REVIEW
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Using simulation in complementary medicine education: an overview of clinical trials

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The authors declare no conflicts of interest.
Abbreviations
CM, Complementary Medicine; CAM, Complementary and Alternative Medicine; OSCE, objective structured clinical examination.
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Abstract
Background and Aim: Using simulation in learning medical interventions is a common practice. Simulation techniques provided a safe environment for trainees and students to acquire clinical skills and knowledge to practice in a real clinical environment. The aim of this review is to assess the use of health simulation in the field of complementary medicine education. **Methods:** Three medical databases were searched from inception to 15 November 2021. The inclusion criteria were clinical trials that used simulation in the field of complementary medicine training and in English language and the full text can be retrieved. **Results:** After searching, 495 articles were retrieved, 235 articles were excluded for duplication and 249 articles were excluded after screening of titles/abstracts and applying inclusion and exclusion criteria. Finally, 11 articles were included in this review. These clinical trials had 719 participants and reported positive impact of using simulation in complementary medicine education. **Conclusion:** Simulation was used for training of some complementary medicine therapies such as chiropractic, acupuncture, massage therapy, cupping therapy and osteopathy. Using simulation in complementary medicine education is recommended to ensure a safe environment for training. Conducting high quality clinical trials to evaluate the use of simulation in complementary medicine education is highly recommended.

Keywords: simulation; chiropractic; acupuncture; cupping therapy; osteopathy; complementary medicine

Background

There was a long history of using simulation in learning medical interventions and practices. It is a way of acquiring new skills in a safe environment and preparing trainees and students for the real clinical practice [1]. Furthermore, simulation-based training allows instructors to assess, and monitor trainees' performance and evaluate their acquired skills and ability to practice in a safe clinical environment [1].

Complementary medicine is a broad term which represented various practices and therapies that are not part of the conventional medicine [2].

Using simulation in the complementary medicine education is dated back to the year 1,027 when Wang Wei-Yi (a Chinese physician) used statutes for teaching acupuncture [3]. The used statutes had 354 open body holes which represented acupuncture points. These holes were filled with a liquid and covered by wax. When a trainee put the acupuncture needle correctly in the hole and remove it, a drip of the solution – which was located inside the hole – should appear. Appearing of drips indicated the success of the trainee [3].

The aim of this review is to assess the use of simulation-based learning in the field of complementary medicine education. This study highlighted the importance of using health simulation in complementary medicine training and gave a descriptive review of the status of using simulation in complementary medicine education. Introduction of simulation into complementary medicine clinical training is very important to decrease any harms that may result from training on healthy volunteers which is a common practice in complementary medicine education. To the best of our knowledge, this is the first full narrative review which gave an overview of the conducted clinical trials that assessed using simulation in complementary medicine therapies.

Materials and methods

Three medical databases (PubMed, Cochrane Library, Scopus) were searched from inception to 15 November 2021. The search keywords were: ("Complementary medicine", "Complementary health", "Integrative health", "Integrative medicine", "acupuncture", "massage therapy", "cupping", "chiropractic", "osteopathy", "Simulation", "Training", "Education"). Search terms were adjusted according to the searched database. A manual search was also performed on references of retrieved articles. The inclusion criteria were clinical trials that used simulation in the field of complementary medicine training or education, in English language and the full text can be retrieved. Articles which were not clinical trials, not directly related to complementary medicine therapies, were not in English or could not be retrieved as a full text were excluded.

Results

495 articles were retrieved after performing search, 235 articles were excluded for duplication, and 249 articles were excluded after screening of titles/abstracts and applying inclusion and exclusion criteria. Finally, 11 articles were included in this review [4 – 14]. Figure 1 showed the search strategy and results.

This review identified 11 clinical trials in the field of 5 complementary medicine therapies (Chiropractic = 5 [4, 6, 7, 12, 14], acupuncture = 2 [8, 9], Massage therapy = 1 [13], cupping therapy = 1 [10] and osteopathy = 1 [5]) and general complementary medicine training = 1 [11].

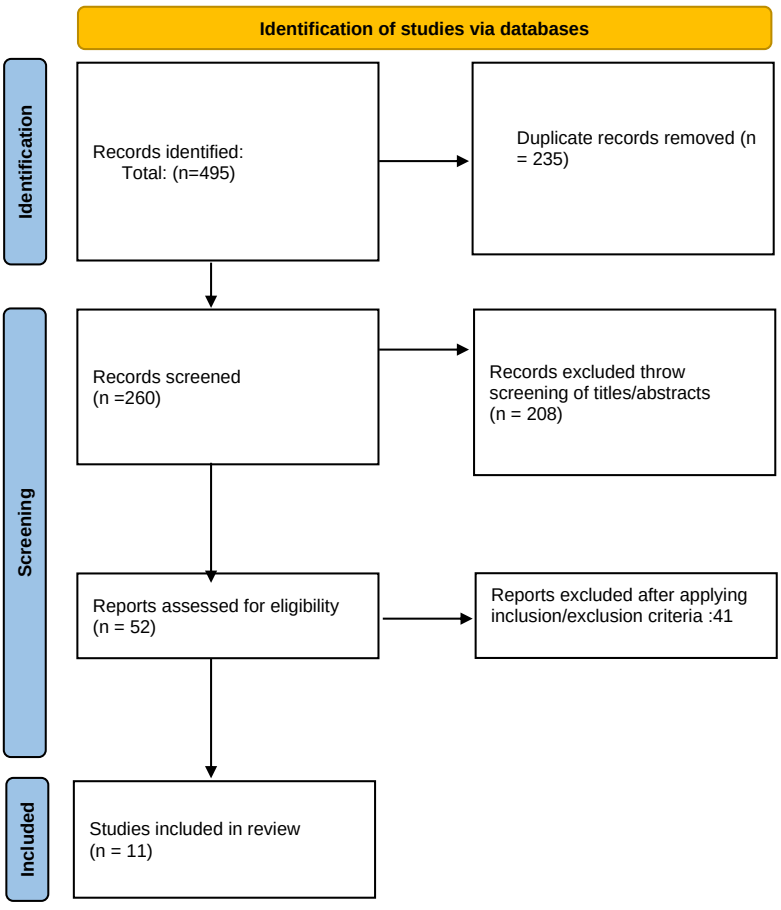

Figure 1 Prisma chart for search strategy and results

The included studies were conducted in 6 countries (Australia = 3 [7, 12, 14], Korea = 2 [8, 9], USA = 3 [4, 5, 13], Canada = 1 [6], Saudi Arabia = 1 [10] and China Taiwan = 1 [11]).

There were 719 participants in all included clinical trials. The highest number of participants in one clinical trial was 173 and the smallest number was 12 [8, 12].

All included clinical trials reported positive effects regarding using simulation-based learning in the training of various complementary medicine therapies. Table 1 showed the characteristics of the included clinical trials.

Discussion

This review included 11 clinical trials that assessed the using of simulation-based learning in complementary medicine training and education. These clinical trials assessed the use of simulation in the

Table 1 Characteristics of included clinical trials

First author, Year	CM Therapy	Simulation method	Participants	Evaluation methods	Results	Country
Scaringe, 2002 [4]	Chiropractic	Simulated high-velocity, low-amplitude procedure	71	Absolute constant error for performance accuracy and variable error for performance consistency.	Simulation devices and performance feedback may be beneficial when implemented in chiropractic motor skills training.	USA
Howell, 2008 [5]	Osteopathy	Virtual haptic back	21	Performance tests before and after and a questionnaire.	Effective potentially to help osteopathic medical students in learning palpatory diagnosis.	USA
McGregor, 2012 [6]	Chiropractic	Manikin	165	Satisfaction and usability questionnaires, perceived achievement of learning outcomes and anxiety scores via a visual analog scale.	High levels of satisfaction and learning achievement outcomes were achieved.	Canada
Chapman, 2015 [7]	Chiropractic	Manikin	41	Questionnaire items, differences between groups in the proportion of students achieving an overall pass mark at baseline, four weeks and eight weeks.	Competence in neck manipulation can be achieved by using mannequins before performing on human.	Australia
Lee, 2015 [8]	Acupuncture	Phantom acupoint (5% agarose gel)	12	Performance tests.	Positive effect of using simulation for acupuncture training.	Korea
Jung, 2015 [9]	Acupuncture	Phantom acupoint (5% agarose gel)	21	Compared the motion patterns and error magnitudes of pre- and post-training tests.	Beneficial effects for students in learning how to manipulate acupuncture needles.	Korea
Aboushanab, 2017 [10]	Cupping therapy	Part task simulator	41	Cupping simulation training evaluation questionnaire before and after.	Significant improvement in performance after cupping therapy simulation course.	Saudi Arabia
Chang, 2020 [11]	CAM	A virtual simulation software app on a smartphone	49	Questionnaires about nurses' attitudes and communication competency at baseline and after completing the 13 exercises.	Increasing the communication competency in consulting, and attitude towards complementary medicine of participants nurses.	Taiwan
Fong, 2020 [12]	Chiropractic	Online procedural videos	173	OSCE and a purpose-built questionnaire.	A small positive effect on OSCE performance. This tool is helpful for OSCE preparation.	Australia
Heslin, 2021 [13]	Massage therapy	Simulation scenarios	81	A questionnaire	Beneficial effects for practical application of cancer risk reduction knowledge and skills.	USA
Shanahan, 2021 [14]	Chiropractic	Projection virtual reality	44	An online survey	Positive effect and a valuable complementary resource in providing chiropractic students with radiographic knowledge and skills.	Australia

CM, Complementary Medicine; CAM, Complementary and Alternative Medicine; OSCE, objective structured clinical examination.

education of 5 complementary medicine therapies and were conducted in 6 countries. In addition, these clinical trials included 719 participants and reported positive impact of using simulation in complementary medicine education.

Using simulation in acupuncture training

Using simulation in the field of acupuncture training is dated back to 1,027 [4]. In this review, two clinical trials evaluated the use of simulation in acupuncture training and education. The included clinical trials used haptic and phantom acupuncture points (using 5% agarose gel) to simulate acupuncture points. The first trial was conducted to evaluate the impact of developed phantom acupuncture simulation points on the training of new students of acupuncture [8]. The second trial was conducted to evaluate pre- and post-simulation-based training on performance of acupuncture students using phantom acupuncture points and visual feedback [9]. Furthermore, the two clinical trials included 33 participants and reported the positive impact of using simulation in acupuncture training.

Many simulation devices and techniques were used, introduced and developed in the field of acupuncture training including virtual reality, learning-based games, model silicon ears for the auricular acupuncture education and mobile application learning using augmented reality [15 – 19].

There were reported adverse events related to acupuncture practice. Examples of acupuncture related adverse events were fainting, nerve/organ injury, pneumothorax, stuck needle, broken needle, bent needle, vascular injury and excessive bleeding from acupuncture point [20]. Using simulation-based learning in the field of acupuncture training and education will ensure that the acupuncture trainees will practice as much as they need to be confident and acquire clinical skills in a safe environment.

Using simulation in chiropractic training

This review included five clinical trials that assessed the use of simulation in chiropractic training and education [6, 12, 14]. The clinical trials included 494 participants and used different simulation devices and techniques (high velocity procedure, manikin, projection virtual reality and online videos) [4, 6, 7, 12, 14]. All included clinical trials reported positive effects of using simulation, the highest was obtained by using the manikin and the smallest effect was obtained by using the online videos [6, 7, 12].

Most of the adverse events related to chiropractic were mild, however, there have been serious reported adverse events such as arterial dissection, extrusion of vertebral disc and epidural hematoma [21]. Practicing chiropractic by simulation in a safe environment can increase trainees' confidence and abilities and it is highly recommended [7]. The main reported benefits of using simulation in chiropractic training included the ability of students to repeat tasks many times as required until they were satisfied with the results [14].

Using simulation in cupping therapy training

Using part-task trainer as a method of simulation and training of cupping therapy was developed and introduced in 2017 [22]. A questionnaire to evaluate the use of simulation in cupping therapy training was developed and validated in 2018 [23].

This review included one clinical trial. The clinical trial included 41 participants and reported significant and positive effects of using simulation [10].

Cupping therapy is a relatively safe practice, but there were many reported adverse events related to cupping therapy [24]. A classification of cupping therapy adverse events was developed in 2018 and updated in 2021 [25, 26]. The most cupping therapy reported adverse events were scars, vasovagal attack, dermatitis, abscesses, anemia and others [25]. Most of cupping therapy adverse events can be prevented by proper training and by following infection control guidelines [25]. Part-task simulation training will ensure proper training especially for invasive procedure such as doing skin scarifications in wet cupping therapy training [10].

Using simulation in massage therapy training

This review included one clinical trial that assessed using simulation technology for massage therapy therapists in the field of skin cancer prevention [13]. This clinical trial included 81 participants, and reported positive results [13].

Hospital-based massage therapy course was developed and introduced in 2015 [27]. The simulation was a part of the course [27]. Furthermore, a new massage therapy simulation platform using two types of flexible array sensors was developed in 2020 for medical training [28].

Most of massage therapy related adverse events were mild. Serious adverse events were reported such as soft tissue trauma, neurologic compromise, cervical cord injury, and myopathy [29, 30].

Using simulation is very important to train massage therapy therapists in a safe environment.

Using simulation in osteopathic medicine training

Using simulation in osteopathic medicine education is relatively new [31]. Many simulation techniques and devices were used in training such as videos, virtual learning environment [31, 32]. Mannequins, task trainers and virtual clinical skill systems [33].

This review included one clinical trial which evaluated the palpatory diagnosis using virtual haptic back. The clinical trial had 21 participants and reported positive effect on outcomes of learning [5].

Adverse events related to osteopathic medicine is commonly mild. Serious adverse events were reported; however, these adverse events were preventable especially with proper training [34].

The status of using simulation-based learning in integrative and complementary medicine was published as an abstract only in a conference proceeding in 2017 [35]. The abstract gave broadlines and general brief overview about the status of the use [35]. This review assessed the use of simulation in complementary medicine education through the inclusion of clinical trials only, is the first full text review – to the best of our knowledge – to give a detailed description about the use and impact of using simulation as a method of learning in various complementary medicine therapies.

Limitations of this review included the small number of clinical trials that evaluated the use of simulation in complementary medicine education, and the inclusion of English only published clinical trials.

This review highlighted the importance of using simulation in complementary medicine education. Implementation of simulation-based learning in complementary medicine education was encouraged for providing safe environment to train and practice. Furthermore, there is a high need for development of new methods of simulation to be used in complementary medicine training. More clinical trials should be conducted for evaluation of satisfaction and performance of the trainees and students.

Conclusion

Simulation-based learning was used for complementary medicine education. Chiropractic, acupuncture, massage therapy, cupping therapy and osteopathy education were examples of using simulation-based learning. All clinical trials reported positive effects from using simulation-based learning in complementary medicine education. Using simulation in complementary medicine education is recommended to ensure safe environment for training especially for new students and trainees. Conducting high quality clinical trials to evaluate the satisfaction, and performance of trainees is highly recommended. Developing new simulation devices for complementary medicine education and training is encouraged.

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