Simulation in Psychiatry for Medical Doctors: A Systematic Review and Meta-analysis

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ABSTRACT

CONTEXT: Most medical doctors are likely to work with patients experiencing mental health conditions. However, there are often limited educational opportunities for medical doctors to achieve professional development in the field of psychiatry. Simulation training in psychiatry may be a useful tool to foster this development.

OBJECTIVES: To assess the effectiveness of simulation training in psychiatry for medical students, post-graduate trainees, and medical doctors.

METHODS: For this systematic review and meta-analysis, we searched 8 electronic databases and trial registries up to August 31, 2018. We manually searched key journals and the reference lists of selected studies. We included randomised and non-randomised controlled studies and single group prepost-test studies. Our main outcomes were based on Kirkpatrick levels. We included data only from Randomised Controlled Trials (RCTs) using random-effects models.

RESULTS: From 46 571 studies identified, we selected 163 studies and combined 27 RCTs. Interventions included simulation by role-play (n=69), simulated patients (n=72), virtual reality (n=22), manikin (n=5) and voice simulation (n=2). Meta-analysis found significant differences at immediate post-test for simulation compared with active and inactive controls on attitudes (SMD=0.52 (95%CI [0.31; 0.73]; I^2= 0%) and 0.28 (95%CI [0.04; 0.53]; I^2= 52%), respectively); on skills (SMD=1.37 (95%CI [0.56; 2.18]; I^2=93%) and 1.49 (95%CI [0.39; 2.58]; I^2= 93%), respectively); on knowledge (SMD=1.22 (95%CI [0.57; 1.88]; I^2= 0%) and 0.72 (95%CI [0.14; 1.30]; I^2= 80%), respectively); and on behaviours (SMD= 1.07 (95%CI [0.49; 1.65]; I^2=68%) and 0.45 (95%CI [0.11; 0.79; I^2=41%), respectively. Significant differences were found at three-month follow-up for patient benefit and doctors' behaviours and skills.

CONCLUSIONS: Despite heterogeneity in methods and simulation interventions, our findings demonstrate the effectiveness of simulation training in psychiatry training.

Registration: This study is registered in PROSPERO (CRD42017078779).

INTRODUCTION

Working with people suffering from mental health needs and training in psychiatry requires specific knowledge, skills, and attitudes, which cannot simply be memorized and need development through experiential learning. While most doctors have to work with patients experiencing mental health conditions, for example somatic problems or interacting mental and physical health needs, opportunities for learning how to work with these patients are limited. Throughout medical training, experiences of working in psychiatry and mental healthcare are minimal, and available experiences provide insight into only part of this field. [1,2] Yet, over the past decade higher rate of mental health conditions, with its physical and mental health comorbidities and increased mortality, demonstrate a growing economic and social burden for society, including social stigmatization, professional exclusion, and poverty.[3] Undoubtedly, efforts to improve the knowledge, skills, and attitudes of doctors are required to address the international burden of mental health conditions.

Simulation training may facilitate the acquisition of knowledge, skills, and attitudes that are required to address this challenge and bridge the gap between theory and practice. [4] Simulation training is widely used in several medical specialties and recognised as an effective approach to enhance medical error management, patient safety, and teamwork in healthcare, among other positive clinical and workforce outcomes.[5,6] Although role-play (RP) has a strong history in psychiatry, especially for teaching psychotherapy and training psychiatric nurses, the use of simulation training is less advanced than for other specialties.[2,4,7] Simulated or standardised patient (SP) training has been progressively developed,[8] as have voice simulation (VS), virtual reality (VR), and manikin training more recently.[7]

Several reviews have demonstrated the effectiveness of simulation training.[6,9-13] However the effectiveness of this training modality in psychiatry has not been addressed. Indeed, the interpersonal authenticity and fidelity of simulation in psychiatry have been questioned alongside the ability of SPs to accurately portray the cognitive, affective, and behaviour complexity and symptomatology of mental health conditions. [14-16] Moreover, while learners need a secure and well-defined frame to develop reflective practice in simulation, challenges can be presented by the blurred boundaries between the non-reality of simulation and the, at times, transversal for reality of mental health conditions and symptoms, for example delusions.[14] Concurrently, due to the complexity of mental health conditions and personal experience, the ability to provide phenomenologically accurate portrayals of psychosis – for example, may be more complex than portraying physical illnesses such as diabetes. Furthermore, due to the high personal involvement required to make simulation more real, psychiatric simulations may generate phenomena such as role adherence and symptom induction.[17-20] This raises ethical issues when depicting a patient with suicidal ideation, for example,[21,22] and may demand specific SP recruitment criteria, careful de-rolling after simulations, specific follow-up or care, and additional training and support.[23] The opportunity to have real patients- simulating scenarios raises other issues. Training real patients may be challenging, for example, some patients may develop a detached style resistant to any acting and rehearsal training, while others may chose to describe their own opinions rather than portray symptoms, such as about their preferences for psychotropic medication [24]. There may also be a risk of psychological consequences, such as decompensating or retraumatising. In addition, clinical practice in psychiatry requires enhanced interpersonal and communication skills, the methods to develop which remain unclear.[14] Finally, fears, assumptions, and stigma towards psychiatric patients still exist among health professionals, which also creates a lack of self-confidence in assessing and providing appropriate care towards these patients,[1,25-28] and questions quality of care and patient safety. Consequently, a safe and structured environment in which to challenges these issues is highly valuable.

Recent reviews have suggested the potential of simulation training in psychiatry across a range of situations: training of undergraduate nursing students; [25,29,30] improving psychiatric knowledge among medical students; [31] assessing the benefit of objective structured clinical examination (OSCE) for medical students,[32] motivational interviewing training;[33] and using manikin[34] or voice simulation [35] training. Since the first and only global review on simulation in psychiatry published in 2008,[2] the number of studies has increased considerably. To our knowledge, no recent global systematic review on simulation training in psychiatry has been conducted since, and no meta-analysis has ever been performed. Hence, we conducted an extensive systematic review on simulation training in psychiatry for medical students, post-graduate trainees, and qualified doctors to assess its effectiveness on learners' change of satisfaction, attitudes, skills, knowledge, behaviours and patient benefit, based on Kirkpatrick's Training Evaluation Model, which WHO consider to be the standard reference for assessment of learning.[36,37]

METHODS

This systematic review and meta-analysis is reported according to the PRISMA Statement (supplemental eTable 1).[38] Our study protocol was registered in PROSPERO (CRD42017078779 (supplemental eText 1 for protocol amendment) and subsequently published (supplemental eText 2 for article). [39]

Search strategy

We searched the following electronic databases: MEDLINE via PubMed, EMBASE, Scopus, CINAHL, PsychINFO, ERIC, the Cochrane Library (Cochrane Database of Systematic Reviews and Cochrane central register of controlled trials (CENTRAL)), and Web of Science (Science and Social Sciences Citation Index) from inception to August 31 2018 with no language restriction. The search algorithm (reported in supplemental eText 3) combined keywords and free-text words on simulation and mental health conditions, and were overseen by an experienced research librarian and senior epidemiologist specialising in systematic reviews.

We then manually searched the table of contents from the last ten years of ten journals specialising in medical education and simulation. We searched clinical trial registries through the International Clinical Trials Registry Platform (supplemental eTable 2) and each registry website. Finally we screened all reference lists for further additional references.

Eligibility criteria and selection process

We included studies evaluating all forms of simulation training in psychiatry, including role-play, simulated patients, manikin, virtual reality, and voice simulation training versus other interventions or no training on Kirkpatrick's levels (learners' satisfaction, attitude, skills, knowledge, behaviours and patient benefit). [39] Patient benefit reflects to what degree targeted outcomes occur in clinical practice as a result of the training event and subsequent reinforcement.[36] We included randomised controlled trials (RCT), non-randomised controlled studies (non-RCT), and single group pre/post-test (PPT) studies. For this study, we focused on training for medical students, post-graduate trainees, and medical doctors.

Two authors independently screened all titles and abstracts retrieved by the search before proceeding to full text review using Covidence. [40] Discussions were conducted on 1 512 articles of the 46 571 articles screened. Any disagreements were resolved through discussion with a third reviewer to reach consensus.

In case of unclear eligibility or lack of full-text article, the corresponding author was contacted for further information by email with two reminders, before the article was automatically excluded if clarifications had not been provided (supplemental eTable 3).

Data extraction

Two authors independently conducted data extraction. Inter-rater agreement for the 10 main data points extracted are reported in eText 4. A standardised data extraction template was developed in Microsoft Excel (supplemental eTable 4) to extract data for each study on general characteristics, objectives, participant characteristics, design, simulation format, outcomes and results. More details are reported in the study protocol (supplemental eText 2). [39]

The methodological quality of included studies was evaluated by the Medical Education Research Study Quality Instrument (MERSQI),[41] and by the Risk of bias (ROB) tool for RCTs developed by Cochrane. [42] We also evaluated presence of key features that are associated with effective learning in simulation training; such as presence of feedback or multiple learning strategies. [5,6,13]

Only English and German language articles were found, understood by both reviewers, needing no further translation.

Where data was missing or unclear, the corresponding author was contacted for further information by email with two reminders.

Data analysis

Meta-analyses (MA) were only performed for RCTs to limit bias as recommended in the Cochrane handbook.[43] Intervention effect was estimated with standardized mean difference (SMD) for quantitative variables. [44] When missing, we imputed mean and SD if enough data were available. [43] For RCTs reporting changes from baseline, we extracted only post-test means and SDs to limit the rate of imputed outcome.[43]

RCTs with unclear outcome reports were not included in meta-analyses. For each outcome, we separately combined comparisons versus active (other training as intervention) or inactive (no other pedagogy) control. We considered two time-points of interest: immediate post-test (until one month after training end) and three months post-test (from two to four months follow-up). When we had an adequate number of studies (more than 5 studies per meta-analyses), subgroup analyses were conducted on trainees' level (medical students, post-graduate and completed post-graduate training) and simulation format (RP, SP, VR, VS and manikin).

Due to heterogeneity in participants and simulation interventions, we used random effects meta-analysis models. We assessed statistical heterogeneity by visually inspecting the forest plots and through I^2 statistic.[43] Assessment of small study effect was planned for meta-analyses including ten studies or more by funnel plots (to investigate asymmetry) and Egger test. To explore the impact of risk of bias, we planned sensitivity analyses when meta-analyses included more than five studies, by excluding trials at high or unclear risk of bias (defined as at least one domain at high or unclear risk of bias according to the ROB tool), according to profession (we excluded from analysis studies with participants mixing with other healthcare professionals), pedagogical design (we excluded from analysis studies with adjuvant pedagogy in addition to simulation training) and pedagogical quality (we excluded from analysis studies with MERSQI scores inferior to 12, reported in a previous meta-analysis on simulation training as a high quality score).[6]

Significant difference was considered when $P<0.05$, and Cohen effect size classification [45] was used to assess clinical significance: >0.8 for large; 0.5 to 0.8 for medium; <0.5 for small. RevMan software V.5.3 was used for all meta-analyses.

We assessed quality of evidence with the Grading of Recommendations Assessment, Development and Evaluation (GRADE).[46]

The analysis of pre/post-test and non-RCTs was qualitative because of differences in study design and expected heterogeneity. [43] We took into account in decreasing order: effect size; statistical significance; and simple increase, decrease or difference observed on data when no other calculation are reported.

RESULTS

Search results

Figure 1 shows a flowchart of study selection process. Our search identified 46 571 studies for title and abstract screening, from which 1 414 were eligible for full text review. Of these, 163 met inclusion criteria (including 10 560 participants) with 27 RCTs combined in meta-analyses (including 2 351 participants).

Study characteristics

Study characteristics are reported in supplemental eTable 5, summarized in eTable 6, with key simulation features reported in supplemental eTable 7. Studies were mainly from USA (97, 59.5%) and UK (26, 16%) (see supplemental eText 5 for other countries). There were 114 (69.9% of studies included) publications since the first and only global review on simulation training in psychiatry was published in 2008.[2] Study quality and risk of bias for RCTs are reported in supplemental eTable 8 and 9. We did not assess reporting bias by examining funnel plots and Egger test because no meta-analysis included ten or more studies. We found only one study judged as low risk of bias.[47] Thus we did not perform sensitivity analysis on risk of bias. We performed sensitivity analysis only for one meta-analysis on skills outcome as it included more than 5 studies. GRADE quality of evidence was found to be between "moderate" and "very low" (supplemental eTable 10). Forest plots of each outcome are reported in figure 2 (and in supplemental eFigure 1 with complete data, subgroup and sensitivity analysis).

Findings

Satisfaction

Satisfaction was reported in eight studies (753 participants). There was a significant difference in one RCT (104 medical students),[48] and in three out of the five non-RCTs (355 medical students), but not in the single PPT.[24]

Attitudes

Attitude outcomes were reported in 103 studies (6 380 participants), including belief, self-confidence, self-efficacy, anxiety and attitudes towards patients and psychiatry as outcomes. A significant medium effect size was found in a meta-analysis of five studies comparing simulation to an active control at immediate post-test (SMD=0.52; 95%CI [0.31; 0.73]) with no heterogeneity (I^2=0%). A significant small effect size was found in a meta-analysis of five studies between simulation and inactive control at immediate post-test (SMD=0.28; 95%CI [0.04; 0.53]) with heterogeneity at 52%. No significant difference was found in a meta-analysis of two studies with active control at three months follow-up (SMD=0.19; 95%CI [-0.22; 0.60]). From the seven RCTs not included in MA (308 participants), three RCTs [49-51] found significant differences between simulation and control groups. Among the 15 non-RCTs (1 655 participants) assessing attitudes, eight (688 participants) showed significant differences between intervention and control groups; maintained at 2 months in two study,[52,53] and six months in one study.[54] From the 70 PPTs (3 267 participants), 49 (2 768 participants) reported significant differences between pre and post-test; maintained at one month in two studies, [55,56] three months in two study,[57,58] four months in one study,[59] six months in two studies,[60,61] ten months in one study,[62] one year in two study,[63,64] with effect sizes between 0.25 and 2.30 in eight studies.[65-72]

Skills

Skills outcomes were reported in 59 studies (3 197 participants). A significant large effect size was found in a meta-analysis comparing simulation to active control on seven studies (SMD=1.37; 95%CI [0.56; 2.18]) at immediate post-test, with high heterogeneity at 93%. Results were consistent in the subgroups medical students (SMD=1.38; 95%CI [0.10; 2.66]; I^2=96%), post-graduate trainees (SMD=1.39; 95%CI [0.22; 2.57]; I^2=84%) and manikin (SMD=2.65; 95%CI [1.34; 3.96]). But in the subgroups of RP (SMD=1.05; 95%CI [-0.10; 2.21]; I^2=92%), SP (SMD=0.69; 95%CI [-0.66; 2.03]; I^2=87%) and VR (SMD=2.00; 95%CI [-1.57; 5.56]; I^2=98%), we found no significant difference. Sensitivity analysis without mixed profession and with high pedagogical quality found consistent results (SMD=1.37; 95%CI [0.56; 2.18]; I^2=93%). Another sensitivity analysis removing studies with blinded learning also found consistent results (SMD=1.56; 95%CI [0.32; 2.80]; I^2=94%).

A significant large effect size was found in a meta-analysis comparing simulation to inactive control on five studies (SMD=1.49; 95%CI [0.39; 2.58]) with high heterogeneity at 93%.

For three month follow-up, we found a small significant differences in a meta-analysis of four studies comparing simulation with inactive control (SMD=0.34; 95%CI [0.02; 0.66]) with low heterogeneity (I^2=35%).

In the six RCTs not included in meta-analyses (271 participants), three [73-75] found significant differences between simulation and control. Among the 16 non-RCTs (1 387 participants) on skills, nine non-RCTs (628 participants) showed significant differences between intervention and control groups, maintained in one study at 5 weeks,[76] in one study at 2 months,[53] and in one study at 7 months;[77] with effect sizes at 0.61 for one study.[78] For the 24 PPTs (547 participants) assessing skills, 19 studies (481 participants) reported significant differences between pre and post-test; maintained in three studies at one month,[55,79,80] in another at three months, [81] in another at two years an half,[82] and not at all at 6 months in two others, [83, 84] with one effect size at 0.58.[79]

Knowledge

Knowledge outcomes were reported in 57 studies (4 064 participants). A significant large and medium effect size was found in meta-analyses comparing simulation to both active (SMD=1.22; 95%CI [0.57; 1.88]; I^2=0%) and inactive (SMD=0.72; 95%CI [0.14; 1.30];

I^2=80%) controls respectively at immediate post-test, including 2 and 5 studies in each meta-analysis.
In the four RCTs not included in meta-analyses (174 participants), one[49] found significant differences between simulation and control. Among the 14 non-RCTs (1 577 participants) on knowledge, six non-RCTs (728 participants) showed significant differences between intervention and control groups, maintained at one month for one study,[85] and at one year for one study,[86] For the 33 PPTs (1 892 participants) assessing knowledge, 20 studies (956 participants) reported significant differences between pre and post-test, with effect sizes between 0.37 and 2.3 for four studies. [65,69,71,87] Results were maintained at three months in three studies,[81,88,89] 6 months in one study,[61] ten months in one study,[62] and one year in one study.[64]

Behaviours
Behaviour outcomes were reported in 36 studies (2 470 participants). A significant large and small effect size was found in meta-analyses comparing simulation to both active (SMD=1.07; 95%CI [0.49; 1.65]) and inactive (SMD=0.45; 95%CI [0.11; 0.79]) controls at immediate post-test, with heterogeneity at 68% and 41%, for three and four studies respectively.
For three month follow-up, a significant large effect in three studies was found for simulation compared with active control (SMD=0.83; 95%CI [0.42; 1.24]), with high heterogeneity (I^2=67%).
In the four RCTs not included in meta-analyses (268 participants), two [50,90] found significant differences between simulation and control. Among the eight non-RCTs (509 participants) on behaviours, four non-RCTs (366 participants) showed significant differences between intervention and control groups, maintained at ten months in one study.[62] For the 15 PPTs (828 participants) assessing behaviours, ten studies (578 participants) reported significant differences between pre and post-test; maintained at one month in two study,[79,91] three months in two studies, [89,92] one year in one study,[63] eighteen months in one study,[93] and two years in one study, [61] with effect size at 0,32 in one study.[92]

Patient benefits
Evaluation of patient benefit was reported in 13 studies (609 participants). A significant small effect size was found in a meta-analysis of two studies comparing simulation to active control at three month follow-up (SMD=0.22; 95%CI [0.08; 0.36]) with no heterogeneity. In the five RCTs not included in meta-analyses (279 participants), two[94,95] found significant differences between simulation and control. Two non-RCT[96,97] reported significant differences with controls. From four PPTs (111 doctors), one reported significant differences between pre and post-test, maintained at six months.[84]

DISCUSSION
This thorough systematic review sought to assess the effectiveness of simulation training in psychiatry for medical students, post-graduate trainees, and doctors based on Kirkpatrick's Evaluation Model. We found significant differences at immediate post-test in meta-analyses for simulation compared with both active and inactive controls for attitudes, skills, knowledge and behaviours. Significant differences were found at three-month follow-up with large effect size for behaviours and small effect size for skills and patient benefits.

Most of the studies included in our systematic review focused on attitudes, skills, and knowledge (ASK), showing wide effectiveness of simulation training in psychiatry on ASK.

PPTs showed significant differences between pre and post-test on ASK for two thirds of studies, although we cannot exclude natural learning effect. Indeed, for non-RCTs and RCTs not included in MA, barely half of the studies showed significant differences between simulation and control groups. However, the low number of controlled studies might explain such results. The number of RCTs was sufficient for meta-analyses, but not enough to provide overwhelming evidence, despite some very high quality research.[47,98-100] Of the 37 RCTs identified, only 27 were included either because of incomplete data or evaluation of different time points for assessment.

For behaviours and patient benefit outcomes, significant differences were found in half of the included studies across RCTs (not included in MA), non-RCTs and PPTs. A smaller number of studies and heterogeneous time points for assessment make interpretation difficult. Limited evidence of effects at three months remains difficult to interpret because few studies were included in meta-analyses. Nonetheless, this raises the question of the need for repeated, consistent and continuous training. Regarding satisfaction, few studies were identified and used PPT and control group, suggesting higher satisfaction for simulation versus control from these initial findings. The majority of published studies used post-test design only, which were not included in this study and whose results will be reported elsewhere. [39]

Comparison with other studies

Findings are consistent with a recent review of medical students' learning and engagement during simulation training in psychiatry regarding attitudes and skills. [31] Our results are congruent with previous reviews on undergraduate nursing students showing effects of simulation on anxiety, self-confidence, [25,30] knowledge, empathy,[30] communication skills, [25,29,30] risk assessment, critical thinking, problem solving, and decision making.[29] Another review on motivational interviewing training also reported significant practitioner change behaviours that are indicated by our findings across a broader setting.[33] However, our results are the first to include a global assessment of all types of simulation training for initial and continuous training among doctors.

We found high heterogeneity across studies, undermining robustness of results regarding outcomes across the Kirkpatrick Model's levels. Simulation design also showed high heterogeneity, both on content (for example, mental health conditions, treatment and clinical processes) and modalities (for example, variation in scenarios, range of difficulties, practice or observation, feedback nature, length). Additionally adjuvant pedagogy and training was often included alongside simulation (for 76.1% of studies), adding complexity to comparison of outcomes across studies. Heterogeneity of participants' level of experience and receiving training in multi-disciplinary groups added further difficulties to comparison and interpretation (for example, comparing students and doctors, or training with other healthcare professionals). Outcome measures and instruments were also highly variable, complicating comparisons. This complexity reflects the diversity and developments in educational technology and approaches that influence doctors' and all healthcare professionals' learning. However, such heterogeneity is consistent with the diverse and complex nature of psychiatry and mental health conditions, as well as that of simulation training in this field. This may highlight the external validity of our findings by recognising that attempting to understand heterogeneity in simulation training in psychiatry reflects the practical implementation of this method within specific contexts. Furthermore, this provides an opportunity to develop clearer guidelines and support to develop simulation training in psychiatry that allows for tailoring and individualization to specific contexts and needs of learners.

Certain studies (mostly PPTs) assessed outcomes at follow-up time points, finding significant differences. However, the time points for data collection were highly disparate, preventing reliable comparison to determine long term effectiveness. Certain studies evaluated behaviour and patient benefit outcomes and had high pedagogical quality (for example)[47,94,101,102] but do not yet demonstrate compelling evidence on simulation training's effectiveness. Indeed the ability of simulation training to improve behaviours, patient outcomes, and be effective longitudinally based on retention and deep learning is a key argument for adopting simulation training over more traditional methods, and as such merits further investigation.

Implications

Nonetheless, even in light of concerns raised with simulation in psychiatry,[2,14,16,22,24] our results suggest notable benefits, including for high complexity topics such as interpersonal dynamics and psychological disturbances. Our findings build on SP guidelines[103] and reports of SP training,[104,105] suggesting foundations for psychiatric simulations, including strengths of using professional actors compared with volunteers; introducing SPs to the psychiatric context (through videos, readings, visit psychiatric hospital or ambulatory setting and/or real patient encounter); careful recruitment and close monitoring of SPs for psychological effects of acting. Role play has traditionally been used in psychiatry-[2] and remains common, often used for mental disorders that are less complex to portray (such as depression or substance use disorders). The promising effects of VR simulation, from preliminary research, has been linked with important efforts to make encounters with virtual patient realistic enough to effectively engage learners. [92,106-108] Early research into the use of manikins to teach discrete procedural skills in psychiatry, such as electroconvulsive therapy, have showed effectiveness.[64,109,110]

Few studies[24,111-114] identified used real patients for simulations, possibly emphasizing the need for prudence, which raises questions around how to address stigma, as proximity and exposure are known approaches. However, simulation training can provide other methods through which to address stigma using alternative pedagogies that illicit the personal narratives and experiences of patients,[111,115] such as: simulation formats (e.g. voice simulation),[35,116,117] simulations focused on patient-centered approaches,[118] empathic skills training,[73] virtual patients,[119] Indeed, almost two-thirds of studies reported attitude change as an outcome, demonstrating the importance of addressing beliefs and self-confidence as essential learning that can be harnessed through simulation in psychiatry to address stigma.

As reported in eTable 7, three quarters of studies used feedback or debriefing and multiple learning strategies, and two third used individualized learning and curriculum integration, to ensure learning outcomes and benefits. Almost all studies were implemented in a controlled environment. These features, recognized as essential in high-fidelity simulation,[5,13] appear to be essential for effective simulation training in psychiatry. Additionally, video-feedback was common in psychiatry (see eTable 5), reflecting the uniqueness and idiosyncrasy of each doctor-patient encounter, and allowing this to be mirror for each trainee-SP encounter. Indeed, this demonstrates that simulation training in psychiatry can provide more authenticity than medical simulation based on the nature of patient and simulated patient interactions. Concurrently, as the principles of repetitive practice to develop mastery learning, deliberate practice and employing a range of task difficulties are less commonly reported, possibly due to the complexity of using these principles in psychiatric scenarios. Moreover, the structure of debriefing is rarely reported and even more rarely assessed,[119,120] demonstrating the pressing need for more guidance, educational rigour and improved practice on this key feature.

Study characteristics summarized in eTable 6 demonstrate the common use of simulation training for depression, anxiety disorders, alcohol and substance use disorders, or suicide and violence symptoms. Other areas such as mania, psychosis, personality disorders, or delirium and hallucination are less common, suggesting more complexity in simulating these topics. Moreover, some areas (subspecialties such as child and adolescent and old age psychiatry; or mental health conditions such as obsessional compulsive disorders, attention-deficit hyperactivity disorders, and autism) featured less in the literature, highlighting the need of taking a global view of psychiatry through simulation training and expanding implementation.

Furthermore, eTable 6 reports that simulation in psychiatry is currently used mainly for professionals not working in mental health. This demonstrates the opportunity for developing simulation training in other medical fields when dealing with mental health, comorbidities and added complexity, for example working with parents responsible for childhood maltreatment in paediatrics, working with sexual disorders in urology and/or gynaecology, and management of an agitated or aggressive carer for a geriatric patient.

Further research is required to clarify the full potential of simulation training in psychiatry, requiring RCTs, assessment of behaviours and patient outcomes, longitudinal evaluations, long term assessment of cost-effectiveness (for example through reducing errors and improving clinical outcomes), and qualitative methodologies to clarify the active mechanisms of learning and behaviour change in simulation training. Essential components of simulation training in psychiatry require further investigation, such as the structure of debriefing, specific use of video-feedback, participation of real patients and peer supporters in part of the simulation training (e,g, scenario development, SP training, debriefing). Such research is required to improve the quality, accessibility and implementation of simulation training in psychiatry through alignment to public health and healthcare policies and funding. Standardisation, while allowing tailoring to needs, and building of quality criteria including pedagogy, structure, delivery and curriculum alignment must be developed. Beyond initial steps, further homogenisation of approaches and learning and outcome measurement will support creation of a robust evidence base in the literature, especially in specific contexts (such as child and adolescent psychiatry). This would justify inclusion of simulation training in psychiatry in curricula as a tool to improve professional development and clinical care. Indeed more robust findings on longitudinal effectiveness would enhance the case for simulation training in psychiatry to be seen as highly valuable to improving patient outcomes and experience, as it is in other specialties such as Obstetrics and Gynaecology. Finally, diversification of cultural implementation beyond the dominant US and UK settings would develop the pedagogical approach as well as advance the field as a whole.

Limitations

While this study presents novel and useful findings in this field, it has some limitations. Although we aimed to be as thorough as possible, we may have missed some studies. We included only post-test results, missing baseline change (to limit data imputations), and for most studies, we did not find a global summary measure of results, limiting inclusion of some results in pooled estimated effects. Moreover, even for only two time point collection, we could not perform meta-analyses with active and inactive controls on each level of Kirkpatrick's Model. Subgroup analyses could be performed only for skills outcome. The number of studies was insufficient to inspect funnel plot and to make Egger tests, raising difficulties in assessing risk of publication bias. We could perform limited sensitivity analyses, both because of lack of studies and high risk of bias for almost all studies included, suggesting potential flaws in meta-analyses results. Consequently, quality of evidence reported though the GRADE tool was on average low. Finally, we chose to limit meta-analyses to RCTs to improve the strength of evidence, but consequently other studies (pre/post-test and non-RCTs) were reported in less detail.

Conclusion

Despite high heterogeneity, our results provide the best currently available evidence for effectiveness of simulation training in psychiatry on medical students, post-graduate trainees, and doctors' behaviours, skills, knowledge, attitudes and patient benefit. A threefold increase in research over the past ten years, the emergence of high quality research, the diversity of countries starting to develop simulation and recent innovations (such as VS and VR) indicate the growing potential in implementing simulation training in psychiatry to support and improve clinical care delivery for patients with mental health conditions.

Contributors

MAP was responsible for the original study proposal. MAP, AD and GG drafted the original study protocol. BF, AT, CLB and CL revised the proposal. MAP and GG independently screened papers and extracted data. AD, BF, AT and CL helped work towards consensus when there was disagreement. MAP did the statistical analysis. AD provided advices on methodology and statistical analyses. MAP wrote the initial draft of the manuscript. AD, BF, FJ, CA, SC, GB, AT, CLB, JJR, CL and DM provided content expertise, methodological guidance and interpreted the findings in the context of the wider literature. All the authors contributed to consecutive drafts and approved the final manuscript.

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Conflicts of interest

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