping with aggression were reported following the simulation-based education in two studies (Ming et al., 2019a, 2019b). Emmerling et al. (2024) reported no significant difference in confidence levels between the standard education group, the standard education group plus in situ simulation training, and the group who received no training. Mitchell et al. (2021) were unable to calculate changes in confidence levels in their pilot and feasibility randomised controlled trial however, baseline confidence levels in managing aggression in the child with autism were low. Martinez (2017) used a validated tool, Mental Health Nursing Clinical Confidence Scale (MHNCCS) to measure student nurses' confidence in managing aggression, with paired *t*-test indicating a statistically significant improvement. A 10-item validated self-efficacy Likert scale was used by Young et al. (2022) pre- and post-simulation training for mental health emergencies and clinical deterioration. Self-efficacy significantly improved for all 10 items post-training. Wu et al. (2019) used the Healthcare Provider's Self-Efficacy when Responding to Workplace Violence instrument to measure participant self-reported efficacy pre-, post- and two weeks post-training with highly statistically significant improvements. Self-efficacy, using the validated general self-efficacy scale (GSES), improved significantly for participants in a study by Liu et al. (2022) who received simulation training, compared to the control group which received workplace violence prevention lectures. Several studies used their own author-developed surveys to assess the effect of the simulation-based education on participant confidence. There were a range of questions asked via these surveys to assess the effect of the training on performance. Participants were asked by Abraham et al. (2001) to rate their confidence on a 4-point Likert scale for providing guidance on weapon use, violence at school or in neighbourhood and fighting history with statistically significant increased scores post-training for the intervention group ($p < .05$). Brown et al. (2018) asked participants to rate their perceptions of

preparedness and confidence in managing aggression on a 5-point Likert scale on a 4-question survey. Statistically significant improvements were reported for all four questions. Krull et al. (2019) also used a 5-point Likert scale for participant self-reported ratings of confidence, skills and abilities and reported statistically significant improvements from strongly disagree/disagree/neutral to agree/strongly agree for the whole group ($p < .001$). Christensen et al. (2021) assessed self-reported changes in confidence and skills using a 7-item questionnaire with 5-point Likert-scale responses ranging from strongly agree (5) to strongly disagree (1). After the training, a statistically significant increase was observed in participants' ability to effectively manage conflicts and use de-escalation techniques to reduce aggression and disruptive behaviours caused by patients and visitors. Confidence in caring for patients exhibiting disruptive or threatening behaviours also increased significantly. Mitchell et al. (2020b) asked participants to report their confidence levels in managing clinical aggression, with statistically significant increases post-training which were maintained 3–6 months post-training. Self-reported competence was highest post-training in utilising de-escalation techniques and maintaining patient safety. The largest increases in self-reported competence were in using hands on and off restraint and acting in the role of the group leader. Stewart and Reeves (2021) and Williams et al. (2019) also used self-devised surveys to assess participant self-reported changes in confidence following the simulation training and reported statistically significant improvements. Improvements in aggregate confidence scores by a self-report questionnaire were reported by Vestal et al. (2017) for the intervention group receiving simulation training for managing agitation however the results did not reach statistical significance. Kunst et al. (2017) reported statistically significant improvements in self-reported confidence and ability to provide mental health care in acute care environments following training, with *t*-values > 1 and $p < .001$. Lee et al. (2017) included a statement in a self-assessment survey asking participants to use a 4-point Likert rating scale to assess how comfortable they felt caring for patients and families with challenging or disruptive behaviours. Improvement in scores was reported up to 1-year post-training. As described in Supplementary material Table 5, fourteen of eighteen studies, which collected self-report data on confidence and performance, reported statistically significant improvements.

In summary, confidence and performance in managing aggression appear to be positively impacted by simulation-based education across settings however self-report and objective assessment instruments varied and were mostly unvalidated, limiting our ability to quantify the results.

3.10.6. Attitudes to workplace aggression and training

Change in participants' attitudes to workplace aggression was measured by six studies (Abraham et al., 2001; Duncan et al., 2021; Liu et al., 2022; Ming et al., 2019a, 2019b; Wong et al., 2015) and one study measured attitudes to simulation-based education (Wong et al., 2018). Each of these six studies reported positive changes in attitudes post-training. To understand the participants' attitudes to the aggression, Ming et al. (2019a) and Ming et al. (2019b) used the Perception of Aggression Scale (POAS) constructed by Jansen et al. (1997). The questionnaire, answered using a 5-point Likert scale, has good reliability and validity, with higher scores indicating that participants have clearer concepts of workplace violence. Perceptions were significantly increased in both studies (Ming et al., 2019a, 2019b). Attitudes to violence was also measured by the Management of Aggression and Violence Attitude Scale (MAVAS) in four studies (Duncan et al., 2021, Liu et al., 2022, Ming et al., 2019a, 2019b, Wong et al., 2015). This validated tool, comprised of 27 items, uses a 5-point Likert scale to examine attitudes about practice strategies employed when dealing with aggression. All four studies assessing changes in attitudes to aggression reported statistically significant improvements following completion of the training.

Abraham et al. (2001) included questions asking participants to rate how important knowledge of weapon access, violence at school or in

their neighbourhood or fighting history was for providing adolescent healthcare. Intervention participants reported statistically significant greater perceived importance post-training for knowledge of weapon use and violence experience. Wong et al. (2015) reported that staff attitudes towards the management of patient aggression did not change significantly post-training however there were statistically significant improvements for questions relating to internal and external factors and situational perspectives on patient aggression. These studies reported statistically significant improvements in attitudes to workplace aggression following training, as described in Supplementary material Table 5.

Attitudes to simulation-based education as a training format were assessed by Wong et al. (2018) using the validated KidSIM ATTITUDES questionnaire. Attitudes to five constructs were measured: relevance of simulation, opportunities for interprofessional education, communication, roles and responsibilities, and situation awareness. Statistically significant improvements in attitudes were reported for the relevance of simulation-based education and opportunities for interprofessional education post-training. Improvements were seen in situational awareness and four of six questions for the construct of roles and responsibilities however no significant changes occurred for questions in the communication construct.

3.10.7. Satisfaction with training

Outcome data on participant satisfaction with the training format was provided by eight studies (Duncan et al., 2021; Krull et al., 2019; Martinez, 2017; Mitchell et al., 2020b, 2021; Sanky, 2023; Vestal et al., 2017; Wong et al., 2018). Engagement with the training format was reported by all studies with participants recommending the training to colleagues (Mitchell et al., 2020b, 2021; Sanky, 2023; Vestal et al., 2017), providing positive ratings of the training (Martinez, 2017; Mitchell et al., 2021; Sanky, 2023) and rating the relevance as high (Duncan et al., 2021; Mitchell et al., 2020b, 2021; Sanky, 2023; Wong et al., 2018). Most intervention participants (93 %) rated the simulation as somewhat or very effective in the Vestal et al. (2017) study. Krull et al. (2019) used the Student Satisfaction and Self-confidence in Learning Revised scale (Adamson et al., 2013; National League for Nursing 2023b) and reported statistically significantly higher satisfaction in nurses, patient care assistants and security staff compared to social sciences staff post-training. The Simulation Design Scale Revised (Adamson et al., 2013; National League for Nursing, 2023a) indicated that satisfaction with the simulation design and feedback provided was significantly different between participants and related to the number of years they had worked in their role. Participants with less experience were more satisfied with feedback provided in the simulation training than participants who had been in their role more than sixteen years. Simulation-based education appears to be a relevant and acceptable format of training for teaching de-escalation and management of aggression skills based on the small number of studies reporting outcome data on attitudes to the training and satisfaction with simulation-based education as a training format.

In summary, studies showed statistically significant improvements in various aspects of knowledge (9 of 11 studies, 82 %), performance (18 of 20 studies, 90 %), attitudes (7 of 7 studies, 100 %), and satisfaction (1 of 8 studies, 13 %), following completion of simulation-based training for managing aggression in the clinical setting. Outcome measures used a variety of validated and non-validated objective and self-report tools and instruments limiting our ability to quantify the effect size of this training intervention.

4. Discussion

4.1. A complex problem requires a novel training approach

This review sought to explore if simulation-based education positively impacted acute care clinician learning experiences and

competence in managing patient aggression. Acute care hospital staff who completed simulation-based training on managing aggression showed statistically significant improvements in knowledge and self-reported confidence. There was a lack of evidence on the magnitude of these improvements and the impact on patient outcomes due to diverse curriculum designs and the inconsistent use of validated outcome measures.

4.2. Simulation design and delivery

This review highlighted that simulation-based education is gaining popularity as a modality to provide practice of skills in preventing and managing aggression for acute care hospital staff. However, each of the twenty-five studies described a training programme unique in design, context, composition, delivery, and evaluation without a clear, evidence-based justification.

Designers of future simulation-based education programmes to develop aggression management skills must include and justify instructional design features of simulation-based education that are relevant to the clinical context and desired learner outcomes. The most effective and important simulation design features to consider are cognitive interactivity, group practice, time spent learning, repetitive practice, range of difficulty, distribution of training across multiple sessions, feedback, capture of clinical variability, curriculum integration and individualised learning (Cook et al., 2013; Issenberg et al., 2005). It was an explicit design feature of this review to include only studies which included live, interactive scenario-based simulations where participants had the opportunity to have an active role. This is because communication skills required to de-escalate aggressive behaviour are not conferred easily and require practice. The communication and decision-making skills of clinicians in each unique and dynamic situation involving behavioural emergencies require practice as a team in simulated situations without patient risk. Clinical and learning needs and identification of learning modalities which are best fit for teaching management of clinical aggression skills are important starting points in the design process (Motola et al., 2013). Simulation scenarios in this review focussed on a variety of different skills from recognising triggers and preventing behavioural crisis situations to managing behavioural crises. Despite the variation in learning objectives, all scenarios delivered active educational experiences to participants.

Curriculum integration has been identified as a key feature of an effective simulation-based education design (Issenberg et al., 2005). Most studies in this review incorporated web-based modules, lectures, workshops and/or skills sessions into the training to support learning. The variation in learning modalities used in addition to simulation-based education is not surprising, given existing evidence on the different ways education should be delivered to promote learning. Embedding other training formats into the simulation-based education was common across included studies, given it is known to increase learning and performance in the simulation (Issenberg et al., 2011; Weller et al., 2012; Yardley et al., 2012). Hybrid innovations in training delivery, including face-to-face and virtual components, are trending due to restrictions imposed by the COVID-19 pandemic and continuing changes in practice. It was not the focus of this review to determine which of the supporting strategies had the greatest efficacy. Future studies should consider which instructional design features and additional learning modalities may enhance effectiveness prior to intervention design and consider organisational culture and practices.

The major gap in this body of evidence is the paucity of programmes focussed on aggression demonstrated by children and young people in hospital. Only three of the twenty-five studies used simulation scenarios that addressed aggression in children and provided opportunities for the participants to practice skills in working with children with differing developmental levels. Given apparent positive learner and organisational acceptability of this training modality, future studies in this area could focus on child and adolescent patients including those

with complex communication needs, given the rapid rise in paediatric behavioural emergencies.

4.3. Efficacy and value of simulation-based education for preventing and managing behavioural emergencies in acute care

In line with the exponential increase in behavioural emergencies triggered by patients in acute hospitals, there has been a similar recent increase in the number of studies using simulation-based education as a training modality for teaching aggression management skills. Twenty-one of the twenty-five studies in this review were published since 2017 and given the increased incidence of aggression reported in hospitals and by parents since the COVID-19 pandemic (Genova et al., 2021; Mutluer et al., 2020; Patrick et al., 2020), we anticipate more in the future. The increase in studies published in the past seven years which have used simulation-based education for teaching aggression management to acute care staff suggests that this training format is gaining acceptance for improving management of behavioural emergencies, following on from the success and establishment of use for medical emergencies. The important implication for researchers in simulation-based education is to demonstrate efficacy of this training modality for its intended purpose ensuring optimum programme design.

Healthcare organisation executives require evidence on programme efficacy and return on investment prior to endorsement for implementation. In this review, our primary outcomes, particularly patient-related outcomes, were not included in most of the studies, instead outcomes such as learner satisfaction and change in confidence were reported. Therefore, the clinical impact of simulation-based education for teaching management of clinical aggression for acute care staff was unable to be assessed. This unexpected finding relating to outcome reporting is likely because many studies were a pre/post-test design with the main focus on learner outcomes. Additionally, the four studies that reported primary outcomes failed to collect sufficient data to estimate the magnitude of effect. This finding is consistent with a previous systematic review by Zendejas et al. (2013) who also endeavoured to measure direct effects for patients from simulation-based education for health professionals and was unable to do so due to a lack of patient-related outcomes.

Most studies in this review reported data relating to participant learning and reaction only. Despite availability of objective measures of participant knowledge and performance (Mavandadi et al., 2016), only five studies provided this type of data with the remainder using self-report measures. Changes in clinicians' self-report of confidence and competence, whilst an accessible method of data collection, need to be considered with caution given they may not be a reliable indication of skill acquisition and knowledge transfer. A weak correlation has been identified between self-reported knowledge and understanding for medical consultants and trainees' literature appraisal skills compared with objective test scores (Khan et al., 2001). Similarly, Hagedorn Wonder et al. (2017) found nurses' self-reported knowledge, skills, attitudes, and practice were not statistically correlated with objectively measured knowledge. Baxter and Norman (2011) also found a negative correlation between nursing students' perceived confidence and their actual clinical ability as evidenced by the score achieved on their objective structured clinical examination. Future research evaluating simulation-based education for aggression management requires objective outcome measurements that address relevant patient and organisational outcomes in addition to learner acceptability and self-report measures of performance.

The value of simulation-based education for an organisation requires consideration of quantitative benefits, qualitative benefits and costs of training delivery. All three components intersect and have an impact on return on investment. None of the studies in this review successfully assessed the value of the training using a monetary value measurement. Future studies should include data around value-related outcomes such as time savings, error reduction, training costs inclusive of staff backfill,

simulation staff and equipment and impact on procedures performed. Researchers should also consider qualitative data on improvements in patient safety and quality of care combined with their subsequent impact on costs. More work needs to be done at an organisational level to ensure patient and staff outcome measures for key parameters are consistently and accurately captured (Mitchell et al., 2021).

4.4. Long-term efficacy and impact

Follow-up assessments, as a measure of knowledge and skill retention, provide important information for educationalists and administrative decision makers to determine the optimal length of time before refresher training is required (Farrell and Cubit, 2005). A small number of studies in this review showed maintenance in confidence at 3–6 months and 12 months however further work is required in this area. Changes that should be considered for measurement over longer time periods in addition to changes in knowledge and confidence include frequency and intensity of aggressive incidents, staff de-escalation skill acquisition, use of restraint and patient and staff harm (Christensen et al., 2021; Livingston et al., 2010). Studies which examine rates of knowledge decay will provide important evidence to support timing of refresher and booster training which in turn impacts return on investment.

4.5. Implications for practice and future research

Simulation-based education using standardised patients, whilst providing clinicians with the valuable opportunity to engage in focussed, repetitive practice with feedback on performance, is a costly and resource-intensive intervention. Hospital administrators or decision-makers require empirical evidence that simulation-based education programmes add value to current training programmes or provide better learner and patient outcomes as a stand-alone training programme. Training design needs to align with organisational culture and service delivery demands.

Researchers designing and delivering these simulation-based training interventions must use validated measures to evaluate patient and organisational outcomes in addition to commonly assessed learner outcomes. Simulation-based education researchers should promote the use of universally agreed tools to ensure studies provide robust data and best scientific evidence about the value of simulation-based education for improving performance in managing clinical aggression.

4.6. Strengths and limitations of this review

The main limitation of this review was our inability to conduct quantitative analysis due to the heterogeneity of the included studies. The major strength of this review is the use of a comprehensive search strategy based on a published protocol with two people independently screening, extracting data and rating risk of bias. Additionally, multiple outcomes were collected that may be associated with effectiveness of the intervention.

5. Conclusions

Simulation-based education on managing clinical aggression showed positive impacts for acute care staff on knowledge and performance. However, with the absence of validated tools, overall effect size was unable to be calculated resulting in insufficient evidence to make strong recommendations for its use. In future, well-designed studies, using reliable, validated tools to objectively measure effects on patient outcomes and skill acquisition with long-term follow-ups, should be conducted in this specialised area. Future directions for research in simulation-based education need to focus on educational, clinical, quality and safety goals and translate findings into practice guidelines.

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijnurstu.2024.104842>.

Funding

This study fulfilled part of the requirements for MM's PhD candidature and was funded in part by an Australian Government Research Training Program Scholarship, the Elizabeth & Vernon Puzey Scholarship and the Rowden White Scholarship. The funders have no input into the planning or conduct of this review or the interpretation or publication of the study results.

CRediT authorship contribution statement

Marijke Mitchell: Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Fiona Newall:** Writing – review & editing, Supervision, Methodology, Formal analysis, Conceptualization. **Charmaine Bernie:** Writing – review & editing, Methodology, Investigation, Formal analysis. **Amanda Brignell:** Writing – review & editing, Investigation, Formal analysis. **Katrina Williams:** Writing – review & editing, Supervision, Methodology, Formal analysis, Conceptualization.

Data availability

The datasets generated by this systematic review will be available from the corresponding author on reasonable request.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors would like to acknowledge Ms Poh Chua and Mr Jason Wasiak for their assistance with this review. JW provided guidance regarding the systematic review process. PC provided assistance with the search strategy and reference management.

References

- Abraham, A., Cheng, T.L., Wright, J.L., Adlestree, I., Huang, Z., Greenberg, L., 2001. Assessing an educational intervention to improve physician violence screening skills. *Pediatrics* 107 (5), E68. <https://doi.org/10.1542/peds.107.5.e68>.
- Abuatiq, A., 2015. Patients' and health care providers' perception of stressors in the intensive care units. *Dimens. Crit. Care Nurs.* 34 (4), 205–214. <https://doi.org/10.1097/dcc.000000000000121>.
- Adamson, K., Kardong-Edgren, S., Willhaus, J., 2013. An updated review of published simulation evaluation instruments. *Clin. Simul. Nurs.* 9 (9), e393–e400. <https://doi.org/10.1016/j.ecns.2012.09.004>.
- Aljohani, B., Burkholder, J., Tran, Q.K., Chen, C., Beisenova, K., Pourmand, A., 2021. Workplace violence in the emergency department: a systematic review and meta-analysis. *Public Health* 196, 186–197. <https://doi.org/10.1016/j.puhe.2021.02.009>.
- Alzahrani, N., 2021. The effect of hospitalization on patients' emotional and psychological well-being among adult patients: an integrative review. *Appl. Nurs. Res.* 61, 151488. <https://doi.org/10.1016/j.apnr.2021.151488>.
- Baxter, P., Norman, G., 2011. Self-assessment or self deception? A lack of association between nursing students' self-assessment and performance. *J. Adv. Nurs.* 67 (11), 2406–2413. <https://doi.org/10.1111/j.1365-2648.2011.05658.x>.
- Benton, T.D., Boyd, R.C., Njoroge, W.F.M., 2021. Addressing the global crisis of child and adolescent mental health. *JAMA Pediatr.* 175 (11), 1108–1110. <https://doi.org/10.1001/jamapediatrics.2021.2479>.
- Bilotta, F.F., Werner, S.M., Bergese, S.D., Rosa, G., 2013. Impact and implementation of simulation-based training for safety. *ScientificWorldJournal* 2013, 652956. <https://doi.org/10.1155/2013/652956>.
- Blackmore, A., Kasfiki, E.V., Purva, M., 2018. Simulation-based education to improve communication skills: a systematic review and identification of current best practice. *BMJ Simul. Technol. Enhanc. Learn.* 4 (4), 159–164. <https://doi.org/10.1136/bmjstel-2017-000220>.
- Brown, R.G., Anderson, S., Brunt, B., Enos, T., Blough, K., Kropp, D., 2018. Workplace Violence Training Using Simulation: a combination of classroom learning, simulation,

- and hands-on defense techniques improves preparedness. *Am. J. Nurs.* 118 (10), 56–68. <https://doi.org/10.1097/01.NAJ.0000546382.12045.54>.
- Carison, A., Bahl, F.E., Hill, A., O'Donnell, S.M., 2020. Children and adolescents with severe acute behavioural disturbance in the emergency department. *Emerg. Med. Australas.* 32 (5), 747–755. <https://doi.org/10.1111/1742-6723.13515>.
- Carubia, B., Becker, A., Levine, B.H., 2016. Child psychiatric emergencies: updates on trends, clinical care, and practice challenges. *Curr. Psychiatry Rep.* 18 (4), 41. <https://doi.org/10.1007/s11920-016-0670-9>.
- Chang, Y.C., Hsu, M.C., Ouyang, W.C., 2022. Effects of integrated workplace violence management intervention on occupational coping self-efficacy, goal commitment, attitudes, and confidence in emergency department nurses: a cluster-randomized controlled trial. *Int. J. Environ. Res. Public Health* 19 (5). <https://doi.org/10.3390/ijerph19052835>.
- Christensen, S.S., Lassche, M., Banks, D., Smith, G., Inzunza, T.M., 2021. Reducing patient aggression through a nonviolent patient de-escalation program: a descriptive quality improvement process. *Worldviews Evid.-Based Nurs.* 26, 26. <https://doi.org/10.1111/wvn.12540>.
- Converso, D., Sottimano, I., Balducci, C., 2021. Violence exposure and burnout in healthcare sector: mediating role of work ability. *Med. Lav.* 112 (1), 58–67. <https://doi.org/10.23749/mdl.v112i1.9906>.
- Cook, D.A., Hamstra, S.J., Brydges, R., Zendejas, B., Szostek, J.H., Wang, A.T., Erwin, P.J., Hatala, R., 2013. Comparative effectiveness of instructional design features in simulation-based education: systematic review and meta-analysis. *Med. Teach.* 35 (1), e867–e898. <https://doi.org/10.3109/0142159X.2012.714886>.
- Cowin, L., Davies, R., Estall, G., Berlin, T., Fitzgerald, M., Hoot, S., 2003. De-escalating aggression and violence in the mental health setting. *Int. J. Ment. Health Nurs.* 12 (1), 64–73. <https://doi.org/10.1046/j.1440-0979.2003.00270.x>.
- Croen, L., Najjar, D., Ray, G., Lotspeich, L., Bernal, P., 2006. A comparison of health care utilization and costs of children with and without autism spectrum disorders in a large group-model health plan. *Pediatrics* 118 (4), e1203–e1211. <https://doi.org/10.1542/peds.2006-0127>.
- D'Ettorre, G., Pellicani, V., Mazzotta, M., Vullo, A., 2018. Preventing and managing workplace violence against healthcare workers in Emergency Departments. *Acta Biomed* 89 (4–s), 28–36. <https://doi.org/10.23750/abm.v89i4-S.7113>.
- Duncan, G., Schabbing, M., Gable, B.D., 2021. A novel simulation-based multidisciplinary verbal de-escalation training. *Cureus* 13 (12), e20849. <https://doi.org/10.7759/cureus.20849>.
- Eldridge, S.M., Campbell, M., Campbell, M., Dahota, A., Giraudeau, B., Higgins, J., Reeves, B., Siegfried, N., 2016. Revised Cochrane risk of bias tool for randomised trials (RoB 2.0): additional considerations for cluster-randomised trials. *Cochrane Methods. Cochrane Database Syst. Rev.* 10.
- Emmerling, S.A., McGarvey, J.S., Burdette, K.S., 2024. Evaluating a workplace violence management program and nurses' confidence in coping with patient aggression. *J. Nurs. Adm.* 54 (3), 160–166. <https://doi.org/10.1097/NNA.0000000000001402>.
- Farrell, G., Cubit, K., 2005. Nurses under threat: a comparison of content of 28 aggression management programs. *Int. J. Ment. Health Nurs.* 14 (1), 44–53. <https://doi.org/10.1111/j.1440-0979.2005.00354.x>.
- Genova, H.M., Arora, A., Botticello, A.L., 2021. Effects of school closures resulting from COVID-19 in autistic and neurotypical children. *Front. Educ. (Lausanne)* 6. <https://doi.org/10.3389/educ.2021.761485>.
- Grossman, D.C., Choucair, B., 2019. Violence and the US health care sector: burden and response. *Health Aff. (Millwood)* 38 (10), 1638–1645. <https://doi.org/10.1377/hlthaff.2019.00642>.
- Hagedorn Wonder, A., McNelis, A.M., Spurlock Jr., D., Ironside, P.M., Lancaster, S., Davis, C.R., Gainey, M., Verwers, N., 2017. Comparison of nurses' self-reported and objectively measured evidence-based practice knowledge. *J. Contin. Educ. Nurs.* 48 (2), 65–70. <https://doi.org/10.3928/00220124-20170119-06>.
- Hazen, E.P., Ravichandran, C., Rao Hureau, A., O'Rourke, J., Madva, E., McDougle, C.J., 2020. Agitation in patients with autism spectrum disorder admitted to inpatient pediatric medical units. *Pediatrics* 145 (Suppl. 1), S108–S116. <https://doi.org/10.1542/peds.2019-1895n>.
- Heale, R., Twycross, A., 2015. Validity and reliability in quantitative studies. *Evid Based Nurs* 18 (3), 66–67. <https://doi.org/10.1136/eb-2015-102129>.
- Iacono, T., Bigby, C., Unsworth, C., Douglas, J., Fitzpatrick, P., 2014. A systematic review of hospital experiences of people with intellectual disability. *BMC Health Serv. Res.* 14 (1), 505. <https://doi.org/10.1186/s12913-014-0505-0>.
- Issenberg, S.B., McGaghie, W.C., Petrusa, E.R., Lee Gordon, D., Scalese, R.J., 2005. Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review. *Med. Teach.* 27 (1), 10–28. <https://doi.org/10.1080/01421590500046924>.
- Issenberg, S.B., Ringsted, C., Ostergaard, D., Dieckmann, P., 2011. Setting a research agenda for simulation-based healthcare education: a synthesis of the outcome from an Utstein style meeting. *Simul. Healthc.* 6 (3), 155–167. <https://doi.org/10.1097/SIH.0b013e3182207c24>.
- Jansen, G., Dassen, T., Moorer, P., 1997. The perception of aggression. *Scand. J. Caring Sci.* 11 (1), 51–55. <https://doi.org/10.1111/j.1471-6712.1997.tb00430.x>.
- Johnson, E., Hamilton, M., Watson, R., Claxton, R., Barnett, M., Thompson, A., Arnold, R., 2017. An intensive, simulation-based communication course for pediatric critical care medicine fellows. *Pediatr. Crit. Care Med.* 18 (8), e348–e355. <https://doi.org/10.1097/pcc.0000000000001241>.
- Khan, K.S., Awonuga, A.O., Dwarakanath, L.S., Taylor, R., 2001. Assessments in evidence-based medicine workshops: loose connection between perception of knowledge and its objective assessment. *Med. Teach.* 23 (1), 92–94. <https://doi.org/10.1080/01421590150214654>.
- Kirkpatrick, D., 2006. *Evaluating Training Programs: The Four Levels*. Berrett-Koehler Publishers, San Francisco.

- Kirkpatrick, D., Kirkpatrick, J., 2007. *Implementing the Four Levels: A Practical Guide for Effective Evaluation of Training Programs*. Berrett-Koehler, California.
- Krull, W., Gusenius, T., Germain, D., Schnepfer, L., 2019. Staff perception of interprofessional simulation for verbal de-escalation and restraint application to mitigate violent patient behaviors in the emergency department. *J. Emerg. Nurs.* 45 (1), 24–30. <https://doi.org/10.1016/j.jen.2018.07.001>.
- Kunst, E.L., Mitchell, M., Johnston, A.N., 2017. Using simulation to improve the capability of undergraduate nursing students in mental health care. *Nurse Educ. Today* 50, 29–35. <https://doi.org/10.1016/j.nedt.2016.12.012>.
- Lee, B., Del Rosario, K., Byron-Iyama, C., 2017. Incorporating relationship-based care into a nurse education program for managing disruptive patient behaviors. *Clin. Nurse Spec.* 31 (4), 201–209. <https://doi.org/10.1097/NUR.0000000000000309>.
- Lewis, R., Strachan, A., Smith, M., 2012. Is high fidelity simulation the most effective method for the development of non-technical skills in nursing? A review of the current evidence. *Open Nurs.* 6, 82–89. <https://doi.org/10.2174/1874434601206010082>.
- Liu, C., Liu, W., Jiao, M., Li, Y., Zhang, G., Wei, L., Zhou, S., Li, Y., Sha, Z., Hao, Y., Wu, Q., 2022. A combined behavioural economics- and simulation-based medical education to promote effectiveness among medical residents in coping with workplace violence in Northern China: a quasi-experimental study. *BMC Public Health* 22 (1), 1090. <https://doi.org/10.1186/s12889-022-13497-y>.
- Livingston, J., Verdun-Jones, S., Brink, J., Lussier, P., Nicholls, T., 2010. A narrative review of the effectiveness of aggression management training programs for psychiatric hospital staff. *J. Forensic Nurs.* 6 (1), 15–28. <https://doi.org/10.1111/j.1939-3938.2009.01061.x>.
- Lovett, C.J., Hiles, J.-A., Calver, L., Pallas, J.D., Thomson Bowe, K., Downes, M.A., 2022. Factors associated with paediatric and adolescent Emergency Department presentations involving acute behavioural disturbance events. *J. Paediatr. Child Health* 58 (1), 110–115. <https://doi.org/10.1111/jpc.15668>.
- Malas, N., Spital, L., Fischer, J., Kawai, Y., Cruz, D., Keefer, P., 2017. National survey on paediatric acute agitation and behavioral escalation in academic inpatient pediatric care settings. *Psychosomatics* 58 (3), 299–306. <https://doi.org/10.1016/j.psych.2017.01.009>.
- Martinez, A., 2017. Implementing a workplace violence simulation for undergraduate nursing students: a pilot study. *J. Psychosoc. Nurs. Ment. Health Serv.* 55 (10), 39–44. <https://doi.org/10.3928/02793695-20170818-04>.
- Mavandadi, V., Bieling, P.J., Madsen, V., 2016. Effective ingredients of verbal de-escalation: validating an English modified version of the 'De-Escalating Aggressive Behaviour Scale'. *J. Psychiatr. Ment. Health Nurs.* 23 (6–7), 357–368. <https://doi.org/10.1111/jpm.12310>.
- McGaghie, W., Issenberg, S., Cohen, E., Barsuk, J., Wayne, D., 2011. Does simulation-based medical education with deliberate practice yield better results than traditional clinical education? A meta-analytic comparative review of the evidence. *Acad. Med.* 86 (6), 706–711. <https://doi.org/10.1097/ACM.0b013e318217e119>.
- Ming, J.L., Huang, H.M., Hung, S.P., Chang, C.L., Hsu, Y.S., Tzeng, Y.M., Huang, H.Y., Hsu, T.F., 2019a. Using simulation training to promote nurses' effective handling of workplace violence: a quasi-experimental study. *Int. J. Environ. Res. Public Health* 16 (19), 28. <https://doi.org/10.3390/ijerph16193648>.
- Ming, J.L., Tseng, L.H., Huang, H.M., Hong, S.P., Chang, C.L., Tung, C.Y., 2019b. Clinical simulation teaching program to promote the effectiveness of nurses in coping with workplace violence. *Hu Li Za Zhi* 66 (3), 59–71. [https://doi.org/10.6224/JN.201906_66\(3\).08](https://doi.org/10.6224/JN.201906_66(3).08).
- Mitchell, M., Bernie, C., Newall, F., Williams, K., 2020a. Simulation-based education for teaching aggression management skills to health care providers in the acute health care setting: a systematic review protocol. *Syst. Rev.* 9 (1), 208. <https://doi.org/10.1186/s13643-020-01466-8>.
- Mitchell, M., Newall, F., Sokol, J., Heywood, M., Williams, K., 2020b. Simulation-based education to promote confidence in managing clinical aggression at a paediatric hospital. *Adv. Simul. (Lond.)* 5 (1), 21. <https://doi.org/10.1186/s41077-020-00139-9>.
- Mitchell, M., Newall, F., Heywood, M., Sokol, J., Williams, K., 2021. Simulation-based education for staff managing aggression and high-risk behaviours in children with autism spectrum disorder in the hospital setting: a pilot and feasibility cluster randomised controlled trial. *J. Nurs. Educ. Pract.* 11 (11), 48–63. <https://doi.org/10.5430/jnep.v11n11p48>.
- Mitchell, M., Newall, F., Williams, K., 2022. Behavioural emergencies in a paediatric hospital environment. *J. Paediatr. Child Health* 58 (6). <https://doi.org/10.1111/jpc.15896>.
- Motola, I., Devine, L.A., Chung, H.S., Sullivan, J.E., Issenberg, B., 2013. Simulation in healthcare education: a best evidence practical guide. *AMEE Guide No. 82*. *Med Teach*, p. 35. <https://doi.org/10.3109/0142159x.2013.818632>.
- Mutluer, T., Doenyas, C., Aslan Genc, H., 2020. Behavioral implications of the Covid-19 process for autism spectrum disorder, and individuals' comprehension of and reactions to the pandemic conditions. *Front. Psychiatry* 11. <https://doi.org/10.3389/fpsy.2020.561882>.
- National League for Nursing, 2023a. "The Simulation Design Scale": tools and instruments. <https://www.nln.org/education/teaching-resources/tools-and-instruments> (Oct 22).
- National League for Nursing, 2023b. "Student Satisfaction and Self-confidence in Learning": tools and instruments. <https://www.nln.org/education/teaching-resources/tools-and-instruments> (Oct 22).
- Nau, J., Halfens, R., Needham, I., Dassen, T., 2010. Student nurses' de-escalation of patient aggression: a pretest-posttest intervention study. *Int. J. Nurs. Stud.* 47 (6), 699–708. <https://doi.org/10.1016/j.ijnurstu.2009.11.011>.
- Paterson, B., Turnbull, J., Aitken, I., 1992. An evaluation of a training course in the short-term management of violence. *Nurse Educ. Today* 12 (5), 368–375. [https://doi.org/10.1016/0260-6917\(92\)90113-3](https://doi.org/10.1016/0260-6917(92)90113-3).
- Patrick, S.W., Henkhaus, L.E., Zickafoose, J.S., Lovell, K., Halvorson, A., Loch, S., Letterie, M., Davis, M.M., 2020. Well-being of parents and children during the COVID-19 pandemic: a national survey. *Pediatrics* 146 (4). <https://doi.org/10.1542/peds.2020-016824>.
- Ramacciati, N., Ceccagnoli, A., Addey, B., Lumini, E., Rasero, L., 2016. Interventions to reduce the risk of violence toward emergency department staff: current approaches. *Open Access Emerg. Med.* 8, 17–27. <https://doi.org/10.2147/oaem.s69976>.
- Rudolph, J.W., Simon, R., Rivard, P., Dufresne, R.L., Raemer, D.B., 2007. Debriefing with good judgment: combining rigorous feedback with genuine inquiry. *Anesthesiol. Clin.* 25 (2), 361–376. <https://doi.org/10.1016/j.anclin.2007.03.007>.
- Rudolph, J.W., Simon, R., Raemer, D.B., Eppich, W.J., 2008. Debriefing as formative assessment: closing performance gaps in medical education. *Acad. Emerg. Med.* 15. <https://doi.org/10.1111/j.1553-2712.2008.00248.x>.
- Sanky, C., 2023. Safe and sound: an improvisational theater-based curriculum and behavioral intervention to address violence in the emergency department. *J. Emerg. Med.* 64 (2), 236–245. <https://doi.org/10.1016/j.jemermed.2022.11.002>.
- Schwartz, F., Bjorklund, P., 2019. Quality improvement project to manage workplace violence in hospitals: lessons learned. *J. Nurs. Care Qual.* 34 (2), 114–120. <https://doi.org/10.1097/NCQ.0000000000000358>.
- Siassakos, D., Bristowe, K., Hamby, H., Angouri, J., Crofts, J., Winter, C., Hunt, L., Draycott, T., 2011. Team communication with patient actors: findings from a multisite simulation study. *Simul. Healthc.* 6 (3), 143–149. <https://doi.org/10.1097/SIH.0b013e31821687cf>.
- Smidt, A., Balandin, S., Sigafos, J., Reed, V., 2009. The Kirkpatrick model: a useful tool for evaluating training outcomes. *J. Intellect. Develop. Disabil.* 34 (3), 266–274. <https://doi.org/10.1080/13668250903093125>.
- Sterne, J.A., Hernán, M.A., Reeves, B.C., Savović, J., Berkman, N.D., Viswanathan, M., Henry, D., Altman, D.G., Ansari, M.T., Boutron, I., Carpenter, J.R., Chan, A.V., Churchill, R., Deeks, J.J., Hróbjartsson, A., Kirkham, J., Jüni, P., Loke, Y.K., Pigott, T.D., Ramsay, C.R., Regidor, D., Rothstein, H.R., Sandhu, L., Santaguida, P.L., Schönemann, H.J., Shea, B., Shrier, I., Tugwell, P., Turner, L., Valentine, J.C., Waddington, H., Waters, E., Wells, G.A., Whiting, P.F., Higgins, J.P., 2016. ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. *BMJ* 355, i4919. <https://doi.org/10.1136/bmj.i4919>.
- Sterne, J.A.C., Savović, J., Page, M.J., Elbers, R.G., Blencowe, N.S., Boutron, I., Cates, C.J., Cheng, H.Y., Corbett, M.S., Eldridge, S.M., Emberson, J.R., Hernán, M.A., Hopewell, S., Hróbjartsson, A., Junqueira, D.R., Jüni, P., Kirkham, J.J., Lasserson, T., Li, T., McAleenan, A., Reeves, B.C., Shepperd, S., Shrier, I., Stewart, L.A., Tilling, K., White, I.R., Whiting, P.F., Higgins, J.P., 2019. RoB 2: a revised tool for assessing risk of bias in randomised trials. *BMJ* 366, i4898. <https://doi.org/10.1136/bmj.i4898>.
- Stewart, C., Reeves, L., 2021. What are you afraid of? Managing staff fear and anxiety with agitated patients. *J. Am. Psychiatr. Nurses Assoc.* 27 (2), 156–161. <https://doi.org/10.1177/1078390320902815>.
- Thackrey, M., 1987. Clinician confidence in coping with patient aggression: assessment and enhancement. *Prof. Psychol. Res. Pract.* 18 (1), 57–60. <https://doi.org/10.1037/0735-7028.18.1.57>.
- Vestal, H.S., Sowden, G., Nejad, S., Stoklosa, J., Valcourt, S.C., Keary, C., Caminis, A., Huffman, J., 2017. Simulation-based training for residents in the management of acute agitation: a cluster randomized controlled trial. *Acad. Psychiatry* 41 (1), 62–67. <https://doi.org/10.1007/s40596-016-0559-2>.
- Weller, J.M., Nestel, D., Marshall, S.D., Brooks, P.M., Conn, J.J., 2012. Simulation in clinical teaching and learning. *Med. J. Aust.* 196 (9), 594. <https://doi.org/10.5694/mja10.11474>.
- Williams, J.C., Balasuriya, L., Alexander-Bloch, A., Qayyum, Z., 2019. Comparing the effectiveness of a guide booklet to simulation-based training for management of acute agitation. *Psychiatry Q.* 90 (4), 861–869. <https://doi.org/10.1007/s1126-019-09670-z>.
- Wong, A., Wing, L., Weiss, B., Gang, M., 2015. Coordinating a team response to behavioral emergencies in the emergency department: a simulation-enhanced interprofessional curriculum. *West. J. Emerg. Med.* 16 (6), 859–865. <https://doi.org/10.5811/westjem.2015.8.26220>.
- Wong, A., Auerbach, M., Ruppel, H., Crispino, L., Rosenberg, A., Iennaco, J., Vaca, F., 2018. Addressing dual patient and staff safety through a team-based standardized patient simulation for agitation management in the emergency department. *Simul. Healthc.* 13 (3), 154–162. <https://doi.org/10.1097/sih.0000000000000309>.
- Woodman, A.C., Mawdsley, H.P., Hauser-Cram, P., 2014. Parenting stress and child behavioral problems within families of children with developmental disabilities: transactional relations across 15 years. *Res. Dev. Disabil.* 36c, 264–276. <https://doi.org/10.1016/j.ridd.2014.10.011>.
- Wu, J.-C., Chen, H.-Y., Lee Hsieh, J., Clinciu, D.L., Tung, H.-H., 2019. Enhancing health care personnel's response to ER violence using situational simulation. *Clin. Simul. Nurs.* 28, 6–14. <https://doi.org/10.1016/j.ecns.2018.12.003>.
- Yardley, S., Teunissen, P.W., Dornan, T., 2012. Experiential learning. *AMEE Guide No. 63*. *Med Teach*, p. 34. <https://doi.org/10.3109/0142159x.2012.650741>.
- Young, J., Fawcett, K., Gillman, L., 2022. Evaluation of an immersive simulation programme for mental health clinicians to address aggression, violence, and clinical deterioration. *Int. J. Ment. Health Nurs.* 31 (6), 1417–1426. <https://doi.org/10.1111/inm.13040>.
- Zendejas, B., Brydges, R., Wang, A.T., Cook, D.A., 2013. Patient outcomes in simulation-based medical education: a systematic review. *J. Gen. Intern. Med.* 28 (8), 1078–1089. <https://doi.org/10.1007/s11606-012-2264-5>.
- Zhang, L., Wang, A., Xie, X., Zhou, Y., Li, J., Yang, L., Zhang, J., 2017. Workplace violence against nurses: a cross-sectional study. *Int. J. Nurs. Stud.* 72, 8–14. <https://doi.org/10.1016/j.ijnurstu.2017.04.002>.
- Zhang, S.-E., Liu, W., Wang, J., Shi, Y., Xie, F., Cang, S., Sun, T., Fan, L., 2018. Impact of workplace violence and compassionate behaviour in hospitals on stress, sleep quality and subjective health status among Chinese nurses: a cross-sectional survey. *BMJ Open* 8 (10), e019373. <https://doi.org/10.1136/bmjopen-2017-019373>.