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Interventions to decrease health students' stigma towards schizophrenia: A scoping review.

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Abstract:	Background: Schizophrenia is heavily stigmatized among health professionals. Given that health professional students are future members of the workforce and will provide care for people with schizophrenia, it's essential to implement interventions aimed at reducing stigma among this group. Objective: This scoping review aimed to identify and synthesize existing literature on interventions to decrease schizophrenia stigma among health professional students, and to determine the possible gaps in the literature. Design: Nine electronic databases and grey literature were searched, including PubMed, Embase, the Cumulative Index to Nursing and Allied Health Literature, PsycINFO, MEDLINE, Web of Science, Scopus, China National Knowledge Infrastructure, Wan Fang, and Google on the 5 May 2023. Two researchers independently conducted data screening, data extraction, and assessed study risks. A most updated search was also done on 22 May 2024. The Cochrane risk-of-bias tool for randomized trials and Risk of Bias in Non-randomized Studies were used to assess the studies' risk of bias. Data synthesis and analysis were conducted by two reviewers using a narrative approach. Reporting adhered to Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews. Results: This review included twenty-one studies with 2520 health professional students. The majority of included studies were non-randomized controlled trials (38%) and pre-post studies (52%). Most of the included studies were conducted in the United States (24%). The participants in ten (48%) studies were medical students. The number of intervention sessions ranged from one to 13, with an average of three. Seven (33%) studies had an intervention duration of less than four weeks and 16 (76%) studies had no follow-up. Various scales were used to assess the outcomes of schizophrenia stigma. Only two studies (10%) indicated the intervention's ineffectiveness, with the majority of interventions led by psychiatry department faculty and individuals with schizophrenia. Conclusions: Most studies (90%) utilized various approaches, including face-to-face or online education, direct contact with individuals with schizophrenia, or a combination thereof, to diminish stigma among health professional students. However, none addressed cultural and empathy factors in their intervention designs, and the included studies lacked theoretical guidance. The review only comprised English quantitative studies with significant heterogeneity, with 17 studies (81%) displaying serious or high risk of bias, limiting comprehensive discussions. These findings offer valuable insights for future systematic review. Tweetable abstract: Studies on reducing health professional students' schizophrenia stigma need to address cultural and empathy factors.

Interventions to decrease health students' stigma towards schizophrenia: A systematic review.

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Interventions to decrease health students' stigma towards schizophrenia: A scoping review.

Abstract

Background: Schizophrenia is heavily stigmatized among health professionals. Given that health professional students are future members of the workforce and will provide care for people with schizophrenia, it's essential to implement interventions aimed at reducing stigma among this group.

Objective: This scoping review aimed to identify and synthesize existing literature on interventions to decrease schizophrenia stigma among health professional students, and to determine the possible gaps in the literature.

Design: Nine electronic databases and grey literature were searched, including PubMed, Embase, the Cumulative Index to Nursing and Allied Health Literature, PsycINFO, MEDLINE, Web of Science, Scopus, China National Knowledge Infrastructure, Wan Fang, and Google on the 5 May 2023. Two researchers independently conducted data screening, data extraction, and assessed study risks. A most updated search was also done on 22 May 2024. The Cochrane risk-of-bias tool for randomized trials and Risk of Bias in Non-randomized Studies were used to assess the studies' risk of bias. Data synthesis and analysis were conducted by two reviewers using a narrative approach. Reporting adhered to Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews.

Results: This review included twenty-one studies with 2520 health professional students. The majority of included studies were non-randomized controlled trials (38%)

and pre-post studies (52%). Most of the included studies were conducted in the United States (24%). The participants in ten (48%) studies were medical students. The number of intervention sessions ranged from one to 13, with an average of three. Seven (33%) studies had an intervention duration of less than four weeks and 16 (76%) studies had no follow-up. Various scales were used to assess the outcomes of schizophrenia stigma. Only two studies (10%) indicated the intervention's ineffectiveness, with the majority of interventions led by psychiatry department faculty and individuals with schizophrenia.

Conclusions:

Most studies (90%) utilized various approaches, including face-to-face or online education, direct contact with individuals with schizophrenia, or a combination thereof, to diminish stigma among health professional students. However, none addressed cultural and empathy factors in their intervention designs, and the included studies lacked theoretical guidance. The review only comprised English quantitative studies with significant heterogeneity, with 17 studies (81%) displaying serious or high risk of bias, limiting comprehensive discussions. These findings offer valuable insights for future systematic review.

Tweetable abstract: Studies on reducing health professional students' schizophrenia stigma need to address cultural and empathy factors.

This scoping review had no funding support.

Keywords: Review, Schizophrenia, Social Stigma, Students, Health Occupations

What is already known

•Stigma causes serious barriers to recovery in people with schizophrenia and can increase their suicidal ideation.

•Stigmatizing attitudes towards mental illness among healthcare professionals and students have a range of harmful effects which warrant increased attention.

•No current review provides a descriptive overview of studies evaluating interventions to decrease the stigma of schizophrenia among health professional students.

What this paper adds

•The combination of education with various specific educational strategies and personal contact is the most popular and effective approach for reducing the stigma associated with schizophrenia.

• Simulation and virtual reality technology interventions were found to decrease stigma surrounding schizophrenia, but adverse effects were also observed and these methods should be used with caution.

• Most intervention studies lack theoretical guidance, do not assess long-term efficacy, and neglect important cultural factors, all of which should be addressed in future interventions.

1. Introduction

Mental illness stigma, which involves societal stereotypes and discrimination against those with mental illness (Corrigan et al., 2005), is widely recognized as the most

significant obstacle in providing mental healthcare and developing effective programs (Beldie et al., 2012; Sartorius, 2013). Among all mental illnesses, schizophrenia is widely acknowledged as the most stigmatized (Valery & Prouteau, 2020). Approximately 24 million people worldwide are affected by schizophrenia (WHO, 2022). Individuals with schizophrenia often describe stigma as a secondary illness, emphasizing its substantial impact on their lives and well-being (Schulze & Angermeyer, 2003).

Stigmatization has significant and detrimental effects on individuals with schizophrenia. It can lead to challenges in finding employment (Koschorke et al., 2014), establishing friendships (Lee et al., 2005) and forming romantic relationships (Koschorke et al., 2014). Stigma also hampers the ability to receive proper treatment (Caqueo-Urizar et al., 2019), engage in rehabilitation (Vass et al., 2017), and reintegrate into society (Vass et al., 2017). Consequently, this can have a negative impact on overall quality of life (Cai & Yu, 2017) and diminish willingness to seek help or confide in others (Corrigan et al., 2014; Gerlinger et al., 2013; Kleintjes et al., 2010; Maharjan & Panthee, 2019). Moreover, stigma can erode individuals' self-esteem and cause them to disregard their symptoms (Lysaker et al., 2008; Lysaker et al., 2009; Maharjan & Panthee, 2019), leading to a loss of social status and familial respect (Koschorke et al., 2014). Stigma can even contribute to suicidal tendencies (Sharaf et al., 2012).

It has been reported that stigmatizing attitudes towards mental illness among healthcare professionals and students can have harmful effects. These effects include a decrease in the quality of care provided to individuals with mental illness, potential neglect of their

medical needs, unnecessary transfers to specialized centers, and a lack of acceptance and support in their social and personal lives (Knaak et al., 2017). Furthermore, the stigmatization of mental illness by healthcare professionals has resulted in a shortage of staff in psychiatry departments (Lien et al., 2021), and in some cases, a "recruitment crisis" in the field (Barkil-Oteo, 2012).

Healthcare students are future professionals who will play an essential role in the treatment, nursing, and recovery processes of people diagnosed with schizophrenia. Studies have shown that health professionals frequently harbour unfavourable opinions regarding mental disorders (Bell et al., 2008; Bennett & Stennett, 2015; Gunay et al., 2016; Wimsatt et al., 2015). These unfavourable opinions may be best addressed during training because attitudes formed early in their education are more susceptible to change (Korszun et al., 2012). Trainee health professionals' attitudes tend to become more stable after they complete their professional training at medical school (Korszun et al., 2012). Compared with health professionals, trainee health professionals more readily change their stigmatising attitudes towards individuals with mental disorders (Korszun et al., 2012). Furthermore, the responses of trainee health professionals to incidents of stigmatising behaviour or attitudes can serve as a model for others who strive to exhibit decent behaviour (Abbey et al., 2011).

Although some reviews address the reduction of mental illness stigma, they have several methodological limitations. Firstly, the absence of longitudinal studies impedes establishing causal relationships regarding factors influencing stigma reduction

(Larkings & Brown, 2017). Secondly, the inclusion of studies from a single region limits the generalizability of findings (Kaur et al., 2021; Mascayano et al., 2016; Codjoe et al., 2021; Vaishnav et al., 2023). Thirdly, these reviews predominantly target reducing the stigma associated with mental disorders generally (Lien et al., 2021; Morgan et al., 2018; Petkari et al., 2018; Xu et al., 2017), utilizing the overarching term 'mental illness', which fails to account for differences among disorders such as depression, schizophrenia, and bipolar disorder. Because there is some evidence to suggest that the impact of biogenetic causes varies across different mental illnesses (Lebowitz & Ahn 2014), it is possible that people with mental illnesses may experience stigma that is specific to their diagnosis. Thus, it is unclear whether broad mental illness stigma interventions can be interchangeably used to reduce levels of health professional students' schizophrenia stigma and attain the same effectiveness. Additionally, the considerable heterogeneity (Waqas et al., 2020; Rodríguez‐Rivas et al., 2022; Zamorano et al., 2023) in interventions, controls, and outcome measurements across studies poses challenges for systematic review implementation, suggesting a scoping review may offer more insightful information than drawing a simple conclusion of the most effective intervention. Moreover, systematic reviews pooling various indicators of stigma may introduce bias (Morgan et al., 2018). Furthermore, interventions effective for health professionals may not translate to similar efficacy in the general public due to differing levels of mental health knowledge (McCullock & Scrivano, 2023). Thus, a scoping review focusing on interventions targeting health professionals'

stigmatization of schizophrenia is warranted yet remains unexplored in current literature. Thus, the research questions of this scoping review are:

1) What kinds of specific interventions were used to decrease health professional students' schizophrenia stigma?

2) What were the theories used to guide the development of interventions (if included)?

3) Whether these specific interventions considered cultural factors?

4) Whether these specific interventions were all effective?

5) What were the long-term effects of the interventions?

6) Whether these specific interventions had adverse effects?

2. Method

2.1 Protocol and registration

The initial design of this study comprised a systematic review and was registered with PROSPERO under the identifier CRD42022338338. However, owing to significant heterogeneity among the interventions and study designs included in the review, a scoping review design was deemed more appropriate. Thus, the method of this scoping review had some deviation from the initial PROSPERO registration. The reporting adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR) checklist and rationale (Tricco et al., 2018).

2.2 Search strategy

To develop the search keywords, a two-step process was followed. First, the search keywords were refined and specified, and a preliminary search in Web of Science was conducted to test previously determined key terms related to 'health professional students', and 'schizophrenia', and or 'stigma'. Second, the guidance of experienced library staff was sought to ensure the accuracy of the search keywords. Adjustments were made based on the suggestions provided by the library staff to avoid retrieving irrelevant results and to ensure that relevant studies were included. The search keywords were focused on the target population ('P'), concept ('C') and context ('C') framework. The target population was narrowed down to health students., Further, identified key words were subsequently included and relevant subject headings were identified (see Table 1 for the full Web of science search strategy). Language restrictions were not imposed, and the search period spanned from the inception of each database to the search date. The search was conducted from 1 May to 5 May 2023 and 22 May 2024. The details of the search strategies for other databases are provided in Appendix 1.

2.3 Inclusion criteria

2.3.1 Population

The population in this scoping review consisted of health professional students, without any restrictions based on age, sex, race, beliefs, type of course being studied, or country of origin.

2.3.2 Concept

Studies were considered for inclusion if the study aimed at reducing health professional students' stigma towards schizophrenia, irrespective of their underlying theoretical framework or cultural context.

2.3.3 Context

The review considered studies from different cultures focused on decreasing health professional students' schizophrenia stigma irrespective of the type of interventions used. Health professional students were defined as students enrolled in academic programmes such as fields encompassing nursing, medicine, social work, nutrition/dietetics, pharmaceutical sciences, dentistry, occupational therapy, and physiotherapy (Khan et al., 2016).

2.3.4 Types of publications

Peer-reviewed journal publications and published dissertations and theses in the English or Chinese language without date limiters and up until the final search date. Editorials, commentaries, discursive papers, and protocols were not included, but reviews were included.

2.3.5 Information sources

A thorough exploration of the literature was conducted across nine electronic databases, namely PubMed, Embase, CINAHL, PsycINFO, MEDLINE, Web of Science, Scopus,

China National Knowledge Infrastructure (CNKI), and WanFang. Additionally, a hand-search of reference lists of all included studies and grey literature were also performed to identify any additional articles that were not captured through database searches. The grey literature search involved reviewing the first 10 pages of Google and Google Scholar using specific keyword combinations. The search was not limited to specific intervention or control measures, and reviews were also manually searched for relevant studies.

2.4 Study selection

Two researchers (XC and XLL) independently conducted the search for studies and followed a six-step process to select the target studies. In Step 1, they searched for studies from the nine databases and Google Scholar, and collated the search results. The first 10 included publications were independently screened (according to the inclusion and exclusion criteria) by reviewers (XC & XLL), then discussed, how to achieve consistency and reliability in screening. The results from the review of the first 10 studies were discussed before continuing with the review. In Step 2, they examined the references of relevant scoping reviews and meta-analyses to identify additional studies. Step 3 involved removing duplicate studies by Endnote X 9. In Step 4, the researchers conducted a primary screening by reviewing the titles and abstracts of the studies. In Step 5, they conducted a secondary screening by reviewing the full texts of the selected studies. In Step 6, the two researchers cross-checked their screening results. In the event of any disagreement, a third researcher (SSW) was invited to resolve the disagreement.

The abstracts of studies that were not published in English or Chinese were excluded in the full-text screening phase.

2.5 Quality assessment of screened studies

Two reviewers (XC &XLL) independently evaluated the quality of the studies included in the review using the Cochrane collaboration tool (Higgins et al., 2011) for randomised controlled trials (ROB-2: Version 2 of the Cochrane risk-of-bias tool for randomized trials, 2011 updated version) and for quasi- randomised controlled trials, non-randomised controlled trials, and pre-post studies (ROBSIN-I: Risk of Bias in Non-randomised Studies - of Interventions, 2017 version). Each domain receives a classification of low, high, or uncertain risk of bias. In the event of any disagreements between the two researchers during the assessment, a third researcher was consulted to participate in a discussion to resolve the discrepancies.

2.6 Data extraction

Two reviewers (XC & XLL) independently extracted and recorded data into pre-determined forms, and any discrepancies were resolved either through discourse or by engaging a third researcher (SSW). The extracted data were compiled and entered into a statistical software program, NVivo for analysis. The data extraction table included the following categories:

1. General study information: first author, year, and country
2. Study type and sample size

3. Study participants

4. Contents of the intervention and control groups

5. Dosage of the intervention (number of sessions, duration of each session, duration of the intervention, and length of follow-up)

6. Outcome measurements

7. Main outcome results of the intervention group

8. Delivery of the intervention (who and how), approaches of the intervention (face to face or online), and theoretical framework

9. Effect size and quality assessment

By sorting the data into these categories, the researchers ensured that all relevant information was captured and organised for further analysis.

2.7 Data synthesis

Data synthesis and analysis were conducted by two reviewers (XC & XLL) after they reached consensus through discussion. Data synthesized from the individual sources resulted in some key observations: (a) General information for including studies; (b) Components of the intervention between the experimental and control groups （If have control groups); (c) Doses of intervention; (d) Assessment tools; (e) Primary outcome of the intervention; (f) Delivery of intervention (who and how), approaches of the intervention, theoretical framework and effect size; (g) The quality of included studies; (h) The long term follow up and the intervention efficacy of included studies; and (i) Adverse effects of interventions.

3. Result

3.1 Search results

The systematic literature search identified 4,117 references on 5 May 2023. Twenty studies were deemed eligible for inclusion. One more new study was included after performing an update search on 22 May 2024. Finally, 21 studies were included.

The specifics of the study screening procedure are depicted in Figure 1.

3.1.1 General information for including studies.

All 21 included studies were published from 2001 to 2023. Among them, five (24%) studies were from the United States, four (19%) studies were from Turkey, three (14%) studies were from Italy, two (10%) studies were from Australia, one (5%) study was from China, one (5%) study was from Germany, one (5%) study was from Brazil, one (5%) study was from Nigeria, one (5%) study was from Canada, one (5%) study was from Greece, and one (5%) study was from India. Eleven (52%) studies were pre-post studies, eight (38%) studies were non-randomised controlled trials, one (5%) study was a randomised controlled trial, and one (5%) study was a quasi-randomised controlled trial. The sample sizes of the pre-post studies ranged from 21 to 363, with a combined total of 1,587 participants; the sample sizes of the non-randomised controlled trials ranged from 34 to 228, with a combined total of 827 participants; and the sample sizes of the randomised controlled trial and the quasi-randomised controlled trial were 150 and 208, respectively. In terms of types of health professional student groups, ten

studies (48%) included medical students; three studies (14%) included nursing students; two studies (9.5%) included pharmacy students; two studies (9.5%) included psychology students; one study (4.8%) included social work students; two studies (9.5%) included medical and psychology students; and one study (4.8%) included psychology or nursing students.

3.1.2 Review of Interventions in decreasing schizophrenia stigma among health professional students

The majority of the studies under review employed a mix of education and interaction with individuals diagnosed with schizophrenia as their intervention approaches. The various intervention methods could be categorised under education, contact, combined education and contact, or other intervention. The educational components included theoretical lessons (Aslan & Batmaz, 2022; Danacı et al., 2016), lectures (Altindag et al., 2006; Aluh et al., 2022; Eack et al., 2012; Economou et al., 2012; Pulkit et al., 2023), watching a film (Altindag et al., 2006; Aluh et al., 2022; Aşık & Albayrak, 2022), educational courses on stigmatisation of schizophrenia (Asik & Albayrak, 2022; Magliano, 2022; Magliano et al., 2016; Sideras et al., 2015), role-playing (Aşık & Albayrak, 2022), reading and discussion (Aşık & Albayrak, 2022), drawing (Aşık & Albayrak, 2022), seminars (Coodin & Chisholm, 2001), focus group discussions (Dearing & Steadman, 2008), contact with individuals with schizophrenia including through psychiatry clerkships or internships (Aslan & Batmaz, 2022; Dearing & Steadman, 2008; Economou et al., 2012; Danacı et al., 2016), direct contact with

individuals with schizophrenia (Altindag et al., 2006; Eack et al., 2012; Danacı et al., 2016; Hsia et al., 2022), indirect contact with individuals with schizophrenia (Galletly & Burton, 2011; Giacobbe et al., 2013; Magliano, 2022), voice simulation exercises (Bunn & Terpstra, 2009; Galletly & Burton, 2011; Hsia et al., 2022; Sideras et al., 2015), augmented reality (Silva et al., 2017), and renaming of schizophrenia (Chiu et al., 2021).

3.1.3 Review of the comparator group Interventions in decreasing schizophrenia stigma among health professional students

Fifty-two percent (11/21) of the included studies were pre-post studies. For other studies, the participants in the comparator groups engaged in various activities, including attending lectures (Altindag et al., 2006; Aşık & Albayrak, 2022; Sideras et al., 2015), watching films (Altindag et al., 2006), clinical rotation (Coodin & Chisholm, 2001; Dearing & Steadman, 2008; Sideras et al., 2015), receiving the same intervention as the experimental group after being allocated to a waiting list (Magliano et al., 2016), engaging with peers without mental health problems (Giacobbe et al., 2013), and participating in an in-person educational intervention (Magliano, 2022).

3.1.4 Dosage of the intevention

Among the 21 included studies, the number of sessions (intervention dosage) ranged from one to 13, with an average of three. The duration of each intervention session ranged from three minutes to four weeks. The total durations of the interventions ranged from 90 mins to 13 weeks, with 7 studies not reporting the duration of the intervention,

and 57% (8/14) of the studies having intervention durations that were less than four weeks.

3.1.5 Outcome measurements

The outcome measurement tools used in the included studies were wide ranging and sometimes varied from those specified in the protocol registration record. The tools broadly assessed knowledge, beliefs, attitudes, and social distance. These included: i) Knowledge: Knowledge about Schizophrenia Questionnaire (Aslan & Batmaz, 2022; Eack & Newhill, 2008) and The Mental Health Knowledge Schedule (Sideras et al., 2015), ii) Beliefs: Beliefs toward Mental Illness Scale (Aslan & Batmaz, 2022), iii) Attitudes: Attitudes toward People with Mental Disorders Scale (Aslan & Batmaz, 2022), schizophrenia attitude questionnaires or scales (Aluh et al., 2022; Economou et al., 2012; Danacı et al., 2016; Pulkit et al., 2023), the Attitudes to Mental Illness Questionnaire (Galletly & Burton, 2011) and The Opinions on Mental Illness Questionnaire (Magliano, 2022; Magliano et al., 2012; Magliano et al., 2016), and iv) the social distance toward schizophrenia: Social Distance Scale (Aluh et al., 2022; Aşık & Albayrak, 2022; Chiu et al., 2022; Giacobbe et al., 2013). Other measurement tools for schizophrenia stigma included the Medical Condition Regard Scale (Dearing & Steadman, 2008), the Opening Minds Survey for Health Care Providers scale (Hsia et al., 2022), the Attribution Questionnaire (Chiu et al., 2022; Sideras et al., 2015), the Fear and Behavioural Intentions scale (Sideras et al., 2015), the Jefferson Scale of Empathy (Bunn & Terpstra, 2009; Sideras et al., 2015), a schizophrenia-related stigma evaluation (Silva et al., 2017), the Dangerousness Scale (Giacobbe et al., 2013), the

Affect Scale (Giacobbe et al., 2013), a questionnaire assessing preexisting subjective models of the aetiology of schizophrenia (Lincoln et al., 2008), the Implicit Association Test (a measure of implicit attitudes) (Lincoln et al., 2008), and the Perceived Psychiatric Stigma Scale (Chiu et al., 2022).

3.1.6 Intervention Efficacy

Fifty-two percent (11/21) of the studies reported a significant change of stigma after the intervention, indicating the interventions' effectiveness at reducing schizophrenia stigma. Additionally, 43% (9/21) of the studies reported a significant change in certain measurement items following the intervention. However, two studies (10%) found that the intervention was ineffective at reducing schizophrenia stigma. Furthermore, one study reported a decreased desire among participants to work with individuals with schizophrenia after the intervention (Eack et al., 2012). Only three studies reported the effect size of the intervention (Aşık & Albayrak, 2022; Aslan & Batmaz, 2022; Giacobbe et al., 2013), which ranged from small to large.

3.1.7 Intervention delivery, theoretical framework and cultural factors

Among the 21 included studies, the interventions were delivered by faculty members of psychiatry department (Aslan & Batmaz, 2022; Coodin & Chisholm, 2001; Economou et al., 2012) or other department faculty members (Eack et al., 2012; Magliano, 2022; Magliano et al., 2016; Magliano et al., 2014), an association called "The friends of schizophrenia" (Altindag et al., 2006), individuals with schizophrenia

(Hsia et al., 2022; Magliano, 2022; Magliano et al., 2014; Sideras et al., 2015), pharmacists (Aluh et al., 2022), the researchers themselves (Aşık & Albayrak, 2022; Sideras et al., 2015), electronic devices (Hsia et al., 2022; Magliano et al., 2016; Sideras et al., 2015; Silva et al., 2017), medical and psychology students (Magliano et al., 2016; Magliano et al., 2014), the participants themselves (Giacobbe et al., 2013), and leaflets (Lincoln et al., 2008). Sixty-seven percent (14/21) of the studies used face-to-face delivery, 29% (6/21) did not report the delivery process, and 5% (1/21) delivered the intervention online. However, none of the included studies provided a theoretical framework or included cultural factors to guide the construction of the intervention process.

3.1.8 The quality of included studies

The methodological quality of studies was assessed and categorised as low, moderate (some concern), or high. Among the studies, 81% (17/21) were assessed as having a serious or high risk and hence, a low quality. Whereas, 19% (4/21) were assessed as having a moderate risk and hence, a moderate quality. Further details regarding the characteristics of the included studies are outlined in Table 2 & 3.

3.1.9 Duration of follow-up

The length of follow-up after the interventions ranged from 4 weeks to 6 months, with 76% (16/21) of the studies not having a follow-up. All included studies reported a significant change after interventions at their follow-up assessment.

3.1.10 Adverse effects of interventions

Only one study (using simulated hallucinations) reported adverse effects (Dearing & Steadman, 2008). Some participants experienced stress, anxiety, anger, frustration, difficulty with mental focus, insecurity, vulnerability, devaluation, and a sense of being trapped. Physical distress such as weakness, sickness, exhaustion, tension, shakiness, increased heart rate and body temperature, and headaches were also reported. None of the other included studies reported any adverse events or other safety concerns.

4. Discussion

4.1 Interpretation of results

Most experimental studies included in this review utilised a combination of education and contact interventions. Various educational methods were employed to decrease stigma towards schizophrenia. A two-hour anti-stigma program, incorporating a lecture, contact with a youth with schizophrenia, and movie watching, had a minor effect on changing negative attitudes (Altindag et al., 2006). Another study showed that a combination of four hours of theoretical psychiatry lessons and a three-week internship increased knowledge, fostered positive attitudes, and reduced social distance (Danacı et al., 2016). Similarly, a three-hour workshop including contact with a young man with schizophrenia and simulated auditory hallucinations shifted attitudes from negative to positive (Galletly & Burton, 2011). However, lectures and movie watching alone

increased negative attitudes and social distance (Aluh et al., 2022). The contradictory research results suggest that even if the same intervention method is used, the content and cultural adaptability of the possible intervention need to be carefully considered (Yang, 2007).

In terms of intervention duration, more than four weeks rotation in psychiatry department can improve participants' knowledge, belief, and positive attitude towards schizophrenia (Aslan & Batmaz, 2022; Economou et al., 2012; Coodin & Chisholm, 2001). Longer interventions, such as a 13-week program involving role-playing, film-watching, and engaging in activities with individuals with schizophrenia could significantly reduce social distance (Aşık & Albayrak, 2022). Shorter interventions, like a 45-minute voice simulation experience, also improved positive attitudes (Dearing & Steadman, 2008). A one-hour didactic lecture showed that it was not enough to induce a change in the attitudes of 314 medical students towards people with schizophrenia (Pulik et al., 2023). It is crucial to involve personal contact with people with mental illness experiences to produce a proper change in attitude. Educational sessions incorporating personal experiences and scientific evidence (Magliano, 2022; Magliano et al., 2016; Magliano et al., 2014) were effective in increasing knowledge and reducing stereotypes. One online intervention yielded positive results (Magliano, 2022), suggesting its potential in overcoming distance barriers and reducing stigma economically. Different approaches yielded mixed results. Imagined contact (Giacobbe et al., 2013) and augmented reality (Silva et al., 2017) reduced fear and segregation but had varying effects on attitudes and social distance. Contact with individuals (Eack et

al., 2012) with schizophrenia during courses impacted attitudes, particularly the degree of contact, rather than frequency. The interventions including classroom education, innovative simulation learning, and a three-scenario illness simulation were found to decrease the participants' negative attitudes and increase their willing to interact with individuals with schizophrenia (Sideras et al., 2015).

However, interventions combining simulated hallucinations and direct contact (Hsia et al., 2022) reduced stigma and negative attitudes but not social distance. Psychoeducational interventions targeting aetiology (Lincoln et al., 2008) had differing impacts. Biogenetic explanations decreased blame and stereotypes but increased negative outlook on prognosis, while psychosocial cause interventions reduced stereotypes and social distance. Specific experiences, like simulated auditory hallucinations (Bunn & Terpstra, 2009; Galletly & Burton, 2011) and renaming schizophrenia (Chiu et al., 2021), increased empathy and decreased public stigma and social distance. Overall, diverse interventions have shown potential to shift attitudes toward schizophrenia, though their effectiveness varies depending on the approach and context.

Researchers should meticulously choose the appropriate approach for implementing education and contact interventions, considering factors like cost-effectiveness, participant acceptance, and minimizing dropout rates. This review highlights that a mixed method combining education and contact appears to be the most effective strategy for reducing schizophrenia stigma among healthcare students, consistent with previous research indicating the superiority of interventions combining contact and

education in reducing mental illness stigma (National Academies of Sciences, Engineering, and Medicine, 2016).

In this review, comparator groups (where included) received similar interventions to experimental arms, strengthening evidence on effective interventions for reducing schizophrenia stigma. However, studies varied in session number, duration, and total intervention length. Notably, 29% of studies employed single-session interventions, despite evidence suggesting their inefficacy (Wegman, 2016), urging exploration of intervention dosage in future research. Relationships between intervention efficacy and session duration, total intervention duration were unclear, warranting further investigation. Additionally, long-term efficacy remained uncertain due to short follow-up periods (<4 weeks) in most studies, emphasizing the need for attention to long-term outcomes in future research.

Among the 21 included studies, the majority (14) focused on interventions in developed nations, reflecting a gap in mental health research conducted in low- and middle-income countries (Collins et al., 2011). This gap is concerning given that schizophrenia is highly stigmatized (Valery & Prouteau, 2020), affects 24 million people worldwide (WHO, 2022) and has serious negative impacts on individuals' (Chen et al., 2022). There is no doubt that China, the most populous country (Guo et al., 2023), grapples with significant schizophrenia stigma (Li et al., 2017), yet few studies address this in mainland China.

Pre-post studies predominated in this scoping review, consistent with previous research on mental illness stigma reduction interventions (Dalky, 2012). This review included

only one randomised controlled trial. Given that randomised controlled trials provide the highest level of evidence for intervention studies (Burns et al., 2011), this highlights the importance of prioritizing such trials for future stigma reduction interventions targeting schizophrenia. Three studies in this review had limited sample sizes, raising concerns about their reliability. Medical students comprised 57% of the target population, while nursing students, who are crucial in caring for individuals with mental illness in future (WHO, 2019), represented only 19% of the target population. Past research indicates that nursing students often harbour negative attitudes toward schizophrenia (Chen et al., 2022), underscoring the need for more intervention studies aimed at reducing schizophrenia stigma among this group.

The reviewed studies presented several stigma reduction strategies, each involving specific contents and durations. These interventions encompassed educational (lecture, workshop, film-watching, classroom instruction, paper case study, biogenetic explanations), contact-based (psychiatry internship, psychiatry internship, role-playing, imagined, co-taught seminar to contact with individuals with schizophrenia), and combined education–contact approaches. These interventions' approaches were very similar to studies focused on decreasing mental illness broadly (Yan et al., 2022; Peter et al., 2021; Tóth et al., 2023; Kaur et al., 2021). Additionally, the review included specific interventions designed to target schizophrenia stigma reduction. For instance, strategies such as hallucination simulation (Galletly & Burton, 2011; Hsia et al., 2022), the utilisation of augmented reality and virtual reality technology to simulate schizophrenia symptoms (Silva et al., 2017), voice simulation (Bunn & Terpstra, 2009;

Dearing & Steadman, 2008), and the renaming of schizophrenia (Chiu et al., 2022) were incorporated. These interventions differ from past approaches to reducing mental illness stigma, indicating a need for future studies to target specific disorders like schizophrenia, depression, or bipolar disorder. While there were innovative interventions for schizophrenia stigma reduction, researchers have also reported adverse effects associated with these interventions. Future research aiming to reduce schizophrenia stigma among health professional students should consider these adverse effects and may explore adjustments such as shorter session durations and increased session frequency to potentially enhance intervention efficacy.

None of the included studies relied on theoretical guidance in developing their interventions, which may cause some lack of clarity, and also replicability regarding the effect of each individual component of the interventions and the mechanisms by which the interventions decrease schizophrenia stigma. In fact, developing implementation interventions necessitates a methodical approach, emphasizing the importance of a clear rationale for design and transparent documentation of the development process (Jarlais et al., 2004; Baker et al., 2008; Boutron et al., 2008). Employing theory is a viable strategy to guide the design of such interventions (Francis, 2006; Eccles et al., 2005). Some theories offer pathways for interventions targeting the stigma of mental illness in previous studies. For example, Yao (2021) applied Weiner's attribution theory to develop an intervention for schizophrenia stigma, focusing on the biogenetic approach to reduce negative attitudes. However, the results were inconclusive regarding its impact on social distance. Allport (1954) introduced

intergroup contact theory, which guided a UK intervention reducing schizophrenia stigma among university students, showing lower fear and anxiety mediated contact's effect on prejudice reduction. Gao & Ng (2021) found differing levels of contact can reduce stigma among college students in Hong Kong towards people with schizophrenia, highlighting the effectiveness of knowledge sessions and moderate to intimate intergroup contact.

Dual coding theory, proposed by Paivio (1986), suggests utilizing both visual and auditory channels for effective learning, while narrative paradigm theory (Fisher, 1987) emphasizes storytelling's role in constructing social reality and altering perceptions of mental illness. Piaget's theory (1972) underscores the importance of developmentally appropriate narratives in shaping attitudes towards mental disorders. Diffusion of innovations theory (Rogers, 1962) and the theory of planned behaviour advocate for change agents and media interventions respectively, to shift attitudes and subjective norms, thereby reducing mental illness stigma. These theories provide frameworks for intervention development, acknowledging the complexity of stigma reduction and highlighting the importance of multifaceted approaches in addressing societal perceptions of mental illness. Future studies aiming to reduce schizophrenia stigma among health professional students may draw from these theories and combine characteristic of schizophrenia to develop specific interventions.

All studies in this review utilized scales to evaluate intervention efficacy in reducing schizophrenia stigma. While most studies employed multiple scales with reported reliability and validity, some used untested self-designed questionnaires or items (Aluh

et al., 2022; Eack et al., 2012; Danacı et al., 2016), which had not been psychometrically tested, potentially introducing measurement bias. As stigma is abstract, researchers indirectly assessed intervention efficacy by measuring knowledge and attitudes towards schizophrenia. However, since stigma is manifested through discriminatory behaviour, a tool directly assessing intentional behaviour towards individuals with schizophrenia may be more direct and precise.

Most studies in this review found positive intervention efficacy, yet a study in Nigeria with 108 pharmacy students showed no significant change post-intervention (Aluh et al., 2022). This highlights the importance of considering intervention applicability beforehand. Despite mirroring intervention procedures from other studies (Altindag et al., 2006) the Nigerian study combined education and contact interventions but did not result in positive outcomes, possibly due to cultural factors. Cultural variations influence how stigma is perceived and managed (Yang, 2007).

Interventions in the studies involved close affiliates of schizophrenia, like psychiatrists and medical faculty, mostly in face-to-face settings. Very few (n=3, 14%) studies reported the effect size of the intervention. Despite some statistically significant changes, many interventions showed minimal impact, highlighting a need for modification. To enhance transparency and validity, researchers should disclose intervention effect sizes with 95% Confidence Intervals. Moreover, 81% of studies exhibited a high risk of bias, questioning the reliability of their findings. Future studies must prioritize reducing bias to ensure more confident estimates of intervention effects.

4.2 Implications for clinical practice and future research

Future studies should be conducted in low- and middle-income countries to address the scarcity of research on reducing schizophrenia stigma within resource-constrained contexts, while simultaneously prioritizing the development of randomized controlled trials to assess the effectiveness of interventions aimed at reducing schizophrenia stigma. Additionally, more intervention studies should focus on reducing schizophrenia stigma among nursing students due to their significant role in patient care, exploring tailored approaches for schizophrenia and considering potential adverse effects of simulations, and adapting appropriate interventions accordingly. Combining education and contact interventions appears to be the most effective strategy for reducing schizophrenia stigma among healthcare students, with careful consideration of content and cultural adaptability, alongside the exploration of optimal dosage, duration, and long-term efficacy of interventions and the use of reliable measurement tools to assess intervention outcomes accurately. Cultural factors should be considered when designing and implementing interventions to ensure effectiveness across diverse contexts, including the comparison of online interventions to in-person interventions to overcome barriers associated with face-to-face delivery. Lastly, future research should prioritize reducing bias and ensuring high methodological quality to enhance the reliability of findings, reporting effect sizes, long-term efficacy and improving study design and implementation to enhance the quality of intervention research.

4.3 Limitations

There are several limitations to this scoping review. Firstly, it only encompassed publications in English. Despite attempts to include Chinese studies on reducing schizophrenia stigma among health professional students, none were found, which indicated research in decreasing schizophrenia stigma among Chinese health professional students is needed. Secondly, only quantitative studies were included, overlooking potential qualitative studies that may have developed interventions for reducing schizophrenia stigma. Qualitative studies could be explored in the future. Thirdly, the review focused solely on interventions targeting schizophrenia stigma among health professional students. Consequently, the generalizability of the research findings to all healthcare professionals and to other patient groups may be limited. However, given that schizophrenia is one of the most stigmatized mental illnesses, the results of this scoping review can still offer insights for developing interventions to reduce stigma associated with other mental disorders. Fourthly, because the included studies either did not report or rarely reported certain essential intervention-related factors, the review was unable to discuss several important aspects potentially linked to intervention efficacy. For instance, the theoretical basis of intervention development, intervention effect size, long-term efficacy, and cultural factors pertaining to intervention forms were not addressed. Lastly, the included studies in this review exhibited considerable heterogeneity which presents challenges synthesizing and analysing their findings.

5. Conclusions

This scoping review indicated that while some studies had been conducted to reduce schizophrenia stigma, they were mainly conducted in developed countries, with innovative methods showing both advantages and drawbacks. However, most of the included studies had a high risk of bias. Education and contact were the most common intervention approaches, albeit with varying effectiveness. Long-term efficacy assessment was overlooked, and interventions often lacked theoretical basis and cultural considerations. Future studies should address these limitations to develop more effective interventions to reduce schizophrenia stigma.

Author contributions

CX initiated the idea to conduct the scoping review and drafted the manuscript. LSF, DTB and LY provided advice and supervision on the scoping review and contributed towards writing the original draft manuscript and editing revised versions. WSS and LXL provided assistance in the process of the scoping review. All authors read and approved the final manuscript.

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Conflict of interest

The authors declare that they have no conflicts of interest.

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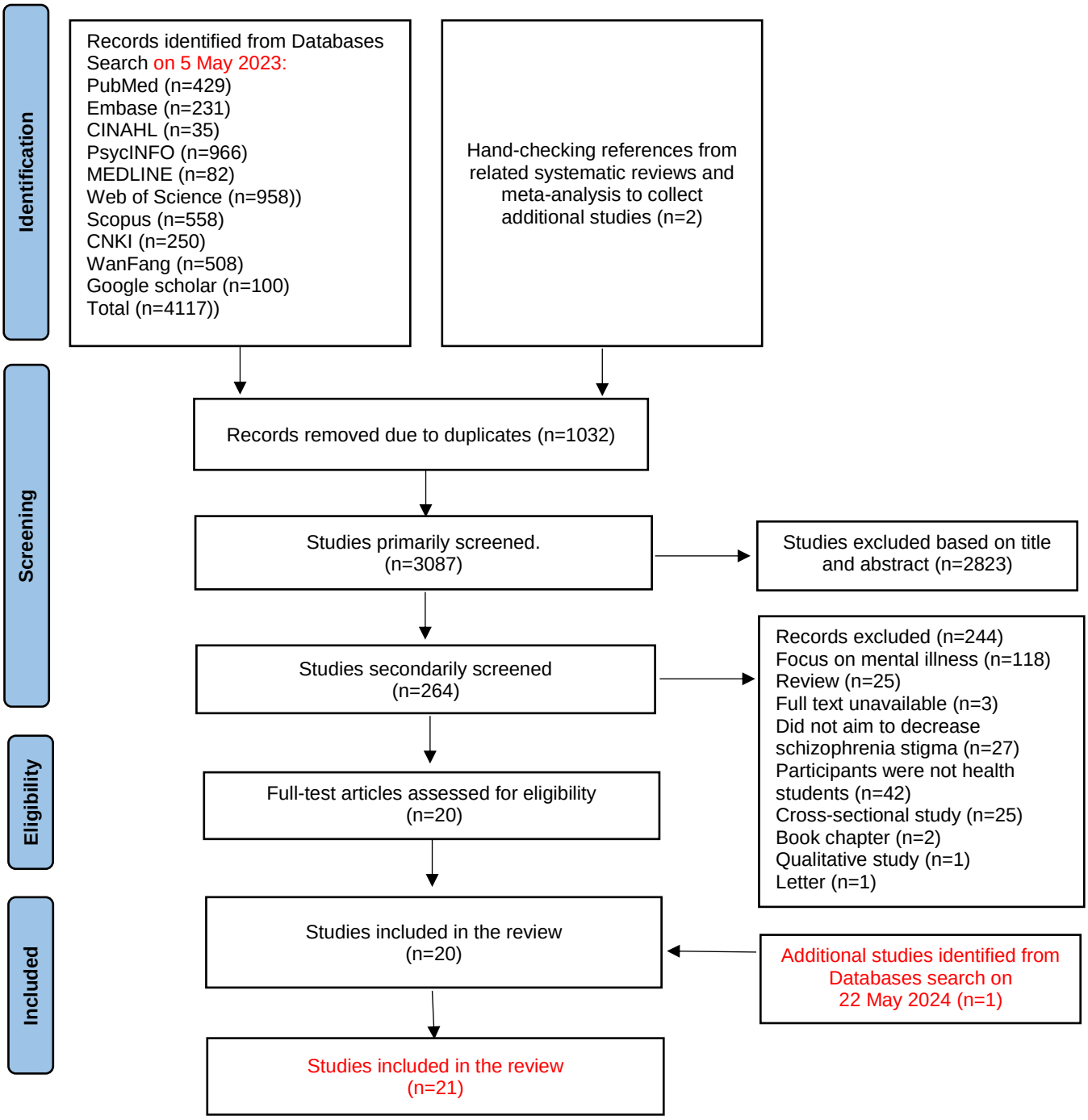

Figure 1: Schematic diagram of the screening process

Table 1 An example of the full search process of Web of Science

Database	Search strategy	Results
Web of Science	(Health student [All fields]) AND (Schizophren* [All fields]) AND ((“Stigma*” OR “discriminat*” OR “attitude*” OR “behav*” OR “social distance*” OR “knowledge” OR “belief*” OR “stereotyp*” OR “bias*” OR “prejudice*”) [All fields])	958

Table 2 Characteristics of the included studies

First author, year (country)	Study type	Sample size (intervention/ controls) at (invitation/ start/ completion)	Participant characteristics	Contents of the intervention group	Contents of the control group	Dosage of the intervention (no. of sessions, duration of each session, duration of the intervention, length of follow-up)	Delivery of the intervention (who and how)/ approaches of the intervention/ theoretical framework	Effect size	Quality assessment
Abdurrahman Altindag 2006 (Turkey)	Non-randomised controlled trial	77 (32/45) 60 (25/35) 60 (25/35)	Medical students	A 2-hour lecture explaining the reasons for schizophrenia stigma and common myths. Relationships of violence, aggressiveness, and independence with schizophrenia A young man with schizophrenia introduced schizophrenia-related information, treatments, and stigma experience. Viewing a film, *A Beautiful Mind*, which tells the life story of John Forbes Nash Jr, a genius mathematician suffering from schizophrenia, who eventually won a Nobel Prize	1. A 2-h lecture about water metabolism 2. Watching a film, *Winged Migration*, about birds and migratory patterns	2; 2 hours, NI; 1 day; 1 month	Intervention was delivered by an association called 'The Friends of Schizophrenia', a young man with schizophrenia, and the authors. Face-to-face NI	NI	Low

Ayşen Esen Danaci 2016 (Turkey)	Pre-post study	NI 106 106	Medical students	One hour of theoretical lessons in the students' 3rd year. Three hours of theoretical lessons during their 3-week psychiatry internship in their 5th year Watching the documentary *We, You, They* Attending interviews held with patients with schizophrenia in inpatient and outpatient clinics	NI	4; 1 hour, 3 hours, NI, NI; NI, 3 weeks, NI, NI; NI	Unclear how the intervention was delivered Face-to-face NI	NI	Moderate
Cherrie Galletly 2011 (Australia)	Pre-post study	NI 87 NI	Medical students	A 3-h workshop that included both a contact component (a DVD about a young man with schizophrenia) and an experience of simulated auditory hallucinations	NI	4; 40 min, 10 min, 45 min, NI; 3 hours; NI	Intervention was delivered via a DVD, television, and an MP3 player NI NI	NI	Low
Deborah Oyine Aluh 2022 (Nigeria)	Pre-post study	200 179 108	Pharmacy students	Attending a clinical lecture on schizophrenia and watching the film *A Beautiful Mind*	NI	3; 5 hours, 5 hours, 5 hours; 1 week; 4 weeks	Intervention was delivered by two pharmacists Face-to-face NI	NI	Low
Elif Aşık 2022 (Turkey)	Non-randomised controlled trial	172 50(25/25) 48(25/23)	Nursing students	The program titled The Education Program on Stigmatization in Schizophrenia was conducted with the students in the intervention groups once a week for a total of 13 weeks. During the education sessions, role-playing, film-watching, reading and discussion, drawing, and participating in activities with individuals diagnosed with schizophrenia were some of the techniques used to detect and determine	Mental health and psychiatric nursing courses	13, 90 min, 13 weeks NI	Intervention was delivered by one of the researchers Face-to-face NI	-η^2: 0.095	Moderate

				stigmatizing thoughts, emotions, and behaviour. Mental health and psychiatric nursing courses.					
Esma, Akpinar, Aslan 2022 (Turkey)	Pre-post study	NI 158 158	Medical students	A psychiatry clerkship lasting for 3 weeks with formal theoretical lessons based on psychopathology, psychiatric assessment and treatment options, and practical applications in outpatient and inpatient clinics A psychiatry internship lasting for 4 weeks, during which the students engaged directly with the routine care of psychiatric patients	NI	1; 3 or 4 weeks; 3 or 4 weeks; NI	-KASQ: 0.67 -BMI: 0.20 -APMDS: 0.22	-KASQ: 0.67 -BMI: 0.20 -APMDS: 0.22	Low
Karen S. Dearing 2008 (USA)	Non-randomised controlled trial	116 98 (NI/NI) 94 (52/42)	Nursing students	Visits to a clinical site and completing the forms necessary for the agency A voice simulation exercise Focus groups to discuss the orientation process.	Visits to a clinical site and completing the forms necessary for the agency	3; NI, 45 min, NI; NI, NI, NI; NI	Intervention was delivered via a voice audiotape NI NI	NI	Low
Lorenza Magliano 2014 (Italy)	Pre-post study	222 211 35	Medical and psychology students	An educational intervention entitled 'Social dangerousness and incurability of schizophrenia: from prejudice to scientific evidence'	NA	2; 3 hours, 3 hours; 3 weeks; 6 months	Intervention was delivered by medical and psychology students, a teacher, and four people	NI	Low

							recovering from mental illness Face-to-face NI		
Lorenza Magliano 2016 (Italy)	quasi-randomised controlled trial	208 (104/104) 208 (86/122) 188(76/112)	Psychology students	Educational intervention, entitled two sessions. The first session addressed stigma and its impact on persons with mental illness, while the second session provided scientific evidence contrasting stereotypes and prejudices toward stigmatized groups	receive the same intervention one month later	2 3 hours, 3 hours 3 weeks, 1 month,	Intervention was delivered by medical and psychology students, a teacher, and video testimonies Face-to-face NI	NI	Low
Lorenza Magliano 2022 (Italy)	Non-randomised controlled trial	284 (198/86) 228 (142/86) 141 (65/76)	Psychology students	At-distance educational intervention: The first session covered the following topics: a) definitions of stigma; b–c) research studies and personal stories of stigma and its effects; d) stigma and the media; e) stigma and mental health problems; f) stigma against persons with mental disorders in health contexts; g) stigma in schizophrenia. The second session focused on a–c) scientific evidence for the dangerousness in 'at-risk' minority social groups, persons with mental disorders, and particularly schizophrenia; d) subjective and objective dimensions of recovery; e) evidence for recovery in schizophrenia; and f) empowerment-oriented mental health services.	-In-Presence Educational Intervention.	2; 3 hours, 3 hours; 3 weeks; 1 month	Intervention was delivered by people recovering from mental illness and psychiatry teaching staff Online NI	NI	Low

				Scientific reports, media articles, and video materials from anti-stigma campaigns were used in both sessions. In addition, four people who had recovered from or experienced stigma related to their mental health problems provided audio testimonies of their personal stories.					
Marina Economou 2012 (Greece)	Pre-post study	160 158 155	Medical students	Conducted after psychiatric placements In the first 2 weeks, emphasis was placed on lectures covering the main psychiatric disorders, their clinical manifestations, and modes of treatment. In the last 2 weeks, students assumed partial responsibility for some clinical cases under the supervision of psychiatric residents and psychiatrists.	NA	2; 2 weeks, 2 weeks; 4 weeks; NI	Intervention was delivered by psychiatric residents and psychiatrists Face-to-face NI	NI	Moderate
Michael R. Giacobbe 2013 (Australia)	Non-randomised controlled trial	NA 97 (NI/NI) NI	Psychology or nursing students	Participants had a face-to-face meeting with a confederate who had been diagnosed with schizophrenia. Participants imagined having an interaction with a similarly aged person who did not mention mental illness.	Participants had a face-to-face meeting with a confederate without a mental illness. Participants imagined having an interaction with a person with	2; 15 min, 15 min; NI; NI	Intervention was delivered by people with schizophrenia or the participants themselves Face-to-face and imagined NI	Intervention group: dangerousness: d = 0.98, affect: d = 0.60, distancing: d = 0.97; imagined contact group: dangerous	Low

					schizophrenia.			ness: d = 0.51, affect: d = 0.42, distancing: d = 0.30	
Pandey Pulkit 2023 (India)	Pre-post study	363 314	Medical students	One-hour didactic lecture	NI	1; 1 hour; 1 hour; NI	Intervention was delivered by the lecturer simulated an interview between a psychiatrist, schizophrenic patient and his family members. Face-to-face NI	NI	Low
Rafael D. de C. Silva 2017 (Brazil)	Pre-post study	NI 21 NI	Medical students	Participation in the use of a newly proposed tool based on augmented reality The tool can simulate the psychotic symptoms typical of schizophrenia by simulating changes in sensory perception to create an immersive experience capable of recreating the pathological experiences of a patient with schizophrenia. Integration into the proposed environment occurs through immersion glasses and an embedded camera. Audio and visual effects can	NA	1; 3 min; NI; NI	Intervention was delivered via virtual reality NI NI	NI	Low

				also be applied in real time.					
Shalom Coodin 2001 (Canada)	Non-randomised controlled trial	NI 34 (24/10) 34 (24/10)	Medical students	A 90-minute seminar on schizophrenia and recovery Clinical rotation	Rotation	2; 90 min, 7 weeks; 90 min, 7 weeks; NI	Intervention was delivered by an invited person with schizophrenia and the authors Face-to-face NI	NI	Low
Shaun M. Eack 2012 (USA)	Pre-post study	NI 60 NI	Social work students	'Social Work Practice with Severe Mental Illness' course An introduction to the knowledge, values, and skills employed in clinical social work practice with clients with severe and persistent mental illness and their families Participants worked with clients with schizophrenia or other severe mental illnesses.	NA	1 NI A semester NI	Intervention was delivered by faculty members Face-to-face NI	NI	Low
Stephanie Sideras 2015 (USA)	Non-randomised controlled trial	NI NI 145 (80/65)	Nursing Students	Classroom education and practicum experiences along with an innovative simulation learning activity	Traditional classroom education along with practicum experiences	3; 4 hours, 2 hours, NI; 3 months NI	Intervention was delivered via a headset, by an individual experiencing his first psychotic break, by the investigator, and by colleagues Face-to-face	NI	Low

							NI		
Stephanie L. Hsia 2022 (USA)	Pre-post study	NI 346 232	Pharmacy students	A hallucination simulation and a presentation by a speaker diagnosed with schizophrenia	NI	2; 45 min, 1 h; 2 weeks; NI	Intervention was delivered via an audio file and by a speaker with schizophrenia Face-to-face NI	NI	Low
Tania M. Lincoln 2008 (Germany)	Non-randomised controlled trial	121 (41/40/39) 115 (38/38/39) NI	Medical and psychology students	Three experimental groups: -Biogenetic explanations of schizophrenia Highlighting the trauma, stressful life events, and cognitive styles of schizophrenia No intervention	NI	2; Group 1: NI, NI Group 2: NI, NI Group 3: NI, NI; NI; NI	Intervention was delivered via a leaflet and video. NI NI	NI	Low
William Bunn 2009 (USA)	Randomised controlled trial	NI 150 (100/50) NI	Medical students	40-min voice simulation while completing tasks Neurocognitive testing	Neurocognitive testing	1; 40 min; 6 weeks; NI	Intervention was delivered via headphones. NI NI	NI	Low
Yi-Hang Chiu 2021 (China)	Pre-post study	180 125 123	Medical students	Renaming of schizophrenia	NI	1; NI; NI; NI	Intervention was delivered by the Taiwanese Society of Psychiatry NI NI	NI	Moderate

Note: NI: No information

Table 3 Continue Characteristics of the included studies

First author, year (country)	Outcome measurements	The main outcome results in the intervention group			
		Knowledge (Significantly increased)	Attitude (Significantly decreased negative attitude)	Behaviour (Social Distance) (Significantly decreased social distance)	Others/Stigma
Abdurrahman Altindag 2006 (Turkey)	A 32 items questionnaire	The correct rate of the item 'Schizophrenia is not a disease but a condition that everyone may experience at some time' had a significant increase after the intervention at Time point 1 and Time point 2.	The disagree rate of the items 'Persons with schizophrenia cannot recover completely' and 'Drugs used in the treatment of schizophrenia may cause serious side-effects' had a significant decrease after the intervention at Time point 1. The agreed rate of the items 'Schizophrenia can be cured with drugs' and 'Drugs used in the treatment of schizophrenia may cause dependency' had a significant increase after the intervention at Time point 1 and Time point 2.	The agreed rate of the items 'I can work with a person with schizophrenia' and 'Having a neighbor with schizophrenia does not irritate me' had a significant increase after the intervention at Time point 1. The disagreed rate of the item 'Persons with schizophrenia are aggressive' had a significant increase after the intervention at Time point 1 and Time point 2.	
Ayşen Esen Danaci 2016 (Turkey)	The 32-item schizophrenia section Questionnaire	The items 'Schizophrenia is an extreme sadness state' and 'Schizophrenia is a mental weakness' had a significant change. Fewer people hold these opinions after the intervention, which indicates that people's knowledge of schizophrenia increases.	'Mr. Ahmet's situation resulted from the weakness of his personality structure.' 'Mr. Ahmet's situation resulted from his social problems.' 'Schizophrenia is a congenital disease.' 'Changes in the environment (like going on vacation) have made major contributions to the treatment of schizophrenia.' 'Schizophrenia doesn't completely resolve.' 'Schizophrenia is a disease that can be treated by medication.' 'Schizophrenia can be treated with psychotherapy.' 'Medications used in the treatment of schizophrenia can be addictive.' 'Medications used in the treatment of schizophrenia have severe side effects.' These above items showed significant change after the intervention which indicated that participants' negative attitudes decreased after the intervention.	'Patients with schizophrenia should not roam freely in public.' 'I can work with a schizophrenia patient.' 'I can marry a schizophrenia patient.' 'My schizophrenic neighbor doesn't bother me.' 'If I have a house, I don't rent it to the schizophrenia patient.' 'Schizophrenia patients become aggressive.' 'Schizophrenia patients cannot make the right decisions about their own lives.' These above items showed significant change after the intervention which indicated that participants' social distance towards people with schizophrenia decreased after the intervention.	The correct rate of item relating to remedy-seeking behavior: 'Which of the following should Mr. Ahmet do primarily to get rid of this situation?' had a significant increase after the intervention. This may indicate the stigma towards people with schizophrenia has decreased.
Cherrie Galletly 2011 (Australia)	The 5-item Attitudes to Mental Illness Questionnaire		A significant improvement in the students' positive attitudes toward people with schizophrenia after the intervention.		

Deborah Oyine Aluh 2022 (Nigeria)	A 10-item attitude scale A 7-item social distance scale		'People with Schizophrenia tend to be mentally retarded or of lower intelligence' 'People with Schizophrenia can be successfully treated without drugs using psychotherapy' 'People with Schizophrenia can work at regular jobs' 'People with Schizophrenia can be creative' These above items showed significantly increased negative attitudes after the intervention.	'I would fall in love with a person with Schizophrenia'. This item showed significantly increased social distance after the intervention. This outcome may indicate the intervention has an adverse effect in decreasing participants' social distance toward people with schizophrenia.	
Elif Aşık 2022 (Turkey)	Social Distance Scale (SDS)			The changes over time in mean social distance scale scores and in the group × time interaction of the intervention group was statistically significantly decreased compared with the control group after the intervention.	
Esma, Akpinar, Aslan 2022 (Turkey)	Knowledge about Schizophrenia Questionnaire (KASQ) Beliefs Toward Mental Illness Scale (BMI) Attitudes Toward People with Mental Disorders Scale (APMDS)	The Knowledge about Schizophrenia Questionnaire total scores were significantly higher after the intervention, which implies that schizophrenia knowledge significantly increased.	The Attitudes Toward People with Mental Disorders Scale total scores were significantly higher after the intervention which implies the negative attitude decrease. The Beliefs Toward Mental Illness Scale - Factor 2 (subscales of Beliefs Toward Mental Illness Scale) and Beliefs Toward Mental Illness Scale scores were significantly lower after the intervention, implying the negative attitude decrease.		
Karen S. Dearing 2008 (USA)	The 11-item Medical Condition Regard Scale (MCRS)		'Satisfying to work with these patients,' 'Insurance plan should cover patients like this,' 'There is little I can do to help patients like this,' 'I feel especially compassionate toward patients like this,' 'I wouldn't mind getting up nights to care for patients like this,' and 'I enjoy giving extra time to patients like this' were larger for the experimental. 'There is little I can do to help patients like this' and 'Treatment for these patients is a waste of		

			money,' were significantly different from those of the control group. These above items showed significantly decreased negative attitudes after the intervention.		
Lorenza Magliano 2014 (Italy)	The Opinions on Mental Illness Questionnaire (OQ) Nine further items added to the OQ	Knowledge of causal explanations of schizophrenia significantly increased after intervention, including: 'psychological traumas', 'stress', 'family conflict', 'disillusionment in love', and 'frequenting bad company'. Knowledge of recovery, unpredictability, dangerousness to others, drug treatments in schizophrenia, and easy of recognize towards people with schizophrenia significantly increased after the intervention.			
Lorenza Magliano 2016 (Italy)	The Opinions on Mental Illness Questionnaire	Knowledge of causal explanations of schizophrenia significantly increased after intervention, including: 'stress', and 'disillusionment in love'. Knowledge of 'recovery of schizophrenia', 'drug treatments in schizophrenia', and 'psychological treatments are useful in schizophrenia' significantly increased after the intervention.			
Lorenza Magliano 2022 (Italy)	The Opinions on Mental Illness Questionnaire (OQ)—Revised Version A further 5 items were added to examine respondents' views	Knowledge of causal explanations of schizophrenia significantly increased after intervention, including 'the possibility to recover', 'usefulness of psychological therapies', 'need of long-term drug therapies', 'insight of people with schizophrenia', 'perception of dangerousness' 'treatments of people with schizophrenia in non-psychiatric hospital wards', 'reliability of people with schizophrenia in reporting their health condition to medical doctors', 'difficulties of people with schizophrenia in having romantic relationships', 'reliability of people with schizophrenia in reporting their health condition to psychologists', 'treatments of people with schizophrenia in		Perception of social distance from people with schizophrenia had significantly decreased after intervention. Perception of social distance from people with schizophrenia had significantly decreased after intervention within the subject factor: baseline and one-month reassessment.	

		psychologist office'. Psychology students' views of schizophrenia: paired comparisons of baseline versus 1-month reassessment in the (At-Distance Educational Intervention) vs. (In-Presence Educational Intervention) groups:1. Within-subject factors: at baseline and 1-month reassessment: 'Possibility to recover', 'Usefulness of drug therapies', 'Usefulness of psychological therapies', 'Need of long-term drug therapies', 'Insight of PWS', 'Perception of dangerousness', 'Treatments of PWS in nonpsychiatric hospital wards', 'Reliability of PWS in reporting their health condition to medical doctors', 'Difficulties of the person with schizophrenia in having romantic relationships'. These above items showed a significant increase in schizophrenia knowledge. Psychology students' views of schizophrenia: Between-subject factor: between intervention and control groups: 'Possibility to recover', 'Insight of person with schizophrenia', 'Perception of dangerousness', 'Treatments of the person with schizophrenia in nonpsychiatric hospital wards', 'Reliability of person with schizophrenia in reporting their health condition to medical doctors'. These above items showed a significant increase in schizophrenia knowledge. Psychology students' views of schizophrenia: interaction effects: Baseline and one-month reassessment x education type: 'Possibility to recover', 'Perception of dangerousness', 'Treatments of PWS in nonpsychiatric hospital wards', 'Reliability of person with schizophrenia in reporting their health condition to medical doctors'. These above items showed a significant increase in schizophrenia knowledge.		Perception of social distance from people with schizophrenia had significantly decreased after intervention in the interaction effects: Baseline and one-month reassessment x education type.	
Marina Economou 2012 (Greece)	Selected questions from the Alberta Pilot Site Questionnaire Tool Kit: the first section, which refers to beliefs and attitudes and encompasses 17 items; and the social distance section, which		The Medical students' beliefs and attitudes to people with schizophrenia scale before and after intervention show that items: 'people with schizophrenia can recover', 'Schizophrenia is not a contagious disease', 'people with schizophrenia are lazy and irresponsible', 'people with schizophrenia have insight into their condition and are capable of reporting accurately the outcome of their treatment', 'people with schizophrenia can make reasonable decisions concerning their lives', 'people with schizophrenia are unpredictable',	Medical students' social distance from people with schizophrenia before and after intervention show that the item: ' Would you decide to live in a house building, where a person with schizophrenia also resides?' had a significant change after the intervention, implying that the social distance towards people with schizophrenia decreased.	

	incorporates a corresponding scale with 14 items.		'people with schizophrenia get worse as time passes by', 'Schizophrenia is the result of poor parenting', 'people with schizophrenia suffer from split or multiple personalities', 'people with schizophrenia can work in regular jobs', and 'people with schizophrenia are dangerous to the public because of violent behavior' had a significant change after the intervention, implying that the negative attitude towards people with schizophrenia decreased.		
Michael R. Giacobbe 2013 (Australia)	Dangerousness Scale Affect Scale Social Distance Scale		The main effect of time was significant. All participants reported that they would experience less negative emotion when interacting with a person diagnosed with schizophrenia after participating in the study. This may indicate negative attitudes toward schizophrenia decrease.	People who interacted (or imagined interacting) with a person with schizophrenia significantly decreased their expected likelihood of distancing.	Dangerousness beliefs were lower in the face-to-face condition (intervention) at both time points than in the imagined condition (control). There was a significant time × contact person interaction for the dangerousness scale. A paired-samples t test indicated that people who interacted (or imagined interacting) with an individual with schizophrenia significantly decreased their beliefs about the dangerousness of people with a mental illness.
Pandey Pulkit 2023 (India)	A self-report questionnaire of attitudes towards schizophrenia		The item "Feel ashamed if people knew someone in your family was diagnosed with schizophrenia?" had a significant change after the intervention, which indicated a more positive attitude of medical students towards people with schizophrenia after the intervention.		
Rafael D. de C. Silva 2017 (Brazil)	Schizophrenia-related stigma evaluation based on three questionnaires:				The results demonstrated an increase in the mean stigma score, with statistical significance for pity, fear, and

	evaluation of schizophrenia-related stigma, evaluation of environmental simulation, and evaluation of stigma after an augmented-reality simulation。				segregation. An increase was found in the average score for the probability of giving help.
Shalom Coodin 2001 (Canada)	The 14-item Attitude Toward Persons with Schizophrenia Scale		Two items, 'I can tell soon after meeting someone if they have schizophrenia' and 'People with schizophrenia rarely if ever truly recover', had significant changes after the intervention. These may indicate negative attitudes toward schizophrenia decrease after intervention.		
Shaun M. Eack 2012 (USA)	-Knowledge about Schizophrenia Questionnaire with 19 items A 13-item self-report questionnaire on attitudes towards individuals with schizophrenia A 9-item social distance measure	Students' knowledge of schizophrenia significantly increased after the intervention.	Students' negative general attitudes towards individuals with schizophrenia had a significant decrease after the intervention.	Those with a BSW (Bachelor of Social Work) degree showed an improved desire to work with people with schizophrenia. Those without a BSW degree expressed a decreased desire to work with individuals with schizophrenia.	
Stephanie Sideras 2015 (USA)	The Mental Health Knowledge Schedule, the 20-item Attribution Questionnaire, the Fear and Behavioral Intentions scale, and the Jefferson Scale of Empathy		Negative attitudes towards individuals with schizophrenia were reduced in the intervention group compared with the control group.		
Stephanie L. Hsia 2022 (USA)	The 20-item Opening Minds Survey for Health Care Providers (OMS-HC) scale. Likert-scale items asking students to		For both the 2018 and 2019 cohorts, the negative attitudes towards schizophrenia significantly decreased after the intervention.	A significant decrease in the social distance subscale was observed for the 2019 cohort. Disclosure/help-seeking subscales significantly changed after the intervention. This may also indicate that the intervention significantly decreases	For both the 2018 and 2019 cohorts, the total Opening Minds Survey for Health Care Providers score declined significantly. These may indicate that the intervention decreases

	indicate whether their perception of people with psychosis changed			the social distance towards people with schizophrenia.	stigma toward schizophrenia.
Tania M. Lincoln 2008 (Germany)	A questionnaire assessing preexisting subjective models of the aetiology of schizophrenia Explicit Attitudes and Social Distance Implicit Association Test (to measure implicit attitudes)		In the group of psychology and medical students, the score differed significantly from zero for dangerousness and responsibility. These may indicate the intervention decreases the negative attitude towards people with schizophrenia.	Psychology students revealed more desire for social distance than medical students after the intervention. There was a significant reduction in stereotyping about responsibility in the biogenetic causal attributions intervention compared with the psychosocial and no intervention interventions and a significant increase in the stereotype of poor prognosis for the biogenetic causal attributions intervention compared with psychosocial and no intervention. Significant reductions in stereotyping after the biogenetic causal attributions intervention occurred about unpredictability/incompetence, responsibility, and social distance, but the biogenetic causal attributions intervention produced an increase in the stereotype of poor prognosis. The psychosocial condition led to a decrease in the stereotype of dangerousness and a decrease in social distance.	
William Bunn 2009 (USA)	Jefferson Scale of Physician Empathy, Student Version				The students' empathy scores increased significantly after the intervention which may indicate that students' stigma towards schizophrenia decreased..
Yi-Hang Chiu 2021 (China)	A self-administered questionnaire that comprised four sections that each inquired into basic information, public stigma, self-stigma, and social distance			The total score of social distance significantly decreased after the intervention.	Public and self-stigma and all sub-self-stigma components significantly decreased after the intervention. First-year medical students' stigma significantly decreased after the intervention, except for the public stigma.

					Fourth-year medical students' stigma significantly decreased after the intervention, except for the self-deprecation component of the self-stigma.

Declaration of interests

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

☐The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:
