Received: 20 April 2020 | Revised: 28 July 2020 | Accepted: 7 August 2020

DOI: 10.1111/jan.14577

REVIEW

JAN Leading Global Nursing Research WILEY

Ageing simulation in health and social care education: A mixed methods systematic review

Charlotte Eost-Telling[1] | Paul Kingston[1] | Louise Taylor[2] | Louise Emmerson[1]

[1]Centre for Ageing and Mental Health, Faculty of Health and Social Care, University of Chester, Chester, UK

[2]Faculty of Health and Social Care, University of Chester, Chester, UK

Correspondence
Charlotte Eost-Telling, Centre for Ageing and Mental Health, Faculty of Health and Social Care, University of Chester, Chester, UK.
Email: c.eosttelling@chester.ac.uk

Funding information
This work was supported by the University of Chester through a QR Grant [QR270].

Abstract

Aim: To identify, evaluate and summarize evidence from qualitative, quantitative and mixed method studies conducted using age suits or other age simulation equipment, with health and social care students.

Design: Convergent segregated mixed method review design as outlined by the Johanna Briggs Institute.

Data Sources: CINAHL (+ with Full Text), MEDLINE, PsycINFO, PubMed, SocINDEX, Web of Science, Cochrane Library, Emerald Insight, Proquest nursing, Science Direct, Wiley Online and BioMed Central (January 2000–January 2020).

Review methods: Convergent segregated synthesis was used to synthesize evidence from the studies and the MERSQI checklist used to appraise quality.

Results: A total of 23 studies were reviewed: one randomized control, two post-test only randomized control, three quasi-experimental, 15 one-group pre/post studies and two qualitative studies. Of the seventeen studies carrying out inferential statistics on attitude scores post intervention, 11 reported an improvement, three indicated no significant change and three reported worsening scores. Key themes included use of appropriate scales, type of equipment used, location and length of interactions, debriefing and contextualization of interventions in broader teaching.

Conclusion: The impact of ageing simulation interventions on health and social care student's attitudes to older people was predominantly positive. However, further high-quality research is warranted to understand the optimal use of such interventions in the context of health care for a growing ageing population.

Impact: It is important health and social care staff have appropriate knowledge and training to enable them to provide high-quality care to older people and challenge potential ageism in the system. This review adds to the body of work around the use of simulation and experiential learning to educate health and social care students about ageing and ageism. It also offers recommendations for using ageing simulations effectively to inform attitudes of prospective professionals who will influence future health and social care.

KEYWORDS
age suit, ageing, attitudes, education, empathy, experiential learning, health and social care, nursing, simulation, systematic review

1 | INTRODUCTION

Simulation-based clinical education is a useful pedagogical approach providing nursing students with opportunities to practice their clinical and decision-making skills through varied real-life situational experiences, without compromising the patient's well-being (Kim et al., 2016). The value of simulation-based education has been acknowledged for some time; in its report '150 years of the Annual Report of the Chief Medical Officer: On the state of public health 2008' (Department of Health, 2009) it was suggested that simulation should be 'more fully integrated into the health service', providing an impetus for the growth of simulation in the UK.

Aside from its clear role in enhancing the effectiveness of teaching procedural aspects of the core medical training curriculum, simulation-based education also offers an opportunity to deepen understanding and awareness of the importance of non-technical skills, such as communication and 'human factors' in healthcare delivery (Purva et al., 2016).

1.1 | Background

In the United Kingdom (UK), the percentage of the population aged 65 and older was 17.8% in 2015. This is estimated to rise to 23.6% by 2035 and those over 90 totalled over half a million people in 2015 (Office for National Statistics, 2013). The impacts healthier lifestyles and modern medicine have had on society have been hugely successful and should be celebrated, however they are also leading to a rethink in how health and social care can be provided to an ageing society (Oliver et al., 2014).

Whilst many people will age well, living long, healthy, independent lives, it must also be recognized that with increasing age comes a greater likelihood of living with disability, frailty and co-morbidity. Consequently, the rise in older people with disabilities or comorbidities, may have significant impacts on health and social care systems; the impact of this compromised longevity may vary across countries, however, it is a complex picture (Bloom et al., 2010; Breyer et al., 2010; Payne et al., 2007). Nevertheless, there is a growing need for knowledgeable and committed staff in geriatrics, but also across all disciplines, who have been trained and educated in programmes where caring for older people is fully embedded (Liu et al., 2013).

These changes in health and social care needs are set against a background of UK and global shortages in qualified healthcare professionals, with an increasingly impact of the ageing workforce in health care paralleling the ageing demography seen in society (Christie & Co, 2015). Further, the low numbers of professionals looking to work with older people and the perceived unattractiveness of a career working with older patients versus younger populations have exacerbated the situation (Gonçalves, 2009; Samra et al., 2013).

Ageism and ageist attitudes amongst health and social care staff are well documented and often most prominent where there are tensions in the system, e.g. where there are most older people (Binstock, 2010), although the picture is complex and often contradictory. Rush et al. (2017) reviewed the literature relating to nurses' attitudes to older people and their care and reported study participants held both positive and negative attitudes, sometimes concomitantly. However ageism among healthcare professionals can impact patient's health and well-being in later life (Kagan & Melendez-Torres, 2015; Lamont et al., 2015) and assumptions regarding decline can lead to restrictions accessing medical information and treatment options (Burnes et al., 2019) and reduce independence and decision-making (Askham, 2008; Courtney et al., 2000).

Whilst experiential education is recognized to play a significant role in the development of positive attitudes towards the care of older people (Koh, 2012) and student nurses identify knowledge as fundamental when providing care (Celik et al., 2010), nurse education often focuses on abstract concepts and theoretical ideas more than practical experiences (Deasey et al., 2014). Ageing simulation equipment enables students to undergo experiences which potentially affect older patients and by asking the learner to act the role of patient this may be more effective in developing greater empathy (Bearman et al., 2015). Ageing simulation equipment is used to describe a variety of methods and props designed to enable participants to experience physical and cognitive aspects of ageing, for example age suits (see Table 1), ageing games which include ageing simulation equipment and locally developed apparatus to model the effects of ageing. In conjunction with conceptual and theoretical teaching, simulation can help to challenge ageist attitudes and behaviour.

The non-academic literature suggests that many hospitals and universities have invested in ageing simulation equipment (Millett, 2014; Platell, 2014; The Press Association, 2011) however its use has remained piecemeal and a limited number of research studies in this area have been published to date. Age suits which use a range of materials to, for example, restrict movement of the knees, elbows, back and neck and goggles to simulate a range of optical conditions vision, have been developed over several years and were primarily used by car manufacturers to ensure their vehicles met the needs of older drivers (Hitchcock et al., 2001; Steinfeld & Steinfeld, 2001). See Table 1 for a description of commonly used ergonomically designed age suits. Latterly, these suits have continued to be developed and the field of application has widened considerably (Cardoso & Clarkson, 2012).

Nevertheless, there is little published literature on the effectiveness of age simulation equipment in increasing users understanding

TABLE 1 Description of ergonomically designed age suits

Overview of ergonomically designed age-suits	
Age suits are made up of modules of 'equipment' that can be used individually or together to simulate the experiences of some older people. These can include: • Weighted body vests, ankle and wrist weights to simulate muscle loss in older people • Elbow, knee and neck braces of different strengths to simulate joint stiffness, or in some cases straps and exoskeletons to restrict movement. Gloves to simulate hand stiffness. • Goggles/glasses simulating eyesight changes in older age and specific eye conditions, e.g. macular degeneration • Ear defenders and tinnitus simulators to mimic the effect of hearing loss/changes • Unsteady/oversized shoe covers to replicate an unsteady gait. • Gloves to simulate nerve damage in fingers • There are also additional elements such as full leg brace, arm sling, walking stick to replicate the possible effects of having a stroke. Further back nerve damage simulators can be included. • There are a small number of suits which have been developed to include an exoskeleton which can include computer controlled joint movement, and augmented reality headsets, however these suits are highly specialized and expensive, and may not provide a large enough return on investment to make them suitable for use within University simulation training programmes.	
Description of current ergonomically designed age suits	
AGNES (Gain Now Empathy System)	Developed by MIT AgeLab researchers (2005) to simulate motor, visual, flexibility, dexterity and strength of someone about 75 years. Helmet, goggles, ear plugs, cervical collar, gloves, wrist orthosis, orthosis for knees and elbows, foam shoes. Elastic straps between helmet and belt, belt and ankles, belt and wrists
Genworth R70i	Produced by Applied Minds LLC—considered most evolved suit at the time (2016). Exoskeleton controlled by computer in the back and a virtual reality helmet to simulate hearing and vision disorders. Force added to joints—experience shown to others by means of LED colours. Multitude of stimuli—participant experiences disorientation and may fall. Controlled wirelessly by operator to vary age related 'deficiencies'
GERT— (Gerontologic Test suit)	Produced by Produkt + Projekt Wolfgang Moll in Germany. Includes special modules for specific conditions. Not aimed at achieving specific age but ageing 30–40 years and this is adjustable. Includes weighted vest, ankle and wrist weights, neck brace, knee brace, elbow brace, ear plugs, goggles, balance shoe covers, and other modules, e.g. for stroke, tinnitus, kyphosis, and nerve damage to cover a wide range of conditions.
PAUL suit— (Premature Ageing Unisex Leisure)	Developed locally in New South Wales, Australia to simulate a wide range of functional losses in the wearer including joint restriction, hemiparesis and sensory losses (visual and hearing deficits). The suit consists of tightening straps on the trunk and limbs of the suit and wearing props such as earplugs, gloves and specially prepared glasses.
Sakamoto suit	'Overall' type suit with belts and straps which can be adjusted, goggles, ear plugs, gloves, weights—ankle and wrist, cane.
Third Age suit	Designed in 1990 by the Ford Motor Company to understand difficulties older people may have getting in and out of cars. Includes weighted vest, eye goggles, leg weights, elbow and neck restrictors, ear coverings and straps to simulate kyphosis of spine.

of the possible physical and sensory changes in later life, or the impact of using an age suit on attitudes to and empathy for older people. This paper aims to review the current research in the field covering the use of age suits and age simulation equipment with healthcare students, to better understand the impact of using ageing simulations in health and social care.

2 | THE REVIEW

2.1 | Aim

The aim of this review was to identify, evaluate and summarize the available evidence from qualitative, quantitative and mixed method studies conducted using an age suit or other age simulation equipment, with health and social care students.

The review aimed to answer the following question:

- What impact does the use of age suits or age simulation equipment have on the attitudes, empathy and anxiety levels of health and social care students regarding their interactions with older people?

2.2 | Design

This review employed a convergent segregated mixed method review design as outlined by the Johanna Briggs Institute (Lizarondo et al., 2020).

2.3 | Search methods

Twelve subject specific databases and journal databases relevant to nursing, health care, education and social science were searched.

These were: CINAHL (+ with Full Text), MEDLINE, PsycINFO, PubMed, SocINDEX, Web of Science, Cochrane Library, Emerald Insight, Proquest nursing, Science Direct, Wiley Online and BioMed Central. The databases were searched for all records between January 2000 and January 2020.

Studies were required to meet the following criteria for inclusion in the review:

1. Written in English
2. Full text article available

Duplicate articles and those considered unrelated to the current review were excluded by title and abstract. To increase the scope of the review and ensure relevant papers were identified, the reference lists of all retrieved articles were hand searched.

2.3.1 | Inclusion criteria

Inclusion criteria for this review were: original research studies that reported the use of 'age suits' or other age simulation equipment, in health and social care settings, conducted between 2000 and 2020. The review considered quantitative, qualitative and mixed methods studies. Studies were excluded if they did not report any outcomes from the activities undertaken, they were written in a language other than English or if they were not in a health or social care setting.

2.3.2 | Search terms

The review involved keyword searches of online databases. Search terms used covered each aspect of the review and search terms were combined as described in Table 2.

2.4 | Search outcome

The databases were searched using the search terms, as described above. Articles identified as potentially relevant from the title were retrieved and the abstract read. If after reading the abstract they were still deemed relevant, the full article was retrieved to be reviewed further. The PRISMA study inclusion process used in this review is detailed in Figure 1.

Data including authors, year, aims, location, population, study design, equipment used and intervention design, attitude and other scales included and results were extracted from the eligible papers and entered into Table 3. Two authors reviewed the papers and agreed on those to be included in the review.

2.5 | Quality appraisal

The included papers used a range of approaches and data reporting and were appraised for quality using the Medical Education Research Study Quality Instrument (MERSQI) (Cook & Reed, 2015). This is a validated 10-item scale covering six domains: study design, sampling, type of data, validity of evaluation instrument, data analysis and outcomes. Quality appraisal was conducted independently by two researchers and consensus through discussion was reached on the final scores.

2.6 | Data abstraction and synthesis

Quantitative and qualitative data extraction was completed by two researchers, using the relevant JBI data extraction tools and details of each of the papers included in the review were entered into Table 3. The extracted data included the author(s), year of publication, study aims, intervention, location, participants, research method, simulation equipment used, the research tools employed and the assigned MERSQI score for quality appraisal. Additionally, the outcomes of the research were extracted into Tables 5–7 for further appraisal and a descriptive analysis of the studies was completed to give an overview of the interventions, contexts and participants.

3 | RESULTS

An initial search of the twelve databases included in this review produced 124 studies. After removing duplicates and studies identified

TABLE 2 Search terms used to identify relevant literature

i	Age suit: "ag* suit" OR "ag*-suit" OR "ag* simulation" OR "ag* game" NOT "agent"
ii.	Health and social care: healthcare OR "social care" OR "health" or "nurs*" OR "doctor*" OR "care assistant*" OR "medic*"
iii.	Attitudes: attitude* OR opinion* OR feeling* OR thought* OR view* OR concept* OR belief* OR understand* OR knowledg* OR empath* OR aware* OR perception* OR compassion* OR toleran* OR insight* OR comprehen*
iv.	Ageing: "age* population" OR geriatric OR age* OR elder* OR old* OR senior* OR "advanc* years" OR "aging population" OR aging OR agei*

Note: Search terms were employed to identify relevant literature in each of the areas, and subsequently combined, initially to include all search terms, i.e. search #1 AND #2 AND #3 AND #4, and sequentially to include Age suit search terms plus any of the other search areas, i.e. #1 AND (#2 OR #3 OR #4).

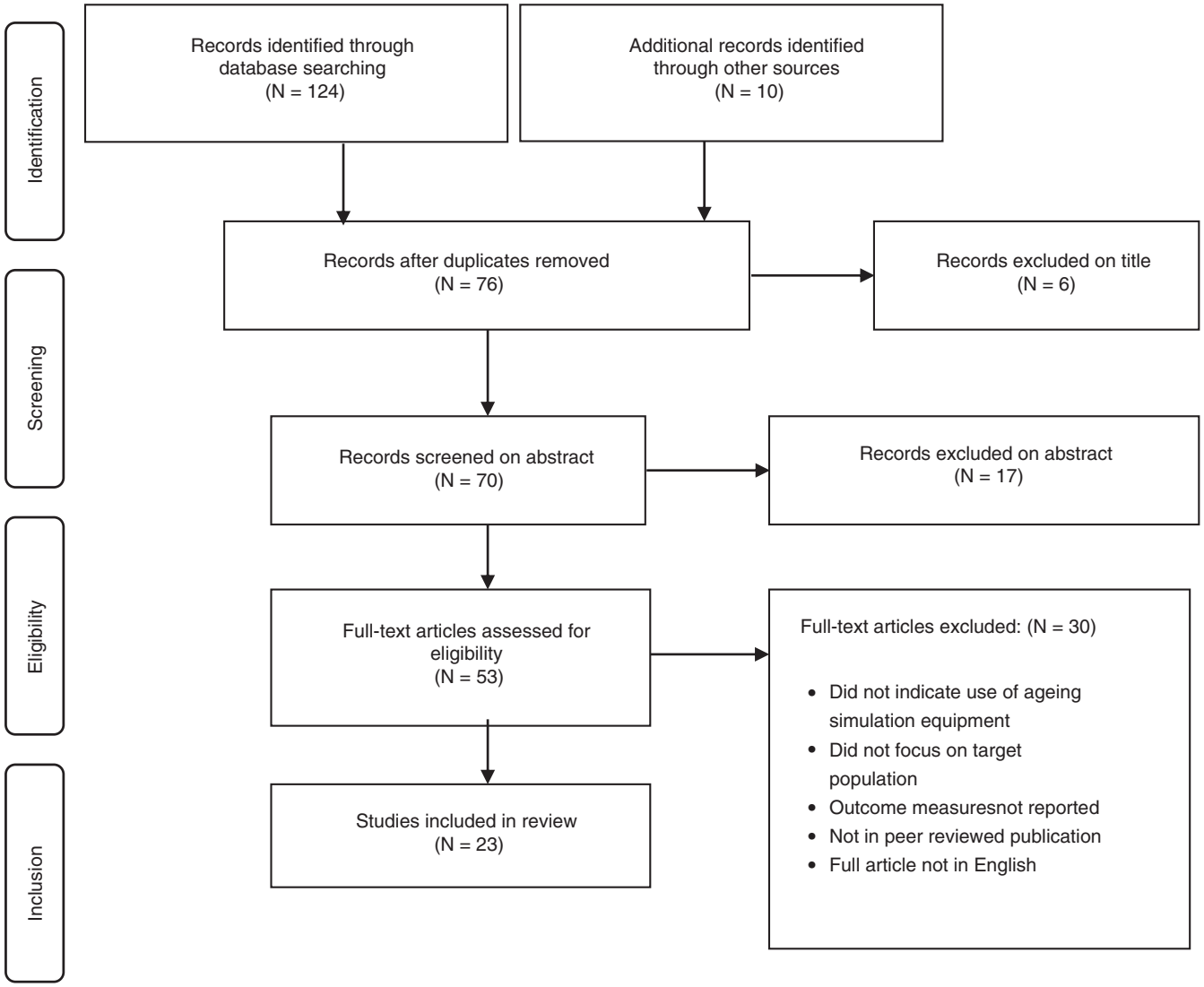


FIGURE 1 PRISMA study inclusion process

from their title and/or abstract, as being outside the scope of the review, 53 studies remained. Subsequently a full review of these titles against the inclusion/exclusion criteria, 23 studies were included in the review. References and citations of the included papers were checked for any further relevant papers; however, none were found and therefore 23 studies were included in the final data extraction and analysis (Figure 1).

3.1 | Study characteristics

Most age simulation studies included in this review took place in the USA, see Figure 2, with only two relevant studies in the UK. Limited numbers of studies have also been conducted in other countries across Europe, South America, Australasia and Asia.

Most studies collected quantitative data, 13 studies (57%) or used mixed methods, eight studies (35%) and two studies gathered only qualitative data. Study designs included quasi-experimental using pre and post intervention data both with a control group (five studies) and without a control group (11 studies), post only data with a control group (one study) and without a control group (four studies) and thematic analysis for the qualitative data (two studies), see Figure 3 below. The most common study design was a controlled pre/post design without a control group. Two studies were longitudinal in design.

Studies were published across the time period included in the review, 2000–2020, with most studies conducted after 2015. Sample sizes for the included research ranged from $N = 16$ to $N = 625$, with studies most commonly recruiting between 51-100 participants, see Figure 4. Participants were often students from health and social care or medical faculties, predominantly nursing students (Figure 5).

Data from eleven different validated scales were reported in the studies and five papers documented using their own locally developed scale/tool, which had not been validated, to collect data, see Table 4. Four studies did not employ scales and were either

TABLE 3 Papers selected for inclusion in this study

Authors/Year	Study Aims	Intervention	Location/ Participants	Research Method	Simulation equipment	Research tools	MERSQI[a]
Bennett et al. (2016)	Help students to gain experience and understanding of issues associated with ageing; understand the social isolation experienced by some older people; identify coping strategies used by elderly people in their daily lives and distinguish between limitation, impairment disability and handicap	1 day learning session—undertake range of daily tasks wearing suit, in company of student 'carer'	Australia Health students (n = 16)	Mixed Post only evaluation No control group	Paul suit	Locally developed questionnaire Subsequent group discussion	6.5
Booth and Kada (2015)	To design, implement and evaluate the effect of an educational intervention on Norwegian student radiographers' attitudes towards older people	2 days—day 1 didactic session re ageing to dispel myths. Day 2—workshop wearing ageing suit or other sensory impairment equipment	Norway Radiography students (n = 38)	Quantitative Pre/post intervention No control group	Sakamoto suit	Kogan's attitude toward older people (KAOP) scale (Norwegian Version)	11.0
Chen et al. (2011)	To examine the impact of participation in the Geriatric Medication Game on pharmacy students' perceptions of and attitudes toward older adults and familiarity with common disabilities that affect them and the process of seeking health care.	3-hr pharmacy practice lab. Given ageing related challenges and participated as patients in simulated healthcare scenarios	USA Pharmacy students (n = 625)	Mixed Post only No control group	Individual/tailored simulation equipment Geriatric Medication Game	Local tool for reflection	7.5
Chen et al. (2015)	To examine the impact of participation in an ageing simulation game on nursing students' empathy and attitudes toward older adults as well as their understanding of patients' experiences in the healthcare system.	3-hr laboratory ageing simulation game. Students randomly assigned simulated physical difficulties, financial status and 'health credits' and asked to navigate healthcare scenarios.	USA Nursing students (n = 58)	Quantitative Pre/post intervention No control group	Individual/tailored simulation equipment -Geriatric Medication Game	Kiersma-Chen (KCES) Jefferson scale of Empathy - Health Professions Scale (JSE_HPS) Aging simulation experience survey (ASES)	11.0
Chen et al. (2015)	To evaluate changes in empathy and perceptions as well as game experiences among student pharmacists participating in an ageing simulation game.	3-hor skills laboratory. Students assigned physical, financial or psychological issues and asked to navigate healthcare system and execute different tasks at 6 simulation stations.	USA Pharmacy students (n = 156)	Quantitative Pre/post intervention No control group	-Individual/ tailored simulation equipment -Geriatric Medication Game.	Kiersma-Chen (KCES) Jefferson scale of Empathy - Health Professions Scale (JSE_HPS) Aging simulation experience survey (ASES)	9.0

(Continues)

TABLE 3 (Continued)

Authors/Year	Study Aims	Intervention	Location/ Participants	Research Method	Simulation equipment	Research tools	MERSQI[a]
de Abreu et al. (2017)	To raise learners' awareness of, and attentiveness to, physical and cognitive changes experienced by the ageing population.	Students wore simulation devices to mimic cognitive and sensory impairments, and were then asked to complete a number of day-to-day activities. Activity took approximately 10 min to complete.	USA Medical students (n = 51)	Quantitative Pre/post intervention No control group	-Individual/ tailored simulation equipment	Approaches to Dementia scale (ADS)	11.0
Diachun et al. (2006)	Tested the hypothesis that experiential education is superior to a traditionally didactic approach by evaluating whether superior knowledge scores measured after a participatory, experiential undergraduate geriatrics learning session were maintained after 1 year.	CG—attended traditional style factual lecture on geriatrics. IG—covered same material as CG, but in an interactive 'game show' presentation, using simulation equipment. Conducted group interview of older 'patient' who revealed herself to be a fitness instructor.	Canada Medical students (n = 42)	Quantitative Post intervention only Control group Longitudinal + 1 year	-Individual/ tailored simulation equipment	Adapted Palmore Facts on Aging Quiz	9.5
Evans et al. (2005)	To evaluate whether the Geriatric Medication Game increases understanding, awareness and empathy towards geriatric patients and the challenges they encounter in our health care system, especially as those challenges relate to medication use.	1.5 hr session of ageing game. Students assigned physical disabilities using simulation equipment and given financial resources. Complete a range of healthcare scenarios at game stations.	USA Pharmacy students (n = 96)	Mixed method Pre/post intervention No control Open ended questions	-Individual/ tailored simulation equipment -Geriatric Medication Game	Locally developed questionnaire	9.0
Eymard et al. (2010)	To gain experience in public speaking and educating others, as well as to increase understanding of older adults and empathy for age changes and the experiences older adults commonly endure.	Simulation stations included as one of four parts in a 3 hr 'Take a walk in my shoes' session. Equipment and role play used to complete unspecified activities.	USA Nursing students (n = 42)	Qualitative Journal	-Individual/ tailored simulation equipment	Thematic analysis of journals	6.5
Fernandes et al. (2019)	The simulation game "Aging Nursing Game" ® was used with the objective of evaluating the impact of an ageing simulation game on nursing students' attitudes towards the elderly.	3 × 4 hr sessions. Students wore simulation equipment as part of the game, completing scenarios, e.g. residence visit, pharmacy visit and nursing appointments.	Portugal Nursing students (n = 45)	Quantitative Pre/post intervention No control	-Individual/ tailored simulation equipment -The Aging Nursing Game	Kogan's attitude toward older people (KAOP) scale	8.0

(Continues)

TABLE 3 (Continued)

Authors/Year	Study Aims	Intervention	Location/ Participants	Research Method	Simulation equipment	Research tools	MERSQI[a]
Halpin (2015)	To evaluate the efficacy of a short ageing simulation workshop toward increasing positive attitudes towards older adults among a multidisciplinary group of workshop participants.	45 min ageing simulation workshop using SECURE Project—22 min video with pauses to carry out activities using ageing devices, e.g. for changes in hearing, vision and manual dexterity. Ends with video of poem set to music.	USA Health and medical employees of Dept of Veterans Affairs (*n* = 476)	Quantitative Pre/post intervention No control	-Individual/ tailored simulation equipment	Kogan's attitude toward older people (KAOP) scale	10.0
Henry et al. (2007)	To determine if the Aging Game, adapted for use with allied health students, could yield positive results in the students' levels of anxiety about ageing and attitudes toward ageing.	Shortened Aging game (no further details)	USA Allied health students (*n* = 156)	Quantitative Pre/post intervention No control	-Individual/ tailored simulation equipment -The Aging Game	Anxiety about Aging Scale (AAS) Aging Semantic Differential (ASD)	11.0
Henry et al. (2011)	To assess the impact of pre-professional education on students' knowledge and attitudes about ageing.	IG—90-min session with Aging Game, assigned physical/ sensory impairments & carried out activities. CG—75-min class discussion and visualization of ageing.	USA Nursing and nutrition students (*n* = 88)	Mixed Pre/post intervention Randomized control group	-Individual/ tailored simulation equipment -The Aging Game	Anxiety about Aging scale (AAS) Aging Semantic Differential (ASD) Adapted Maxwell & Sullivan survey (AMSAS)	11.5
Kwon et al. (2017)	To identify the effects and experiences of the senior simulation applied to nursing students on those students' attitudes toward seniors	Session included: simulation clothing, orientation & pre-test, senior simulation activity (everyday activities), post treatment group discussion 1 week later	South Korea Nursing students (*n* = 70)	Mixed Pre/post intervention Control Group Discussion group Longitudinal	-Sakamoto suit	Sanders semantic differential scale Content analysis of discussion group data	9.5
Lavallière et al. (2017)	To examine, through a series of clinical tests, whether younger adults' physical capacities were reduced in a direction consistent with ageing by wearing a suit developed by the MIT AgeLab. To understand its impact on completion of an instrumental activity of daily living.	2-hr lab session. Measurements and tasks to assess: postural balance, neck and shoulder range of motion, low back and hamstring flexibility and gait.	USA General public (*n* = 22)	Quantitative Post only—repeated measures counter balanced design	-AGNES: Age Gain Now Empathy System	Locally developed questionnaire Technical measures of physical attributes	8.5

(Continues)

TABLE 3 (Continued)

Authors/Year	Study Aims	Intervention	Location/ Participants	Research Method	Simulation equipment	Research tools	MERSQI[a]
Lucchetti et al. (2017)	To determine the impact of two educational strategies on the topic "Geriatrics and Gerontology" ("experiencing aging" and "myths of aging") as compared to a control group (no intervention) on the attitudes, empathy and knowledge of first year medical students.	1-day session. IG—Experiencing ageing (Aging game) using simulations, e.g. visual, hearing, and walking, at 5 different activity stations. CG—Myths of Aging—quiz show based activity.	Brazil Medical students (n = 230)	Quantitative Pre/post intervention Control group	-Individual/ tailored simulation equipment -Experiencing Aging using The Aging Game -Myths of Aging Quiz	Locally developed knowledge of subject, UCLA geriatrics attitudes test; Palmore Facts on Aging, modified Maxwell–Sullivan attitudes towards the elderly scale.	10.5
Moriello et al. (2005)	To determine the influence of an educational intervention on the knowledge and attitudes of pre-allied health students toward older adults	IG—attended 6-hr workshop with three phases: Introduction, Self-insight into prejudice (including non-specified simulation activities), and Action plan. CG—no intervention	USA Pre-allied health students (n = 41)	Quantitative Posttest only Control group Longitudinal	-Unknown	Kogan's attitude toward older people (KAOP) scale Palmore Facts on Aging Quiz Locally developed descriptive survey	8.5
Qureshi et al. (2017)	To enhance understanding of effects of age-related physical impairments on activities of daily living; how these impairments may challenge good clinical care; and stimulate discussion about how these challenges may be mitigated.	90-min session—split into two groups—focus on mobility and special senses before swapping. Each student wore suit, and others in group acted as 'carers'. Carried out every day activities and filmed. Film watched back in debrief session for reflection.	UK Medical students (n = not specified)	Qualitative Debrief interview after activity, whilst playing back video footage of the activity	-GERT suit	Thematic analysis of debrief interviews	6.5
Robinson and Rosher (2001)	To allow students to experience the functional decline that may occur with normal ageing, while learning how function can be improved by simple environmental adaptations. Student attitudes were measured before and after the simulation experience.	'Half-full' simulation experience—exploring how to capitalize on people's strengths. Followed by ageing simulation with simulation equipment and everyday tasks, but focusing on how to make positive adaptations	USA Medical students (n = 49)	Quantitative Pre/post intervention No control	Individual/tailored simulation equipment	Aging semantic differential scale	8.0
Seung (2017)	To evaluate the impact of the ageing simulation experience on students" attitudes towards the elderly.	IG—wore age suit for 3 hr × 3 sessions, carried out daily activities. Also went out for 2 hr and carried out community level activities, e.g. using a bus, going to the library. CG—basic introductory social work lecture	South Korea General students (n = 156)	Quantitative Pre/post Control group	-Sakamoto suit + GERT eyeglasses	Aging semantic differential scale	10.5

(Continues)

TABLE 3 (Continued)

Authors/Year	Study Aims	Intervention	Location/ Participants	Research Method	Simulation equipment	Research tools	MERSQI[a]
Tremayne et al. (2011)	To evaluate the effectiveness of an aged simulation suit in pre-registration nurse education to enhance knowledge and understanding of some of the changes that can occur as a consequence of ageing.	1-hr session: volunteers wear suit, and other students take part in real ward simulation activities. Other students in group observe and write reflections. Discussion at end of session.	UK Nursing students (n = 90)	Mixed Post only No control group	-Age suit—unspecified (Sakamoto?)	Discussion re effectiveness of session and locally developed scale for overall session rating	6.5
Varkey et al. (2006)	Evaluate the effectiveness of a modified ageing game to enhance medical students' attitudes toward caring for elderly patients, enhance empathy for elderly patients and improve general attitudes towards the elderly.	3 hr ageing game, using simulation equipment in 3 phases: introduction to medication, simulation of semi-independent living, simulation of long-term care facility	USA Medical students (n = 84)	Mixed Pre/post No control	-Individual/ tailored simulation equipment	Modified Maxwell–Sullivan Aging Semantic Differential scale	9.0
Yu and Chen (2012)	To identify the effects and experiences of the senior simulation applied to nursing students on those students' attitudes toward seniors.	IG—Elderly simulation program—1-hr lecture about ageing changes & 1-hr simulation exercise. Other participants were carers or observers. CG- no intervention. Data collected pre and 4-week post intervention.	Taiwan Nursing assistants (n = 83)	Quantitative Pre/post Control group	-Individual/ tailored simulation equipment -Elderly Simulation Program	3 locally developed scales: Knowledge of Aging Scale Attitudes towards older people scale Motivation to care for older adults' scale	10.5

[a]MERSQI (Cook & Reed, 2015) scored out of 18 for quantitative and mixed studies, scored out of 15 for qualitative studies. There is no published cut off constituting a good MERSQI score, however a higher score on scale is considered to be indication of a higher quality paper.

TABLE 4 Measurement tools utilized

	Number of studies	% of studies
Aging Semantic Differential (ASD)	5	22
Kogan's Attitude Towards Older People Scale (KAOP)	4	17
Palmore's Facts on Aging quiz/ Adapted Palmore (PFAQ)	3	1
Maxwell-Sullivan's Attitude Scale (MSAS)/Adapted MSAS	3	13
Jefferson Scale of Empathy (JSE)	2	9
Anxiety about Aging Scale (AAS)	2	9
Kiersma-Chen (KCES)	2	9
Aging simulation experience survey (ASES)	2	9
Approaches to Dementia Questionnaire (ADQ)	1	4
Sander's semantic differential scale (SSDS)	1	4
UCLA Geriatric Attitudes Scale (UCLA-GSA)	1	4
Non-validated/local scale	5	22
No scale utilized	4	17

Note: (note some studies used more than one scale).

qualitative or included a reflection on the activity only. The Aging Semantic Differential scale (ASD: Rosencranz & McNevin, 1969) was the most frequently employed scale, used in five studies, whilst Kogan's Attitude Towards Older People Scale (KAOP: Kogan, 1961) scale was used in four studies and Palmore's Facts on Aging quiz (PFAQ: Palmore, 1977) and Maxwell-Sullivan's Attitude Scale (MSAS: Maxwell & Sullivan, 1980) were each recorded in three papers. Jefferson Scale of Empathy (JSE: Hojat et al., 2001), Anxiety about Aging Scale (AAS: Lasher & Faulkender, 1993), Kiersma-Chen Empathy Scale (KCES: Kiersma et al., 2013) and the Aging Simulation Experience Survey (ASES: Chen et al., 2015b) were reported in two studies each and Approaches to dementia questionnaire (ADQ: Lintern, 2001), Sander's Semantic Differential Scale (SSDS: Sanders et al., 1984) (SSD) and the University of California at Los Angeles Geriatric Attitudes Scale (UCLA-GSA: Reuben et al., 1998) were each used in one study. The results of the studies comparing intervention and control groups are presented in Table 5 and those from single group pre/post intervention studies in Table 6.

A single randomized controlled design study was included in this review (Henry et al., 2011) where participants completed a range of scales; the Anxiety about aging scale (AAS, anxiety), Aging semantic differential scale (ASD, attitude) and an adapted Maxwell and Sullivan survey (AMAS, empathy), both pre and post intervention (an adapted version of the Aging Game). Repeated measures ANOVA tests on anxiety (AAS), attitude (ASD) and empathy (AMAS) scores did not identify significant differences between the intervention group (IG) and the control group (CG), or in either of the groups. However, thematic analysis of reflection papers as part of this study identified differences between the IG and CG: the IG reported they had been able to feel like older adults and were able to apply information they learned, whereas the descriptions from the CG were more 'matter-of-fact'. Reflections by the IG were also more often empathetic than those from the CG.

Two studies employed a randomized controlled post only design, (Diachun et al., 2006; Moriello et al., 2005). In the Diachun et al study, data were collected using Palmore's Facts on Aging quiz and analysis split into the domains of knowledge, attitude and interest in geriatric medicine. No overall quiz score was presented. Data collected immediately after the intervention showed that the IG demonstrated a higher level of knowledge than the CG, nevertheless this gap had disappeared 1 year later and the intervention group's level of knowledge had dropped to that of the control group. No significant main or interaction effects were found in the attitude scores and although interest in geriatric medicine was higher immediately after the intervention, by the 1-year follow up this had significantly reduced for both the intervention and control groups. Moriello et al used the Facts on Aging quiz and reported a significant difference between IG and CG group scores at one week after the intervention with the IG scoring higher. However, there was a significant interaction effect between time and group and at 10 weeks the IG scores had dropped to near the level of the CG, whilst the CG scores had not changed, thus resulting in no significant difference between the groups.

Of the three non-randomized controlled studies in this review, two found an overall significant increase in attitudes towards older people post program in the IG (Seung, 2017; Yu & Chen, 2012), but no significant difference between attitude scores of the IG and CG groups post intervention. Chen et al also reported a significant difference post program in the IG's knowledge about ageing and significant differences between the IG and CG knowledge scores post intervention. However, there was no difference either within or between groups on motivation to care for older adults. The third non-randomized controlled study (Lucchetti et al., 2017) compared two intervention groups (Experiencing Aging, EA and Myths of Aging, MA) against a control group, CG. They found mixed results pre and post intervention, both positive and negative. The EA intervention was associated with significant worsening of attitudes towards older people on UCLA-GDS score, more negative opinions on the PFAQ and worse attitude towards older people on the MS attitude scale, but a greater empathy score on the MS empathy scale. Conversely the MA intervention resulted in an improved attitude to older people on UCLA-GDS, more positive opinions and knowledge on the PFAQ and a more positive attitude on the MS attitude scale, but no change on the MS empathy scale. The MA group was also significantly different to the CG in UCLA-GDS, PFAQ and MSAS and further, significantly different to the EA group on the same measures, post intervention when controlling for changes in score.

Of the 11 pre/post intervention without control studies in this review, eight reported a significant improvement in attitudes to older people, using a range of scales (Booth & Kada, 2015; Chen et al., 2015a, 2015b; de Abreu et al., 2017; Evans et al., 2005; Fernandes et al., 2019; Halpin, 2015; Varkey et al., 2006). One

TABLE 5 Results of case control studies

Authors/year	Tools	Intervention/ control	Activity	*N*	Pre-score mean (*SD*)	Post-score mean (*SD*)	Follow up score mean (*SD*)	*p*	*d*	Findings
Randomized control studies										
Henry et al. (2011)	ASD MSAS AAS	Intervention	Aging game	ASD 51 MSAS 55 AAS 49	74.08 (19.58) 12.29 (1.78) 59.16 (6.23)	68.59 (15.16) 12.64 (1.78) 57.65 (5.77)	n/a			n/s ATT within or between groups n/s EMP within or between groups n/s ANX within or between groups Student reflections indicated differences between intervention and control groups, e.g. empathy, more meaningful experience, less self-focussed
		Control	Presentation and discussion re ageing	ASD 47 MSAS 55 AAS 49	75.68 (17.70) 11.75 (2.10) 57.98 (6.52)	69.62 (15.59) 12.15 (1.90) 56.69 (7.12)	n/a	0.21 0.21 0.54	0.07 0.27 0.15	
Post only randomized control studies										
Diachun et al. (2006)	PFOAQ (Knowledge (K), Attitude (A) & Interest (I) domains only, no overall score)	Intervention	Game show style presentation	25	n/a	K 18.3 (2.18) A −3.5 (2.54) I 3.04 (0.54)	K 17.3 (1.98) A—4.58 (1.74) I 2.76 (0.78)	**0.03** 0.47 0.17 Post	0.77 0.24 0.15	Intervention group sig +ve knowledge scores than control after intervention ($p = .03$) Sig −ve interaction effect between teaching method and time for knowledge domain ($p = .03$). Significant—ve time effect for all groups in Interest domain ($p = .004$) Qualitative data indicates intervention group felt their attitudes had changed, and saw increase in students taking geriatrics after intervention.
		Control	Traditional lecture on geriatrics	17	n/a	K 16.5 (2.49) A −4.06 (2.16) I 2.76 (0.75)	K 17.8 (1.68) A—3.94 (2.22) I 2.35 (0.70)	0.64 0.65 0.16 Follow up (+1yr)	0.27 0.32 0.55	
Moriello et al. (2005)	PFAQ KOGAN (+ve and −ve dimensions, no overall score)	Intervention	Multi-modal workshop	19	n/a	(+1 week) PFAQ59.2 (2.3) K +ve 72.2 (1.3) K −ve 40.9 (1.9)	(+10 weeks) PFAQ51.6 (1.4) K +ve 74.8 (1.1) K −ve 41.8 (1.7)	**0.001** 0.198 0.587	5.09 1.03 0.60	Sig −ve diff on PFAQ scores for intervention group at 1 and 10 weeks ($p = .001$). n/s difference in Kogan attitude scores in either group PFAQ significant interaction effect between groups, −ve for intervention, over time ($p = .031$)
		Control	No intervention	22	n/a	PFAQ48.2 (1.7) K + ve 70.7 (1.6) K −ve 42.1 (2.1)	PFAQ48.9 (2.4) K + ve 71.0 (1.7) K−ve 43.6 (2.1)	0.361 0.152 0.736	1.37 2.65 0.94	

(Continues)

TABLE 5 (Continued)

Authors/year	Tools	Intervention/ control	Activity	*N*	Pre-score mean (*SD*)	Post-score mean (*SD*)	Follow up score mean (*SD*)	*p*	*d*	Findings
Controlled or quasi experimental studies										
Lucchetti et al. (2017)	UCLA-GSA PFOAQ MSAS-ATT MSAS-EMP	Intervention 1	Experiencing Aging - The Aging Game (EA)	82	UCLA-GSA 51.88 (4.67) PFOAQ 11.61(2.74) MSAS-ATT 15.53 (2.93) MSAS-EMP 5.33 (1.62)	UCLA-GSA 50.51 (5.19) PFOAQ 10.94 (2.28) MSAS-ATT 16.78 (2.83) MSAS-EMP 4.63 (1.29)		**0.001** **0.033** **0.007** **0.001**	r 0.36 r 0.23 r 0.37 r 0.46	Intervention 1 group: Sig more −ve attitude on UCLA post ($p < .001$), more negative opinions of ageing ($p < .001$), more −ve attitude MSAS ($p = .007$), more +ve empathy MSAS ($p = .001$)
		Intervention 2	Myths of Aging (MA)	76	UCLA-GSA 51.01 (5.25) PFOAQ 11.13(2.41) MSAS-ATT 16.17 (3.65) MSAS-EMP 5.44 (2.37)	UCLA-GSA 53.67 (4.16) PFOAQ 17.58 (1.96) MSAS-ATT 14.83 (3.46) MSAS-EMP 5.13 (2.10)		**<0.001** **<0.001** **<0.001** 0.07	r 0.56 r 0.93 r 0.92 r 0.47	Intervention 2 group: Sig more +ve attitude on UCLA post ($p < .001$), increased level of knowledge ($p = .003$), improved facts score ($p < .001$) and more +ve opinions of ageing ($p < .001$). No improvement in empathy.
		Control	No intervention (CG)	72	UCLA-GSA PFOAQ - MSAS-ATT - MSAS-EMP -	UCLA-GSA 50.00 (5.68) PFOAQ 10.22 (2.24) MSAS-ATT 16.29 (4.2) MSAS-EMP 5.32 (2.09)				Post intervention + post hoc UCLA: Sig ($p < .001$) MA > EA, MA > MA, EA/CG n/s PFOAQ: Sig ($p < .001$) MA > EA, MA > CG, CG > EA ATT: Sig ($p = .007$) MA > EA, MA > CG,EA/CG n/s MSAS: n/s
Seung (2017)	ASD	Intervention	Ageing simulation program	78 (not stated)	78.17 (14.09)	74.81 (15.38)	*n*/a	**<0.05**	0.23	Significant +ve effect on attitude for intervention group ($p < .05$) n/s diff for control group
		Control	Basics of social work	78 (not stated)	78.19 (19.24)	80.81 (17.24)	n/a	n/s	0.14	
Yu and Chen (2012)	NAKAAS NAATOA NAMCOAS	Intervention	Elderly simulation program	43	NAKAAS 27.4 (5.5) NAATOA 62.4 (6.1) NAMCOAS 46.6 (4.5)	NAKAAS 33.3 (5.8) NAATOA 65.2 (6.8) NAMCOAS 47.7 (4.2)	n/a	**<0.001** **<0.001** 0.06	0.19 0.5 0.37 Pre	Knowledge scores sig +ve in intervention group 4 weeks post intervention ($p < .001$), n/s in control group Attitude scores sig +ve in intervention group 4 weeks post intervention ($p < .001$), n/s in control group Motivation to care for older people n/s in intervention and control groups.

(Continues)

TABLE 5 (Continued)

Authors/year	Tools	Intervention/control	Activity	*N*	Pre-score mean (*SD*)	Post-score mean (*SD*)	Follow up score mean (*SD*)	*p*	*d*	Findings
		Control	No intervention	40	NAKAAS 28.4 (4.8) NAATOA 65.3 (5.6) NAMCOAS 48.3 (4.6)	NAKAAS 28.0 (4.1) NAATOA 65.4 (8.8) NAMCOAS 47.1 (4.6)		0.61 0.95 0.12	1.06 0.03 0.14 Post	

Abbreviations: AAS, Anxiety about Aging Scale; ASD, Aging Semantic Differential scale;KAOP, Kogan's Attitude Towards Older People Scale; MSAS, Maxwell–Sullivan's Attitude Scale; MSAS-ATT, Maxwell-Sullivan Attitude subscale; MSAS-EMP, Maxwell–Sullivan Empathy subscale; NAATOA, Nursing Assistants' Attitudes Towards Older Adults Scale; NAKAAS, Nursing Assistants' Knowledge About Aging Scale; NAMCOAS, Nursing Assistants' Motivation to Care for Older Adults Scale; PFOAQ, Palmore's Facts on Aging quiz; UCLA-GSA, UCLA geriatric attitudes scale.

study (Robinson & Rosher, 2001) found no overall difference in attitude post intervention on the ASD, but did find a significant improvement on the instrumental subscale which related to attitudes to older people's ability to improve, change and pursue goals. The final two studies employing this methodology (Henry et al., 2007; Kwon et al., 2017) found a significant worsening of attitudes to older people. The Henry et al. study also found that anxiety levels rose post intervention. The Kwon et al. study was longitudinal and although recorded attitudes worsened straight after the intervention, this study also included a follow up sharing of experiences in small groups. Two weeks after the intervention and post the follow-up groups, attitudes were more positive and were significantly improved over both the pre and immediate post intervention. Two studies also measured empathy (Chen et al., 2015a, 2015b) and found a significant increase in empathy towards older people after the intervention.

Four papers employed a pre/post intervention without control design but reported only descriptive findings about attitude, empathy and knowledge changes (Bennett et al., 2016; Chen et al., 2011; Lavallière et al., 2017; Tremayne et al., 2011), although one paper offered objective measures of physical difference when wearing an 'age-suit', e.g. gait, balance, flexibility, which are important measures but not the focus of this current review. Findings from these studies, other studies including descriptive elements and the themes identified in the two qualitative only papers (Eymard et al., 2010; Qureshi et al., 2017) are summarized in Table 7 below. Qualitative findings indicated that ageing simulation experiences helped participants to understand the challenges older people can face. In addition and in contrast to some of the quantitative findings, the data showed that the simulations increased empathy and participants reported developing a more positive attitude towards caring for older people. Nevertheless, it would be interesting to evaluate whether these findings are borne out in practice. There were however some negative findings reported about increased anxiety towards ageing.

3.2 | Study methodology

Study methodology of the papers included in this review mostly scored in the lowest two categories, 1 or 1.5, on the MERSQI tool, see Table S1. A single relevant randomized controlled study, scoring 3 on the MERSQI scale, was identified for inclusion; this reported improvements in control and intervention groups post intervention. Two randomized controlled studies did not include a pre-intervention arm, thus scoring 2 on the scale and making comparison of post intervention data less robust. The results of these studies showed mixed outcomes both post intervention and at follow up. However it is interesting to note that some scores deteriorated between the post intervention and follow up, i.e. PFAQ at +10 weeks post in Moriello et al. (2005) and Kogan's at +1 year in Diachun et al. (2006) without further intervention or

TABLE 6 Results of single group pre - post studies

Authors/Year	Tools (see footnote for full titles of scales included)	*N*	Pre mean (*SD*)	Post mean (*SD*)	Follow up mean (*SD*)	Findings
Pre/Post without control group						
Booth and Kada (2015)	KAOP	38	155.84 (16.32)	165.92 (18.13)		Sig +ve ($p = .001$) (Sig 14/34 scale items)
Chen et al. (2015a)	KCES JSE ASES	58	89.16 (5.55) 111.41 (11.41) Not shown	90.91 (6.39) 117.39 (10.78) Not shown		Sig +ve ($p = .015$) Sig + ve (p=<.001) Sig increase in 7 of 13 items, but no overall scale score given
Chen et al. (2015b)	KCES JSE ASES	156	82 (8) 105 (11) Not shown	86 (9) 109 (15) Not shown		Sig +ve ($p < .001$) Sig +ve ($p < .001$) Sig increase in 11 of 13 items, but no overall scale score given
de Abreu et al. (2017)	ADQ	51	74.19 (6.29)	77.40 (6.13)		Sig +ve ($p < .005$)
Evans et al. (2005)	Locally developed questionnaire	96				No overall total, but sig +ve ($p < .05$) on all 8 perceptions of ageing included in scale
Fernandes et al. (2019)	KAOP	45	125 (no *SD* given)	145 (no *SD* given)		Sig +ve ($p = .001$)
Halpin (2015)	KAOP	476	168.8 ?	171.4 ?		Sig +ve ($p = .001$)
Henry et al. (2007)	AAS ASD	156	55.79 (6) 78.84 (18.2)	54.15 (6.5) 82.61 (20.7)		More anxious, sig +ve ($p < .001$) Attitude score sig −ve ($p < .05$)
Jeong and Kim (2010)	SSD	70	3.92 (0.59)	4.26 (0.49)	3.73 (0.57)	Attitude more −ve pre to post ($p < .001$) Attitude post to follow up +ve ($p < .001$) Attitude pre to follow up +ve ($p = .022$)
Robinson and Rosher (2001)	ASD	49	124.35 (no *SD* given)	116.14 (no *SD* given)		*n*/s overall Sig +ve on instrumental subscale ($p < .003$)
Varkey et al. (2006)	MMSES ASD	84	5.12 (1.40) Total not reported	4.60 (1.19) Total not reported		Sig on 7/8 MMSES attitude items (5 +ve and 2 −ve) and 2/3 empathy (+ve). ASD sig changes on 23/32 questions: sig −ve on the autonomous–dependent scale (A–D), and the personal acceptability–unacceptability scale (PA-U), n/s on the instrumental–ineffective scale (I-I)

Pre/post descriptive only				
Authors/Year	**Tools**	***N***	**Analysis**	**Findings**
Bennett et al. (2016)	Locally developed questionnaire	16	Descriptive only	Most felt their attitude to elderly people had changed ($n = 13$ moderately to strongly agreed). Reported themes: an increased understanding of the challenges elderly people can face, increased empathy, an intention to provide better care for the elderly and an enjoyment and appreciation of the simulation experience.

(Continues)

TABLE 6 (Continued)

Pre/post descriptive only				
Authors/Year	**Tools**	***N***	**Analysis**	**Findings**
Chen et al. (2011)	Qualitative reflection only	625	Descriptive only	Content analysis identified themes: improved attitudes toward older adults, better understanding of patient experiences and increased willingness to provide assistance
Eymard et al. (2010)	Journal entries	42	Analysis of diary entries	Codes from diary entries developed into four themes: Nervous/anxious, Fun, Teacher/educating and Empathy.
Lavallière et al. (2017)	Locally developed scale	22	Physical measurements and descriptive analysis of experience	Scores on physical measurements sig different: Balance −ve ($p < .001$), neck and shoulder range of movement −ve ($p < .001$). Sit and reach −ve ($p < .001$), gait, velocity and number of steps −ve ($p < .01$). Only descriptive analysis of experience of wearing suit: the experience was frustrating and fatiguing, overwhelming and physically straining due to reduced motion and flexibility.
Qureshi et al. (2017)	Debrief only	Not specified	Verbal debrief only	Reflections suggest more empathetic attitude to older patients, e.g. suggestions participants will spend longer with hearing or visually impaired patients to ensure they have assimilated clinical information.
Tremayne et al. (2011)	Mostly qual	90	Descriptive stats only	46% of students rated the session as excellent, 48% good and 6% satisfactory. Feedback: use of simulation highly regarded and an effective learning aid.

Note: Titles of scales included in table: AAS, Anxiety about Aging Scale; ADQ, Approaches to dementia questionnaire; ASD, Aging Semantic Differential scale; ASES, Aging Simulation Experience Survey; JSE, Jefferson Scale of Empathy; KAOP, Kogan's Attitude Towards Older People Scale; KCES, Kiersma-Chen Empathy Scale; MMSAS, Modified Maxwell–Sullivan's Attitude Scale; SSD, Sander's Semantic Differential Scale.

TABLE 7 Qualitative findings summary

Themes	Bennett et al. (2016)	Chen et al. (2015)	Diachun et al. (2006)	Eymard et al. (2010)	Henry et al. (2011)	Kwon et al. (2017)	Qureshi et al. (2017)	Tremayne et al. (2011)	Varkey et al. (2006)
Understanding challenges older people can face	✓	✓	✓		✓	✓		✓	✓
Increased empathy	✓			✓	✓		✓	✓	✓
Better/more positive towards care for older people	✓	✓			✓	✓	✓		
Experience of wearing ageing equipment considered valuable	✓		✓		✓				✓
Frustration wearing the suit/ playing the game		✓						✓	
Improved attitudes towards older people		✓				✓			✓
Better understanding of the healthcare system		✓							✓
Increased anxiety re ageing									

teaching, although Diachun et al. report that qualitative feedback indicated changes in attitude and an increase in students taking geriatrics after the intervention. Conversely in the Kwon et al. (2017) pre/post/follow-up study a decrease in scores on the semantic differential scale SSD immediately post intervention was reversed at follow up one week later after a group debrief and discussion about the experience of wearing the age suit had taken place. This would indicate that post intervention discussion is important to help students 'make sense' of the ageing experience and discuss any issues it has raised. This was further highlighted in the Robinson and Rosher (2001) paper whereby students experienced the simulated difficulties encountered by some older people, e.g. lacing shoes, but in contrast to other studies, they also explored and discussed possible adaptations which could be made to improve functioning, e.g. using contrasting laces to retie shoes. Results were significant only on the instrumental subscale of the ASD scale, which may reflect the focus on possible change and adaptation by older people, strongly emphasized in the teaching. However qualitative feedback suggested students found the experience highly beneficial and had changed their point of view when looking at older people. In some studies, (e.g. Diachun et al., 2006; Henry et al., 2007) where quantitative scales did not pick up changes in attitude post intervention, qualitative findings indicated that there had been changes in attitude as a result of the study. This may indicate that the scales used were not sensitive enough to pick up the changes and suggests the need for mixed methods to more fully understand the impact of interventions.

3.3 | Outcome measurement scales

Eleven different scales and modified scales, together with five locally developed scales/feedback questionnaires were used to evaluate the programs. This makes comparison of results problematic as there is inconsistency in both the effect being measured and the assessment criteria.

3.3.1 | Attitude measures

The four most commonly used attitude scales, Aging Semantic Differential (ASD), Kogan's Attitude Towards Older People Scale (KAOP), Palmore's Facts on Aging quiz/Adapted Palmore (PFAQ) and Maxwell-Sullivan's Attitude Scale (MSAS)/Adapted MSAS all have inherent weaknesses. The ASD is considered to be outdated and the original validation process was flawed, assessing only attitudes towards older men (Polizzi, 2003). KAOP is felt to contain archaic language which may not be relevant to today's younger people and further, has been accused of confounding attitudes with knowledge and beliefs (Ayalon et al., 2019). PFAQ has been discredited as a measure of attitudes, again confounding attitudes with knowledge and there have been concerns about the reliability and validity of the original MSAS (Stewart et al., 2006). Therefore it has been suggested that there is

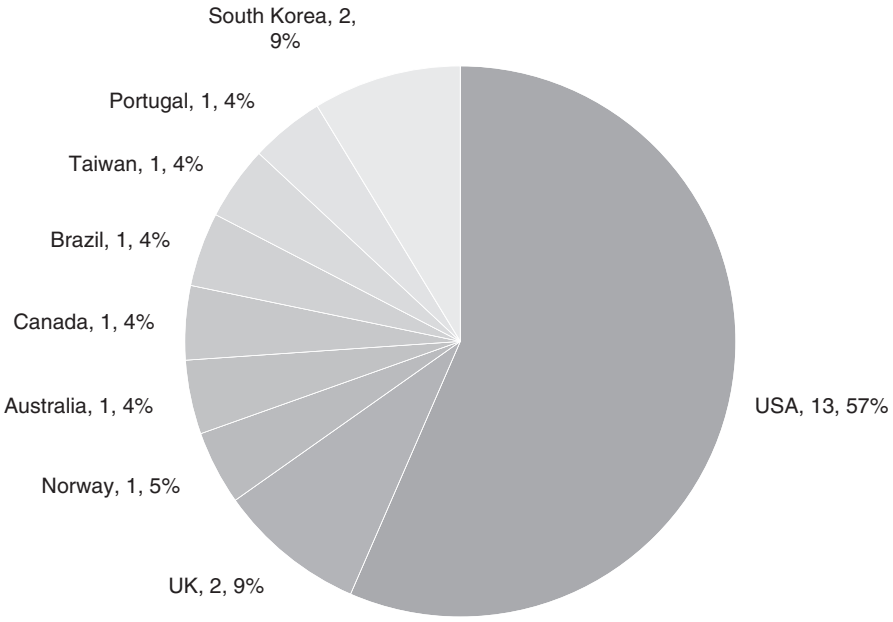


FIGURE 2 Location of studies

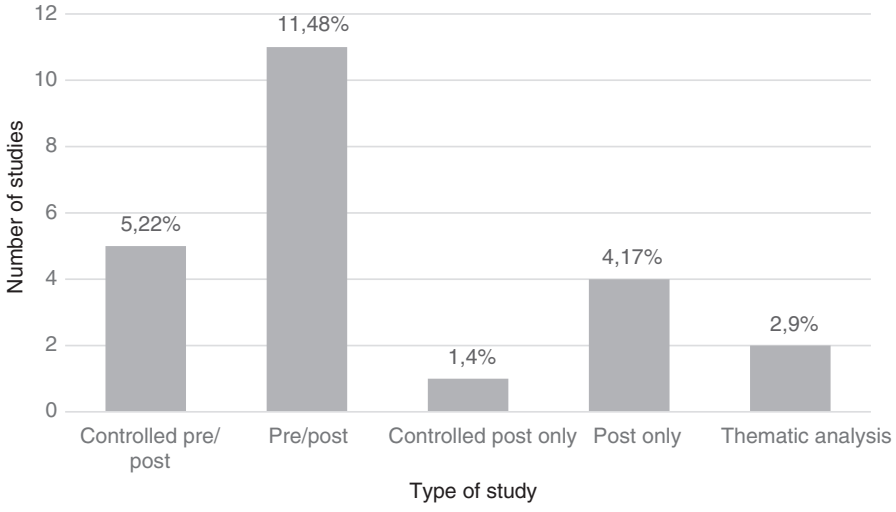


FIGURE 3 Study design

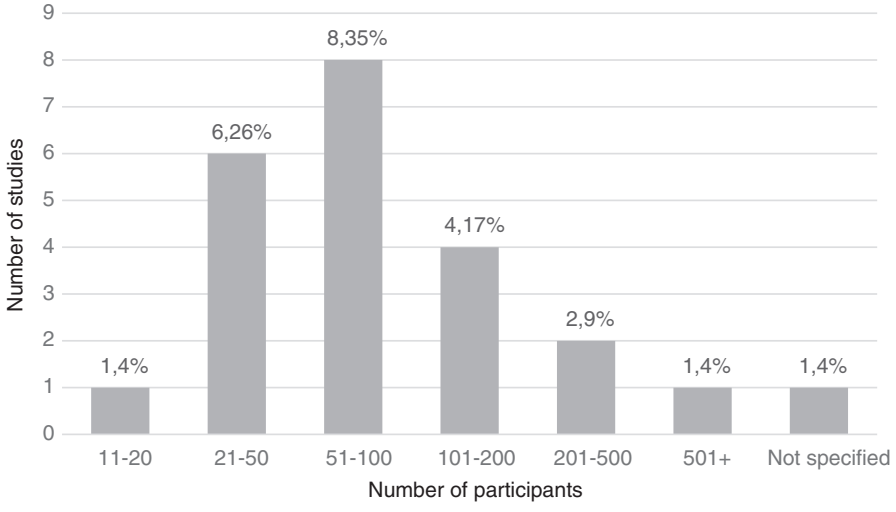
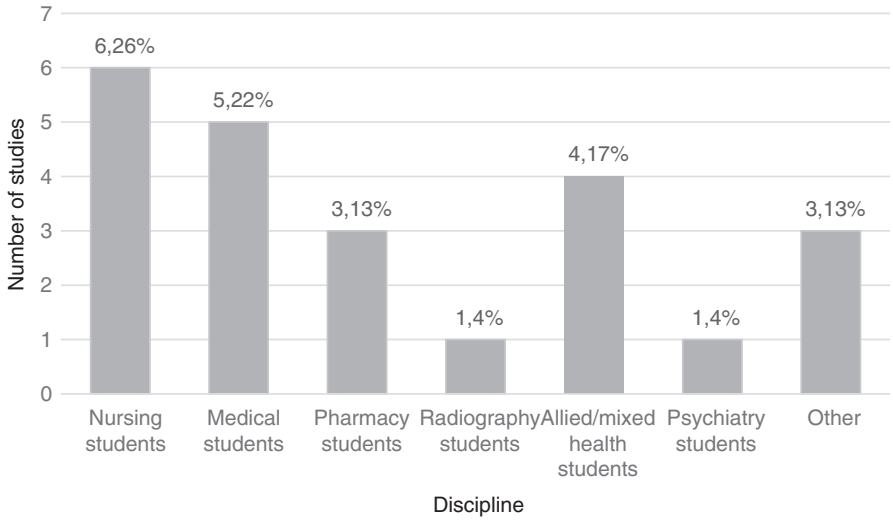


FIGURE 4 Number of participants in study

FIGURE 5 Participant disciplines



currently no reliable and well validated data collection instrument to assess student's attitudes to older people (Wilson et al., 2018) and this is an area where more research would be warranted.

3.3.2 | Empathy measures

The most often used scales of this measure were the empathy section of the MSAS and the JSE-HPS. Both these scales focus on empathy in a medical setting, which make them suitable for use with health and social care students, however the MSAS still suffers from issues regarding its validity, as discussed above.

3.3.3 | Anxiety measures

Only one validated anxiety measure, the Anxiety about Ageing Scale (AAS) was used in the papers included in this review and this is an area which has often been overlooked in the studies to date.

3.4 | Attitudes/empathy/anxiety

Findings reported in some of the papers indicate that whilst experiencing simulated ageing can increase empathy for older people amongst students, it can also increase anxiety and worsen attitudes. This may be due to the increased insight produced by the ageing simulations, but also the concomitant realization of what may happen in older age and the reinforcement of negative stereotypes. There is a balance to be struck between enabling students to understand the difficulties some older people will experience, but also ensuring the wider context is included and highlighting the experiences of older adults in good health. Some studies (Bennett et al., 2016) have included interactions with older people in good health, to balance the teaching, others have asked participants to consider wider aspects of ageing well or how to overcome some of the difficulties they experienced in the study (Robinson & Rosher, 2001).

3.5 | Ageing games versus ergonomically designed age suit

The studies included in this review employed a wide range of simulation equipment, from single pieces, such as vision impairment goggles, through multiple simulation items used in an ageing game to the full named 'age-suits'. Six studies used a full age suit (see Table 1 for a description of ergonomically designed age suits), four studies employed the Geriatric Medication Game, four the Ageing Game, two other ageing games/role play and one used the Ageing nursing game. The remaining six studies focussed on delivering the 'ageing experience' through a series of physical activities carried out whilst wearing ageing simulation equipment. The range and diversity of equipment used and the wide variety of interventions employed makes it difficult to identify which specific pieces or combinations of equipment are most informative and have an impact in changing attitudes to older people.

3.6 | Length of interaction

Interventions included in this review offered students the 'ageing experience' for between 10 min and 6 hr, over a period of one afternoon to several weeks. Whilst there was no conclusive evidence as to the optimal length of the simulation, there is a balance to made between ensuring the interaction is long enough to provide a worthwhile experience, but as the interventions can be labour intensive, not so long as to make usage cost prohibitive. Further, longitudinal studies whereby pre and post intervention results were reassessed at a later time, were important in exploring the long-term effect of any attitude, empathy or anxiety changes resulting from the interventions.

3.7 | Location of studies

Most studies were carried out with US or Australian students, with only a small number of studies focusing on UK students. There was

also an absence of any study exploring the use of age suits internationally, or indeed across different locations in the same country. This would allow comparison of age simulation equipment across different cohorts and cultures.

3.8 | Age of study participants

This review focussed on the use of ageing simulation with Health and Social Care students and as expected most of the participants were under the age of 25 years and most were female. There may be a wider range of responses if older participants and males were included.

3.9 | Quality assessment

Studies included in this review had a MERSQI score ranging from 6.5 to 11.5, with a mean score of 9.11 (*SD* 1.65) across all the studies. For a complete breakdown of the scores see Table S1. The mean score of included qualitative studies was 6.5 (*SD* 0, max 15), mixed methods studies 8.63 (*SD* 1.71, max 18) and quantitative studies 9.81 (*SD* 1.22, max 18). The single group studies had a mean score of 7.21 (*SD* 0.95), single group pre and post design 9.68 (*SD* 1.19), two-group non-randomized studies and randomized controlled trials both 10.50 (*SD* 0 and *SD* 1.41 respectively).

4 | DISCUSSION

This mixed method review aimed to identify and synthesize research using ageing simulation equipment and examine its impact on attitudes, empathy and anxiety levels of health and social care students regarding their interactions with older people. Evidence included indicates that in general the use of ageing simulation equipment has a positive impact on student's empathy levels, a more mixed impact on attitudes and a somewhat negative impact on their anxiety levels, although the evidence for this was very limited. Most studies recognized the usefulness of including experiential teaching regarding older people's experience of ageing in changing student's understanding of the challenges some older people will encounter.

Included studies were most commonly single group pre and post intervention studies (11 studies), a design which may threaten internal validity and increase the risk of bias in the data. Further, only five studies included a control group, randomized or otherwise, highlighting the need for further high-quality research to clarify the impacts of using ageing simulation equipment. It is interesting to note that in several studies (e.g. Diachun et al., 2006; Henry et al., 2011; Kwon et al., 2017) researchers found no significant change to student's scores on attitude scales after using the equipment, nonetheless in subsequent interviews/discussions participants reported that the experience had a high impact. This may be due to a current lack of suitable and effective measures to assess the changes in attitude, i.e. the scales are not sensitive enough to change, or they are locally developed unvalidated scales and this is an area where development would also be beneficial. Furthermore, this highlights the benefits of using mixed methods studies which can explore impacts both quantitatively and qualitatively, providing richer insights into the experience of using ageing simulation equipment and the impacts of such an intervention.

In terms of simulation equipment, it was difficult to draw any conclusions as to which afforded the most authentic experience due to the wide and complex range of equipment used. However, to allow comparisons across data sets, e.g. in different settings, or cohorts of participants it would be advisable to use a standardized ergonomically designed age suit in research studies to minimize bias in delivery of the simulation.

A further factor which may influence the outcome of interventions is the length of time participants are able to experience the ageing simulation. Some studies in this review (e.g. de Abreu et al., 2017) offered participants a short 10–15 min experience with the ageing simulation equipment and this may be considered insufficient time to become accustomed to the equipment and to fully interact with the experience. In contrast other studies offered participants a full or half day in the suit (e.g. Bennett et al., 2016; Chen et al., 2015b), allowing them to become familiar with the equipment and encounter a wider range of experiences. However, this may prove prohibitive if the numbers of students using the suit is high, therefore there is a trade-off to be made between the amount of time/resources available and the need to provide a worthwhile experience. Concomitant with the timing of the intervention is its location and the importance of a high-fidelity setting. This may be a simulation suite set up as a realistic health and social care, or community setting or alternatively as in some studies (e.g. Seung, 2017) where participants were encouraged to go into the community and interact with people outside the study group. Increasing the fidelity of the interactions helps to provide a full range of experiences whilst wearing the age suit and enables the simulation to be as realistic as possible.

Two longitudinal studies included in this paper provided interesting findings in that the first study (Diachun et al., 2006) illustrated how the positive effects of simulation can drop off over time. This suggests it would be beneficial to provide repeated exposure, rather than viewing the simulation as a one-off stand-alone intervention, perhaps in each year of training, to reinforce and maintain any changes brought about during the exercise. This would further help to embed the needs of older people into participant's thinking, sustaining the impact and helping to ensure the benefits become an integrated part of future professional health and social care staff's thought processes and behaviour.

The second longitudinal study (Kwon et al., 2017) was also instructive in that a debrief and discussion was included before the follow up stage. Although participant's attitudes had become more negative immediately following the intervention, once they had the opportunity to discuss the experience with other participants and reflect on the impact, their attitudes became significantly more positive.

The study (Robinson & Rosher, 2001) which included discussions and testing of ideas aimed at overcoming some of the simulated deficiencies could also be an exemplar as to how to incorporate ageing simulation activities in the wider scheme of teaching. As some of the other study findings indicate (Henry et al., 2007), interventions in isolation can lead to more negative attitudes and higher anxiety amongst students, as they become aware of the realities some older people experience. Nevertheless, by reframing the experiences in the wider context of ageing, with for example concurrent teaching on the myths and misconceptions of ageing and presenting them as challenges which can be overcome with care and compassion, this is expected to enable participants to reflect on the experiences with a more positive holistic perspective.

These findings are in line with effective learning strategies as outlined in Macaden et al. (2017), including four stages suggested when conducting simulation training: a pre-briefing session clearly outlining the purpose of the simulation activity and the intended learning outcome, a well-equipped and resourced simulation environment where to practice, time built in to the session for reflection followed by an interactive discussion and debriefing. Although conducting ageing simulations, can be time and resource intensive and have been criticized by some (e.g. Bennett, 2014) for being patronising and an unrealistic experience of ageing, they have a valuable place as part of a range of interventions/teaching. This review has shown that outcomes can help to foster a deeper understanding of the experiences some ageing people encounter and embed more positive attitudes and empathy into staff of the future. Indeed, the use of age suits and ageing simulation may benefit other staff in the health and social care system and consideration should be given to the impact this simulation experience could afford if it changed the attitudes of health and social care staff across the board.

4.1 | Limitations

It is evident that there is a lack of high-quality robust research regarding the impact of using ageing simulation equipment to influence attitudes and empathy amongst health and social care students. Much of the research included in this review used ageing simulation equipment as part of either an 'ageing game' or a wider teaching module, making it difficult to assess the specific contribution the ageing simulation equipment made to the outcomes.

Only papers written in English were included in the current review, which may have led to the exclusion of important studies, in particular there are several studies on the use of ageing simulation equipment arising from Asia (e.g. Choi & Park, 2009; Jeong et al., 2010) and these may add to the body of research but are outside the scope of this review.

Further, grey literature and non-academic pieces were excluded from the review, although there are several reports of age suits and simulation equipment being used in health care and business settings (Fowler, 2016; Lidz, 2015; Newman, 2016; Platell, 2014; The Press Association, 2011) but these do not include evaluation of the impact of wearing the suit on the participants.

5 | CONCLUSION

Evidence from this review suggests that ergonomically designed age suits and age simulation equipment can have a positive impact on student's attitudes and empathy when interacting with older people. Whilst there needs to be more high-quality research undertaken in this area, there are several key findings from the studies included in this review which should be considered when teaching students and staff about working with older people. Principally: clarity in the aims and outcomes of the simulation, use of high-fidelity equipment and realistic setting, adequate length of intervention to maximize the experience balanced against available time and resources, the benefit of discussion and debrief at the end of the simulation, regular maintenance of the experience through multiple sessions over a longer time period, integration of the experiential learning into the wider context of traditional teaching and reflection around how the learning can be used to close the practice–theory gap and enhance the care of older people in all settings.

CONFLICT OF INTEREST

No conflict of interest has been declared by the authors.

AUTHOR CONTRIBUTIONS

Made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data (CE-T, LE, PK, LT); Involved in drafting the manuscript or revising it critically for important intellectual content (CE-T, LE, PK, LT); Gave final approval of the version to be published. Each author participated sufficiently in the work to take public responsibility for appropriate portions of the content (CE-T, LE, PK, LT); Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved (CE-T, LE, PK, LT).

PEER REVIEW

The peer review history for this article is available at https://publons.com/publon/10.1111/jan.14577.

ORCID

Charlotte Eost-Telling https://orcid.org/0000-0002-9568-3195

TWITTER

Charlotte Eost-Telling @UAgeing @FhscChester

REFERENCES

Askham, J. (2008). *Health and care services for older people: Overview report on research to support the National Service Framework for Older People*. Department of Health.

Ayalon, L., Dolberg, P., Mikulionienė, S., Perek-Białas, J., Rapolienė, G., Stypinska, J., de la Fuente-Núñez, V. (2019). A systematic review of existing ageism scales. *Ageing Research Reviews*, *54*, 100919–https://doi.org/10.1016/j.arr.2019.100919

Bearman, M., Palermo, C., Allen, L. M., & Williams, B. (2015). Learning empathy through simulation a systematic literature review. *Simulation in Healthcare-Journal of the Society for Simulation in Healthcare*, *10*(5), 308–319. https://doi.org/10.1097/sih.0000000000000113

Bennett, C. (2014). *Comment: Wouldn't it be easier just to try a little empathy?: Do NHS staff really need 'ageing suits' to understand the old? Surely compassion is better than mimicry*. The Observer, 37. Retrieved from https://search.proquest.com/docview/1505118544?accountid=14620

Bennett, P., Moore, M., & Wenham, J. (2016). The PAUL Suit©: An experience of ageing. *The Clinical Teacher*, *13*(2), 107–111.

Binstock, R. H. (2010). From compassionate ageism to intergenerational conflict? *The Gerontologist*, *50*(5), 574–585. https://doi.org/10.1093/geront/gnq056

Bloom, D. E., Canning, D., & Fink, G. (2010). Implications of population ageing for economic growth. *Oxford Review of Economic Policy*, *26*(4), 583–612. https://doi.org/10.1093/oxrep/grq038

Booth, L., & Kada, S. (2015). Student radiographers' attitudes toward the older patient – An intervention study. *Radiography*, *21*(2), 160–164. https://doi.org/10.1016/j.radi.2014.09.010

Breyer, F., Costa-Font, J., & Felder, S. (2010). Ageing, health and health care. *Oxford Review of Economic Policy*, *26*(4), 674–690. https://doi.org/10.1093/oxrep/grq032

Burnes, D., Sheppard, C., Henderson, C. R. Jr, Wassel, M., Cope, R., Barber, C., & Pillemer, K. (2019). Interventions to Reduce ageism against older adults: A systematic review and meta-analysis. *American Journal of Public Health*, *109*(8), e1–e9. https://doi.org/10.2105/AJPH.2019.305123

Cardoso, C., & Clarkson, P. J. (2012). Simulation in user-centred design: Helping designers to empathise with atypical users. *Journal of Engineering Design*, *23*(1), 1–22. https://doi.org/10.1080/09544821003742650

Celik, S. S., Kapucu, S., Tuna, Z., & Akkus, Y. (2010). Views and attitudes of nursing students towards ageing and older patients. *The Australian Journal of Advanced Nursing*, *27*(4), 24.

Chen, A. M. H., Kiersma, M. E., Yehle, K. S., & Plake, K. S. (2015a). Impact of an aging simulation game on pharmacy students' empathy for older adults. *American Journal of Pharmaceutical Education*, *79*(5), 65. https://doi.org/10.5688/ajpe79565

Chen, A. M. H., Kiersma, M. E., Yehle, K. S., & Plake, K. S. (2015b). Impact of the Geriatric Medication Game® on nursing students' empathy and attitudes toward older adults. *Nurse Education Today*, *35*(1), 38–43. https://doi.org/10.1016/j.nedt.2014.05.005

Chen, A. M. H., Plake, K. S., Yehle, K. S., & Kiersma, M. E. (2011). Impact of the geriatric medication game on pharmacy students' attitudes toward older adults. *American Journal of Pharmaceutical Education*, *75*(8), 1–158. Retrieved from https://search.proquest.com/docview/904035778?accountid=14620. https://doi.org/10.5688/ajpe758158

Christie & Co. (2015). *The UK nursing workforce crisis or opportunity?* Retrieved from https://www.christie.com/christieMediaLibraries/christie/PDFs-Publications/Care/UK-nursing-workforce.pdf

Cook, D. A., & Reed, D. A. (2015). Appraising the quality of medical education research methods: The medical education research study quality instrument and the Newcastle-Ottawa scale-education. *Academic Medicine*, *90*(8), 1067–1076. https://doi.org/10.1097/ACM.0000000000000786

Courtney, M., Tong, S., & Walsh, A. (2000). Acute-care nurses' attitudes towards older patients: A literature review. *International Journal of Nursing Practice*, *6*(2), 62–69. https://doi.org/10.1046/j.1440-172x.2000.00192.x

de Abreu, I. D., Hinojosa-Lindsey, M., & Asghar-Ali, A. A. (2017). A simulation exercise to raise learners' awareness of the physical and cognitive changes in older adults. *Academic Psychiatry*, *41*(5), 684–687. https://doi.org/10.1007/s40596-017-0775-4

Deasey, D., Kable, A., & Jeong, S. (2014). Influence of nurses' knowledge of ageing and attitudes towards older people on therapeutic interactions in emergency care: A literature review. *Australasian Journal on Ageing*, *33*(4), 229–236. https://doi.org/10.1111/ajag.12169

Department of Health. (2009). *150 years of the annual report of the chief medical officer: On the state of the public health 2008*. Department of Health.

Diachun, L. L., Dumbrell, A. C., Byrne, K., & Esbaugh, J. (2006). But does it stick? Evaluating the durability of improved knowledge following an undergraduate experiential geriatrics learning session. *Journal of the American Geriatrics Society*, *54*(4), 696–701. https://doi.org/10.1111/j.1532-5415.2006.00656.x

Evans, S., Lombardo, M., Belgeri, M., & Fontane, P. (2005). The Geriatric Medication Game in pharmacy education. *American Journal of Pharmaceutical Education*, *69*(3), 304–310. https://doi.org/10.5688/aj690346

Eymard, A. S., Crawford, B. D., & Keller, T. M. (2010). "Take a Walk in My Shoes": Nursing students take a walk in older adults' shoes to increase knowledge and empathy. *Geriatric Nursing*, *31*(2), 137–141. https://doi.org/10.1016/j.gerinurse.2010.02.008

Fernandes, C. S. N. N., Couto, G., & Afonso, A. (2019). An aging simulation game's impact on the attitudes of nursing students. *Nursing Practice Today*, *6*(3), 142–151. https://doi.org/10.18502/npt.v6i3.1257

Fowler, G. A. (2016). Getting Old? This High-Tech Suit Simulates Aging; R70i age suit, made by Applied Minds and shown at CES, is designed to make you feel 40 years older. *Wall Street Journal*. Retrieved from https://search.proquest.com/docview/1754232663?accountid=14620

Gonçalves, D. C. (2009). From loving grandma to working with older adults: Promoting positive attitudes towards aging. *Educational Gerontology*, *35*(3), 202–225. https://doi.org/10.1080/03601270802466884

Halpin, S. N. (2015). Evaluating the efficacy of a short aging simulation workshop for an interdisciplinary group of health-care employees at a veterans affairs medical center. *Educational Gerontology*, *41*(3), 207–215. https://doi.org/10.1080/03601277.2014.938975

Henry, B. W., Douglass, C., & Kostiwa, I. M. (2007). Effects of participation in an aging game simulation activity on the attitudes of allied health students toward older adults. *Internet Journal of Allied Health Sciences & Practice*, *5*(4), 9p. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=rzh&AN=105761009&site=ehost-live

Henry, B. W., Ozier, A., & Johnson, A. (2011). Empathetic responses and attitudes about older adults: How experience with the Aging Game measures up. *Educational Gerontology*, *37*(10), 924–941. https://doi.org/10.1080/03601277.2010.495540

Hitchcock, D. R., Lockyer, S., Cook, S., & Quigley, C. (2001). Third age usability and safety—An ergonomics contribution to design. *International Journal of Human-Computer Studies*, *55*(4), 635–643. https://doi.org/10.1006/ijhc.2001.0484

Hojat, M., Mangione, S., Nasca, T. J., Cohen, M. J. M., Gonnella, J. S., Erdmann, J. B., & Magee, M. (2001). The Jefferson scale of physician empathy: Development and preliminary psychometric data. *Educational and Psychological Measurement*, *61*(2), 349–365. https://doi.org/10.1177/00131640121971158

Jeong, K., Kim, E. J., & Kim, J. H. (2010). Experience of aging simulation clothes among undergraduate nursing students. *Journal of the Korean Gerontological Society*, *30*(1), 141–157.

Kagan, S. H., & Melendez-Torres, G. (2015). Ageism in nursing. *Journal of Nursing Management*, *23*(5), 644–650. https://doi.org/10.1111/jonm.12191

Kiersma, M. E., Chen, A. M. H., Yehle, K. S., & Plake, K. S. (2013). Validation of an empathy scale in pharmacy and nursing students. *Journal of Pharmaceutical Education*, *77*(5), 94. https://doi.org/10.5688/ajpe777594

Kim, J., Park, J.-H., & Shin, S. (2016). Effectiveness of simulation-based nursing education depending on fidelity: A meta-analysis. *BMC Medical Education*, *16*, 152. https://doi.org/10.1186/s12909-016-0672-7

Kogan, N. (1961). Attitudes toward old people: The development of a scale and an examination of correlates. *The Journal of Abnormal and Social Psychology*, *62*(1), 44. https://doi.org/10.1037/h0048053

Koh, L. C. (2012). Student attitudes and educational support in caring for older people–a review of literature. *Nurse Education in Practice*, *12*(1), 16–20.

Kwon, H., Jeong, H., & Lee, Y. (2017). Effects of senior simulation program for nursing students: An integrated Study in South Korea. *EURASIA Journal of Mathematics, Science and Technology Education*, *13*(8), 4437–4447. https://doi.org/10.12973/eurasia.2017.00936a

Lamont, R. A., Swift, H. J., & Abrams, D. (2015). A review and meta-analysis of age-based stereotype threat: Negative stereotypes, not facts, do the damage. *Psychology and Aging*, *30*(1), 180. https://doi.org/10.1037/a0038586

Lasher, K. P., & Faulkender, P. J. (1993). Measurement of aging anxiety: Development of the anxiety about aging scale. *The International Journal of Aging and Human Development*, *37*(4), 247–259. https://doi.org/10.2190/1U69-9AU2-V6LH-9Y1L

Lavallière, M., D'Ambrosio, L., Gennis, A., Burstein, A., Godfrey, K. M., Waerstad, H., & Coughlin, J. F. (2017). Walking a mile in another's shoes: The impact of wearing an Age Suit. *Gerontology & Geriatrics Education*, *38*(2), 171–187. https://doi.org/10.1080/02701960.2015.1079706

Lidz, G. (2015). Exclusive: New super suit simulates aging for millennials. *Newsweek*, *165*(3). Retrieved from https://search.proquest.com/docview/1695137610?accountid=14620

Lintern, T. C. (2001). *Quality in dementia care: Evaluating staff attitudes and behaviour*. Prifysgol Bangor University.

Liu, Y.-E., Norman, I. J., & While, A. E. (2013). Nurses' attitudes towards older people: A systematic review. *International Journal of Nursing Studies*, *50*(9), 1271–1282. https://doi.org/10.1016/j.ijnurstu.2012.11.021

Lizarondo, L., Stern, C., Carrier, J., Godfrey, C., Rieger, K., Salmond, S., Apostolo, J., Kirkpatrick, P., & Loveday, H. (2020). Chapter 8: Mixed methods systematic reviews. In E. Aromataris & Z. Munn (Eds.), *JBI manual for evidence synthesis*. The Joanna Briggs Institute. Retrieved from https://synthesismanual.jbi.global

Lucchetti, A. L., Lucchetti, G., de Oliveira, I. N., Moreira-Almeida, A., & da Silva Ezequiel, O. (2017). Experiencing aging or demystifying myths? - impact of different "geriatrics and gerontology" teaching strategies in first year medical students. *BMC Medical Education*, *17*(1), 35. https://doi.org/10.1186/s12909-017-0872-9

Macaden, L., Smith, A., & Croy, S. (2017). Simulation on sensory impairment in older adults: Nursing education. *British Journal of Nursing*, *26*(19), 1057–1064. https://doi.org/10.12968/bjon.2017.26.19.1057

Maxwell, A. J., & Sullivan, N. (1980). Attitudes toward the geriatric patient among family practice residents. *Journal of the American Geriatrics Society*, *28*(8), 341–345. https://doi.org/10.1111/j.1532-5415.1980.tb01095.x

Millett, R. (2014). Physios train with age simulation suit. *Frontline*, *20*(15), 9. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=rzh&AN=107817701&site=ehost-live

Moriello, G. R., Smey, J. W., Pescatello, L. S., & Murphy, M. A. (2005). Influence of an educational intervention on pre-allied health students' attitudes toward older adults. *Gerontology & Geriatrics Education*, *25*(3), 1–11. https://doi.org/10.1300/J021v25n03_01

Newman, A. (2016). *A futuristic suit that gives you a taste of old age*. The New York Times.

Office for National Statistics. (2013). *Estimates of the very old (including Centenarians), 2002–2011, England and Wales*. Statistical Bulletin.

Oliver, D., Foot, C., & Humphries, R. (2014). *Making our health and care systems fit for an ageing population*. King's Fund London.

Palmore, E. (1977). Facts on aging: A short quiz. *The Gerontologist*, *17*(4), 315–320. https://doi.org/10.1093/geront/17.4.315

Payne, G., Laporte, A., Deber, R., & Coyte, P. C. (2007). Counting backward to health care's future: Using time-to-death modeling to identify changes in end-of-life morbidity and the impact of aging on health care expenditures. *The Milbank Quarterly*, *85*(2), 213–257. https://doi.org/10.1111/j.1468-0009.2007.00485.x

Platell, A. (2014). *'My terrifying step into old age': A special aging suit gave Amanda Platell an insight into what elderly parents endure every day*. The Daily Mail. Retrieved from https://www.dailymail.co.uk/femail/article-2584638/My-terrifying-step-old-age-A-special-aging-suit-gave-Amanda-Platell-insight-elderly-parents-endure-day.html.

Polizzi, K. G. (2003). Assessing attitudes toward the elderly: Polizzi's refined version of the aging semantic differential. *Educational Gerontology*, *29*(3), 197–216. https://doi.org/10.1080/713844306

Purva, M., Fent, G., & Prakash, A. (2016). *Enhancing UK Core Medical Training through simulation-based education: An evidence-based approach. A report from the joint JRCPTB/HEE Expert Group on Simulation in Core Medical Training*. Health Education England.

Qureshi, S., Jones, H., Adamson, J., & Ogundipe, O. A. (2017). Ageing simulation for promoting empathy in medical students. *BMJ Simulation & Technology Enhanced Learning*, *3*(2), 79. https://doi.org/10.1136/bmjstel-2016-000161

Reuben, D. B., Lee, M., Davis, J. W. Jr, Eslami, M. S., Osterweil, D. G., Melchiore, S., & Weintraub, N. T. (1998). Development and validation of a geriatrics attitudes scale for primary care residents. *Journal of the American Geriatrics Society*, *46*(11), 1425–1430. https://doi.org/10.1111/j.1532-5415.1998.tb06012.x

Robinson, S. B., & Rosher, R. B. (2001). Effect of the 'half-full aging simulation experience' on medical students' attitudes. *Gerontology & Geriatrics Education*, *21*(3), 3–12. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=rzh&AN=107053468&site=ehost-live. https://doi.org/10.1300/J021v21n03_02

Rosencranz, H. A., & McNevin, T. E. (1969). A factor analysis of attitudes toward the aged. *Gerontologist*, *9*(1), 55–59. https://doi.org/10.1093/geront/9.1.55

Rush, K. L., Hickey, S., Epp, S., & Janke, R. (2017). Nurses' attitudes towards older people care: An integrative review. *Journal of Clinical Nursing*, *26*(23–24), 4105–4116. https://doi.org/10.1111/jocn.13939

Samra, R., Griffiths, A., Cox, T., Conroy, S., & Knight, A. (2013). Changes in medical student and doctor attitudes toward older adults after an intervention: A systematic review. *Journal of the American Geriatrics Society*, *61*(7), 1188–1196. https://doi.org/10.1111/jgs.12312

Sanders, G. F., Montgomery, J. E., Pittman, J. F. Jr, & Balkwell, C. (1984). Youth's attitudes toward the elderly. *Journal of Applied Gerontology*, *3*(1), 59–70. https://doi.org/10.1177/073346488400300107

Seung, H. (2017). College students attitude toward elderly persons after aging simulation experience. *Biomedical Journal of Scientific & Technical Research*, *1*(6), 1768–1770.

Steinfeld, A., & Steinfeld, E. (2001). *Universal design in automobiles. Universal design handbook*. New York: McGraw-Hill.

Stewart, T., Roberts, E., Eleazer, P., Boland, R., & Wieland, D. (2006). Reliability and validity issues for two common measures of medical students' attitudes toward older adults. *Educational Gerontology*, *32*(6), 409–421. https://doi.org/10.1080/03601270600685628

Choi, S. W., & Park, M. H. (2009). Effect of senior simulation on geriatric unit nurses' attitude and job satisfaction toward the elderly. *Journal of the Korea Gerontological Society*, *29*(2), 513–527. Retrieved from <Go to ISI>://KJD:ART001347168.

The Press Association (2011). *Simulation suit recreates conditions facing older patients*. NursingTimes.net Retrieved from https://search.proquest.com/docview/883487411?accountid=14620

Tremayne, P., Burdett, J., & Utecht, C. (2011). Simulation suit aids tailored care. *Nursing Older People*, *23*(7), 19–22. https://doi.org/10.7748/nop2011.09.23.7.19.c8678.

Varkey, P., Chutka, D. S., & Lesnick, T. G. (2006). The aging game: Improving medical students' attitudes toward caring for the elderly. *Journal of the American Medical Directors Association*, *7*(4), 224–229. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=rzh&AN=106197902&site=ehost-live. https://doi.org/10.1016/j.jamda.2005.07.009

Wilson, M. A., Kurrle, S., & Wilson, I. (2018). Medical student attitudes towards older people: A critical review of quantitative measures. *BMC Research Notes*, *11*(1), 71. https://doi.org/10.1186/s13104-018-3186-z

Yu, C. Y., & Chen, K. M. (2012). Experiencing simulated aging improves knowledge of and attitudes toward aging. *Journal of the American Geriatrics Society*, *60*(5), 957–961. https://doi.org/10.1111/j.1532-5415.2012.03950.x

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: Eost-Telling C, Kingston P, Taylor L, Emmerson L. Ageing simulation in health and social care education: A mixed methods systematic review. *J Adv Nurs* 2020;00:1–24. https://doi.org/10.1111/jan.14577