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REVIEW ARTICLE

Common mental health problems in medical students and junior doctors – an overview of systematic reviews

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ABSTRACT

Background: Common mental health problems (CMHP) are prevalent among junior doctors and medical students, and the COVID-19 pandemic has brought challenging situations with education disruptions, early graduations, and front-line work. CMHPs can have detrimental consequences on clinical safety and healthcare colleagues; thus, it is vital to assess the overall prevalence and available interventions to provide institutional-level support.

Aims: This overview summarises the prevalence of CMHPs from existing published systematic reviews and informs public health prevention and early intervention practice.

Methods: Four electronic databases were searched from 2012 to identify systematic reviews on the prevalence of CMHPs and/or interventions to tackle them.

Results: Thirty-six reviews were included: 25 assessing prevalence and 11 assessing interventions. Across systematic reviews, the prevalence of anxiety ranged from 7.04 to 88.30%, burnout from 7.0 to 86.0%, depression from 11.0 to 66.5%, stress from 29.6 to 49.9%, suicidal ideation from 3.0 to 53.9% and one obsessive-compulsive disorder review reported a prevalence of 3.8%. Mindfulness-based interventions were included in all reviews, with mixed findings for each CMHP.

Conclusions: The prevalence of CMHPs is high among junior doctors and medical students, with anxiety remaining relatively stable and depression slightly increasing during the COVID-19 pandemic. Future research on mindfulness-based interventions is required for a resilient and healthy future workforce.

PRISMA/PROSPERO: the researchers have followed PRISMA guidance. This overview was not registered with PROSPERO as it was conducted as part of an MSc research project.

Introduction

Medical careers are renowned for their demanding nature and challenging environments (Sekhar et al., 2021). Due to laborious working conditions and exposure to occupational hazards (e.g. occupational infections and radiation exposure) (Naithani et al., 2021), all healthcare professionals are susceptible to illness (Søvold et al., 2021). Mental difficulties are a growing public health concern (Jacob et al., 2020), and evidence suggests that the prevalence may be higher among healthcare professionals (Weibelzahl et al., 2021). Junior doctors and medical students are recognised for experiencing stressors during their rigorous training programmes; and, consequently, increased strain on their mental health (Sekhar et al., 2021). This risk is further compounded by lengthy work/study times and an increased financial burden (Tam et al., 2019), along with an increased likelihood of possessing personality characteristics like maladaptive perfectionism (Prabhu & Rashad, 2021).

Common mental health problems are characterised by changes to behaviour and emotional control; they are typically linked to functional impairment, and the most prevalent are anxiety disorders, depression, and obsessive-compulsive disorder (NICE, 2022a). Common mental health problems can have detrimental effects on working ability and performance (Khan et al., 2006). A 2016 systematic review and meta-analysis estimated the prevalence of depression in medical students to be 27.2% and 11.1% for suicidal ideation (Rotenstein et al., 2016). A further systematic review found a higher prevalence of depression and anxiety among medical students during the COVID-19 pandemic than that of the general population (37.9% and 33.7% vs 24.2% and 21.3%) (Castaldelli-Maia et al., 2021; Jia et al., 2022). According to the NHS sickness absence rates from January 2022, anxiety/stress/depression/other psychiatric illnesses are the most frequently represented sickness absence reasons among all NHS workers (19.9%) (Statistics – NHS Digital, 2022), which, correspondingly, increases the pressure on healthcare services and affects patient care. This reinforces the significance of assessing the prevalence and available interventions during medical training to inform efforts to prevent and treat causes of mental distress and ensure that there is institutional-level support for their mental health, especially after the COVID-19 pandemic.

There have been previous attempts to summarise the body of evidence from published systematic reviews on the

prevalence of common mental health problems and interventions to tackle them, albeit with a discrete focus on individual common mental health problems. Overviews of systematic reviews have the benefit of summarising different prevalence rates and effects of interventions for the same disorder or target group where many systematic reviews are already available (Pollock et al., 2022). Given the plethora of existing systematic reviews, it was decided to conduct an overview of systematic reviews to gather and assess the evidence on the prevalence of common mental health problems and interventions to inform clinical practice, understand their consequences and avoid the need for additional systematic reviews.

Appendix 1 Provides definitions of the abbreviations.

Aim and objectives

The overall aim is to summarise the prevalence of common mental health problems and interventions for junior doctors and medical students from existing published systematic reviews; this information can then be used to inform public health prevention and early intervention practice.

The objectives are:

1. To collate the overall prevalence of common mental health problems in junior doctors and medical students.
2. To highlight the change in prevalence rates during the COVID-19 pandemic.
3. To assess the evidence on the effects of interventions to tackle common mental health problems.

Methods

Study design and research protocol

This overview was conducted in adherence with the recommendations of the Cochrane Handbook of Systematic Reviews of Interventions (Higgins et al., 2019) and the Preferred Reporting Items for Systematic Reviews and Meta-Analysis-(PRISMA) guidelines (Moher et al., 2009).

Eligibility criteria

Eligibility criteria were divided into two parts, and all published systematic reviews met the following inclusion criteria.

1. Prevalence of common mental health problem(s):

- Study designs: a systematic review and/or meta-analysis
- Participants: Junior Doctors and/or Medical Students
- Common mental health problems:

- Common mental health problems are characterised by clinically significant impairment to behaviour, emotional control, and individual intellect; it is typically linked to functional impairment and the most prevalent and included in the inclusion criteria are anxiety disorders, stress, depression, obsessive-compulsive disorder, burnout, suicidal ideation, and post-traumatic stress disorder (NICE, 2022a).

- Outcome measure: Prevalence of common mental health problem(s)

2. Interventions to tackle common mental health problem(s):

- Study designs: a systematic review and/or meta-analysis
- Participants: Junior Doctors and/or Medical Students
- Common mental health problem: as defined above
- Outcome measure: Improvement in common mental health problem(s)
- Intervention: Any social or psychological intervention(s)
- Comparator: Any comparator investigated

Literature search

A search of major electronic databases (MEDLINE, EMBASE, ERIC, PsycINFO) was conducted on 16 May 2022 to identify eligible systematic reviews published in the English language from 2012, allowing for ten years' worth of data to be collected that is most relevant to today's junior doctors and medical students.

The search strategies were designed to include an appropriate combination of MeSH and text words for the population of interest (e.g. medical students, student doctors, student physicians), types of common mental health problems (e.g. depression, anxiety, burnout, stress) and interventions to tackle them (e.g. counselling, cognitive behavioural therapy, mindfulness). Different facets of the search were combined using the Boolean operators "AND" and "OR" when appropriate. An example of the search strategies is included in Appendix 2. Additionally, the citation lists of identified systematic reviews were perused to identify further eligible reviews.

Data extraction and quality assessment of included reviews

Citations' titles and abstracts were reviewed by the primary author (SA), who then retrieved potentially relevant articles for full-text screening; any uncertainty or doubt about eligibility was discussed among all review authors to ensure that no potentially relevant papers were discarded. The full-text assessment was conducted according to the pre-specified inclusion criteria. Data extraction was performed by the primary review author (SA); however, 20% of the included reviews were randomly checked by co-authors, three experts of this overview. Details recorded for systematic reviews

assessing the prevalence of common mental health problems included: publication dates and the scope of the review, target population and the number of participants, and included studies, type of common mental health problem, and review outcomes. For systematic reviews assessing interventions to tackle common mental health problems in addition to the review characteristics, information on the characteristics of interventions, comparators and outcome measures were recorded. Appendix 3 provides the data extraction forms. Measures of effect and accompanied confidence intervals (CI) were noted for systematic reviews with a meta-analysis component.

The quality of the eligible systematic reviews was assessed using the validated AMSTAR-2 tool (A Measurement Tool to Assess Systematic Reviews-2), consisting of 16 items (Shea et al., 2017), where each review received an overall quality rating. Reviews were not excluded based on AMSTAR-2 ratings.

Data synthesis

The main characteristics of each identified review and the relevant outcomes (prevalence rates and the effects of interventions) were summarised using summary tables with no attempt to standardise results across reviews.

Results

Literature search

The literature searches retrieved 624 records. After eliminating duplicates, 395 citations were screened for eligibility, and 47 citations were selected for full-text screening, of which 45 were accessible. Twenty reviews were subsequently excluded as they failed to meet the eligibility criteria. Eleven reviews were identified by citation searching, and ultimately, 36 systematic reviews (with or without meta-analysis) were deemed suitable for inclusion.

The PRISMA diagram in Figure 1 summarises the study selection process.

Study details

Twenty-five reviews were on the prevalence of common mental health problems (Bacchi & Licinio, 2015; Chunming et al., 2017; Coentre & Góis, 2018; Cuttilan et al., 2016; Erschens et al., 2019; Frajerman et al., 2019; Galaiya et al., 2020; Hope & Henderson, 2014; IsHak et al., 2013; Jia et al., 2022; Lasheras et al., 2020; Lawlor et al., 2022; Lei et al., 2016; Li et al., 2021; Low et al., 2019; Mao et al., 2019; Naji et al., 2021; Pacheco et al., 2017; Puthran et al., 2016; Quek et al., 2019; Rotenstein et al., 2016; Santabárbara et al., 2021; Shah et al., 2023; Zeng et al., 2019; Zhou et al., 2020) and 11 assessed the effects of common mental health problem interventions (Daya & Hearn, 2018; Hathaisaard et al., 2022; Krishnan et al., 2022; Kunzler et al., 2020; McConville et al., 2017; Regehr et al., 2014; Sekhar et al., 2021; Shiralkar et al.,

2013; Walsh et al., 2019; Witt et al., 2019; Yogeswaran & El Morr, 2021).

Across the 25 reviews assessing prevalence, the number of included studies ranged between 3-and 62 and the participants from 979-to 69,423. Twelve reviews focused on burnout (Chunming et al., 2017; Erschens et al., 2019; Frajerman et al., 2019; Galaiya et al., 2020; IsHak et al., 2013; Lawlor et al., 2022; Li et al., 2021; Low et al., 2019; Naji et al., 2021; Pacheco et al., 2017; Shah et al., 2023; Zhou et al., 2020), 12 on depression (Bacchi & Licinio, 2015; Cuttilan et al., 2016; Hope & Henderson, 2014; Jia et al., 2022; Lasheras et al., 2020; Lei et al., 2016; Mao et al., 2019; Pacheco et al., 2017; Puthran et al., 2016; Rotenstein et al., 2016; Santabárbara et al., 2021; Zeng et al., 2019), eight on anxiety (Cuttilan et al., 2016; Hope & Henderson, 2014; Jia et al., 2022; Lasheras et al., 2020; Mao et al., 2019; Pacheco et al., 2017; Quek et al., 2019; Zeng et al., 2019), five on suicidal ideation (Coentre & Góis, 2018; Cuttilan et al., 2016; Puthran et al., 2016; Rotenstein et al., 2016; Zeng et al., 2019), three on stress/psychological distress (Hope & Henderson, 2014; Pacheco et al., 2017; Zhou et al., 2020) and one on-obsessive-compulsive disorder (Pacheco et al., 2017). Eleven used validated outcome measuring tools (Bacchi & Licinio, 2015; Chunming et al., 2017; Erschens et al., 2019; Frajerman et al., 2019; IsHak et al., 2013; Lasheras et al., 2020; Lawlor et al., 2022; Low et al., 2019; Naji et al., 2021; Puthran et al., 2016; Santabárbara et al., 2021) and 14 used a mixture of validated and non-validated methods (Coentre & Góis, 2018; Cuttilan et al., 2016; Galaiya et al., 2020; Hope & Henderson, 2014; Jia et al., 2022; Lei et al., 2016; Li et al., 2021; Mao et al., 2019; Pacheco et al., 2017; Quek et al., 2019; Rotenstein et al., 2016; Shah et al., 2023; Zeng et al., 2019; Zhou et al., 2020) (see Appendix 4).

Across the 11 reviews assessing interventions, the number of included studies ranged between 2 to 39 and the number of participants from 99 to 7,387. Ten reviews focused on stress (Daya & Hearn, 2018; Hathaisaard et al., 2022; Krishnan et al., 2022; Kunzler et al., 2020; McConville et al., 2017; Regehr et al., 2014; Sekhar et al., 2021; Shiralkar et al., 2013; Witt et al., 2019; Yogeswaran & El Morr, 2021), seven on burnout (Daya & Hearn, 2018; Hathaisaard et al., 2022; Regehr et al., 2014; Sekhar et al., 2021; Walsh et al., 2019; Witt et al., 2019; Yogeswaran & El Morr, 2021), six on depression (Daya & Hearn, 2018; Krishnan et al., 2022; Kunzler et al., 2020; McConville et al., 2017; Sekhar et al., 2021; Witt et al., 2019), five on anxiety (Krishnan et al., 2022; Kunzler et al., 2020; McConville et al., 2017; Sekhar et al., 2021; Witt et al., 2019) and one on suicidal ideation (Witt et al., 2019). All reviews included elements of mindfulness-based practices, assessing the effects of different forms of mindfulness-based interventions. Four reviews included papers with only validated outcome measuring tools (Regehr et al., 2014; Shiralkar et al., 2013; Walsh et al., 2019; Yogeswaran & El Morr, 2021), and seven reviews included papers with a mixture of validated and non-validated methods (Daya & Hearn, 2018; Hathaisaard et al., 2022; Krishnan et al., 2022; Kunzler et al., 2020; McConville et al., 2017; Sekhar et al., 2021; Witt et al., 2019) (see Appendix 5).
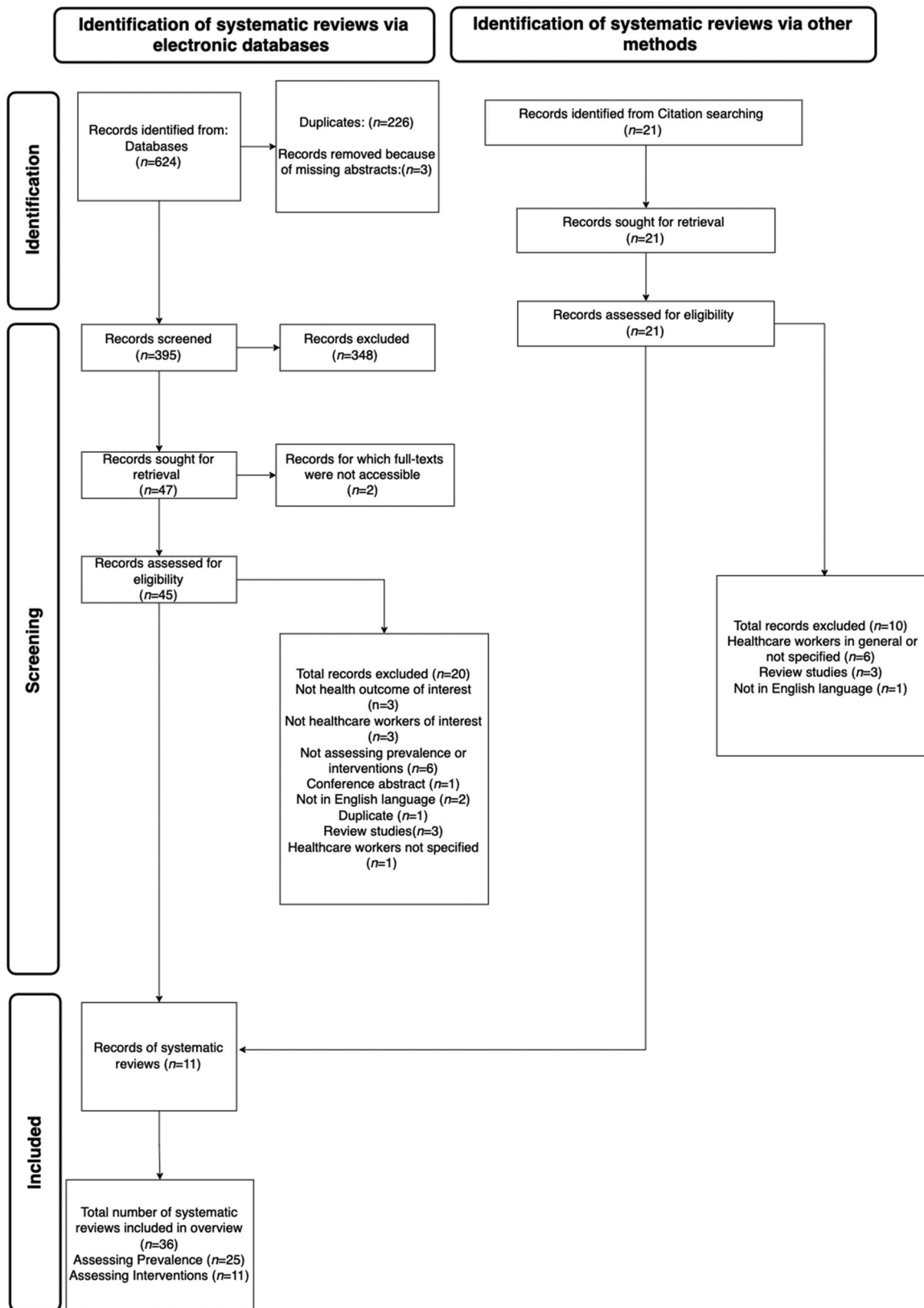
Identification of systematic reviews via electronic databases

Records identified from: Databases (*n*=624)

Duplicates: (*n*=226)

Records removed because of missing abstracts:(*n*=3)

Identification of systematic reviews via other methods

Records identified from Citation searching (*n*=21)

Records sought for retrieval (*n*=21)

Records assessed for eligibility (*n*=21)

Records screened (*n*=395)

Records excluded (*n*=348)

Records sought for retrieval (*n*=47)

Records for which full-texts were not accessible (*n*=2)

Records assessed for eligibility (*n*=45)

Total records excluded (*n*=20)
Not health outcome of interest (n=3)
Not healthcare workers of interest (*n*=3)
Not assessing prevalence or interventions (*n*=6)
Conference abstract (*n*=1)
Not in English language (*n*=2)
Duplicate (*n*=1)
Review studies(*n*=3)
Healthcare workers not specified (*n*=1)

Total records excluded (*n*=10)
Healthcare workers in general or not specified (*n*=6)
Review studies (*n*=3)
Not in English language (*n*=1)

Records of systematic reviews (*n*=11)

Total number of systematic reviews included in overview (*n*=36)
Assessing Prevalence (*n*=25)
Assessing Interventions (*n*=11)

Identification

Screening

Included

Figure 1. PRISMA flow diagram.

All reviews included both male and female participants. Reviews that reported information on the gender of participants were predominantly female.

The basic characteristics of the 36 included systematic reviews assessing prevalence are shown in Table 1, and the systematic reviews assessing interventions in Table 2.

Table 1. Basic characteristics of the systematic reviews and meta-analysis included in the overview – prevalence.

Author, Year	Country	Number of participants and Population	Search dates	Databases	No of Studies	Common Mental Health Problem
IsHak et al., 2013	• UK • Australia • USA • Sweden	8,453 Medical Students	• 1974–2011	• PubMed/Medline • PsycINFO	9	• Burnout
Bacchi & Licinio, 2015	• **Global*** (South/East Asia, Middle East, Oceania, Europe, South America)	10,344 Medical Students	• 1 January 2000 – 16 June 2014	• • PubMed • Medline • Embase • PsycINFOScopus	12	• Depression
Hope & Henderson, 2014	• UK • Europe • English speaking world excluding North America	9,784 Medical Students	• **Medline:** 1948 - October 2013 • **PsycINFO:** 1806 – October 2013 • **Embase:** 1980 – October 2013	• Ovid Medline • PsycINFO, • Embase	29	• Anxiety • Depression • Psychological Distress
Cuttilan et al., 2016	• **East/South Asia**: Nepal, Pakistan, China, Korea, Singapore, Vietnam, Sri Lanka • **Middle East:** Saudi Arabia, Egypt, UAE, Israel	13,111 Medical Students	• January 2000 – February 2015	• Medline • Embase • SpringerLink	14	• Anxiety • Depression • Suicidal Thoughts
Lei et al., 2016	• China	**Total:** 32,694 Medical Students: 9,054 Non-medical Students: 23,660	• 1995 – December 2015	• Chinese Web of Knowledge** • Embase • PubMed • Wanfang** • Weipu**	**Total:** 39 11 on Medical Students 28 on Non-medical Students	• Depression
Puthran et al., 2016	• **Global*** (Europe, Asia, North America, South America, Middle East)	**Total:** 64,573 Medical Students: 62,728 Non-medical Students: 1,845	• Inception – April 2015	• PubMed • MEDLINE • PsycINFO • Embase • Science Direct	**Total:** 77 64 on Medical Students 13 on Medical and Non-medical Students	• Depression • Suicidal Ideation
Rotenstein et al., 2016	• **Global*** (Asia, Africa, Europe, North America, South America, Middle East, Oceania)	129,123 Medical Students	• Inception – 17 September 2016	• Embase • ERIC • Medline • psycARTICLES • PsycINFO	195	• Depression and Depressive Symptoms • Suicidal Ideation
Chunming et al., 2017	• China	14,774 Medical Students	• 1 January 1989 – 31 July 2016	• Chinese Scientific Journals Database • Medline • Wanfang Data Resource System • China Academic Journals Full-text database	33	• Burnout
Pacheco et al., 2017	• Brazil	18,015 Medical Students	• Inception – 29 September 2016	• Medline/PubMed • SciELO • LILACS, PsycINFO	57	• Anxiety • Burnout • Depression • Obsessive Compulsive Disorder • Stress
Coentre & Góis, 2018	• **Global*** (South/East Asia, South America, Middle East, Europe, North America)	13,244 Medical Students	• July 2011 – May 2018	• PubMed • Cochrane Databases	17	• Suicidal Ideation
Erschens et al., 2019	• **Global*** (North America, Europe, South America, Oceania, South/East Asia, Middle East)	35,166 Medical Students	• January 2000 – November 2017	• PsycINFO • PubMed	58	• Burnout
Frajerman et al., 2019	• **Global*** (Middle East, South America, North America, South America, Europe, Oceania, South/East Asia)	17,431 Medical Students	• 1 January 2010 – 31 December 2017 • Searched in Jan 2018.	• Medline	24	• Burnout

Table 1. Continued.

Author, Year	Country	Number of participants and Population	Search dates	Databases	No of Studies	Common Mental Health Problem
Low et al., 2019	• **Global*** (North America, South America, Europe, Asia, Africa, Oceania)	22,778 Medical and Surgical Residents	• Inception – March 2018	• PubMed • PsycINFO • Embase • Web of Science	47	• Burnout
Mao et al., 2019	• China	35,160 Medical Students	• 1 January 2000 – 1 April 2018	• PubMed • Embase • Cochrane Library	21	• Anxiety • Depression
Quek et al., 2019	• **Global*** (Asia, Middle East, Europe, South America, North America, Oceania, and Africa)	40,348 Medical Students	• Medline – 1946 – March 2019 • PsycINFO – 1806 – March 2019 • Embase – 1980 to March 2019	• Medline • PsycINFO • Embase	69	• Anxiety
Zeng et al., 2019	• China	30,817 Medical Students	• EMBASE, PubMed and PsychINFO – Inception – June 2016 • Ovid, CDSR and CENTRAL – June 2018	• Embase • PubMed • PsycINFO • OVID • CDSR • CENTRAL	10	• Anxiety • Depression • Suicidal Ideation
Galaiya et al., 2020	• **Global*** – Europe (UK, Ireland, France, Switzerland), North America (USA), Asia (China, Pakistan), Oceania	69,423 Surgeons and Trainee Surgeons	• Inception – October 2018	• Medline, • PsycINFO • Embase	62	• Burnout
Lasheras et al., 2020	• Middle East – UAE, Iran • Asia – China, India • South America – Brazil	11,710 Medical Students	• 2019 – 26 August 2020	• PubMed	8	• Anxiety • Depression
Zhou et al., 2020	• **Global*** (Middle East, North America, Europe, Oceania, Africa, South America, South/East Asia)	36,266 Trainee Physicians	• Inception – 30 April 2019	• Medline • Embase • PsycINFO • Cochrane Database of Systematic Reviews	48	• Burnout • Stress
Li et al., 2021	• China	29,020 Medical Students	• Inception – September 2019	• China National Knowledge Infrastructure • Wangfang database • VIP database • Chinese biomedical literature database • PubMed • Embase • Web of Science • Google Scholar	48	• Burnout
Naji et al., 2021	• **Global*** (Africa, Asia, Australia, the Middle East, South America, Europe, and North America)	31,210 Postgraduate Medical Trainees	• Inception – 21 August 2018	• Medline • Embase • PsycINFO • Cochrane Database of Systematic Reviews • Web of Science • Education Resources Informational Center	114	• Burnout
Santabárbara et al., 2021	• Asia – China, India, Japan, Kazakhstan • Africa – Morocco, Libya • South America – Brazil	6,576 Medical Students	• 1 December 2019 – 27 December 2020	• Medline • Embase • Web of Science	11	• Depression
Jia et al., 2022	• **Global*** (South/East Asia, Middle East, Europe, North America, South America)	36,608 Medical Students	• 2019–18 August 2021	• Embase • PubMed • PsycArticles • Web of Science • China Biology Medicine disc	41	• Anxiety • Depression

Table 1. Continued.

Author, Year	Country	Number of participants and Population	Search dates	Databases	No of Studies	Common Mental Health Problem
Lawlor et al., 2022	• USA	1,228 Otolaryngology Trainees	• January 2000 – February 2021	• Embase • Medline • Scopus • Web of Science • CENTRAL	**Total:** 34 9 quantitative analysis, 25 qualitative summary	• Burnout
Shah et al., 2023	• **Global*** (North America, Europe, Middle East, South/East Asia)	12,125 Surgical Residents	• January 2016 – May 2021	• Ovid Medline • Embase	94	• Burnout

*Global – is defined as reviews that include studies from 4 or more continents.
**Chinese Databases.

Methodological quality of included systematic reviews

Among the reviews assessing prevalence, there were 13 of high quality (Frajerman et al., 2019; Lasheras et al., 2020; Lei et al., 2016; Li et al., 2021; Low et al., 2019; Mao et al., 2019; Naji et al., 2021; Puthran et al., 2016; Quek et al., 2019; Rotenstein et al., 2016; Santabárbara et al., 2021; Zeng et al., 2019; Zhou et al., 2020), one of moderate quality (Hope & Henderson, 2014), one of low quality (Pacheco et al., 2017), and ten of critically low quality (Bacchi & Licinio, 2015; Chunming et al., 2017; Coentre & Góis, 2018; Cuttilan et al., 2016; Erschens et al., 2019; Galaiya et al., 2020; IsHak et al., 2013; Jia et al., 2022; Lawlor et al., 2022; Shah et al., 2023) (Appendix 6).

Regarding the reviews assessing interventions, there were three of high quality (Kunzler et al., 2020; Sekhar et al., 2021; Witt et al., 2019), seven of moderate quality (Daya & Hearn, 2018; Hathaisaard et al., 2022; Krishnan et al., 2022; McConville et al., 2017; Regehr et al., 2014; Walsh et al., 2019; Yogeswaran & El Morr, 2021), and one of critically low quality (Shiralkar et al., 2013) (Appendix 7).

Synthesis of results

Prevalence

Table 3 shows the prevalence rates of common mental health problems among junior doctors and medical students as reported by the identified systematic reviews, and Appendix 8 provides definitions of the included common mental health problems.

(a) Anxiety. Of the eight reviews focusing on anxiety in medical students, the pooled prevalence rates in the six meta-analyses were between 7.04-to 33.8% (Cuttilan et al., 2016; Jia et al., 2022; Lasheras et al., 2020; Pacheco et al., 2017; Quek et al., 2019; Zeng et al., 2019) and between 7.7-to 88.3% in the two reviews that reported only ranges (Hope & Henderson, 2014; Mao et al., 2019). The reasons for reporting ranges varied from using different assessment tools (Mao et al., 2019) to not stating cut-off scores and not examining anxiety in a formal way (Hope & Henderson, 2014). Of the meta-analyses that provided a pooled prevalence rate, the highest anxiety prevalence rate was 33.8% and was conducted globally (Quek et al., 2019); however, when anxiety prevalence rates were grouped by continent, the prevalence was highest in the Middle East at 42.4%, followed by Asia at 35.2% (Quek et al., 2019). This is similar to the prevalence rate reported in another review that focused on anxiety during the COVID-19 pandemic (33.7%) (Jia et al., 2022). Two reviews found anxiety prevalence rates since the COVID-19 pandemic to be relatively stable 28.0% (Lasheras et al., 2020)-and 33.7% (Jia et al., 2022) compared to pre-COVID-19 pandemic 33.8% (Quek et al., 2019)-and 32.9% (Pacheco et al., 2017). Measuring instruments included the Beck-Anxiety-Inventory-(BAI) (Cuttilan et al., 2016; Jia et al., 2022; Lasheras et al., 2020; Mao et al., 2019; Pacheco et al., 2017) and the Generalised-Anxiety-Disorder-Assessment-(GAD-7)-tools (Hope & Henderson, 2014; Jia et al., 2022; Lasheras et al., 2020).

(b) Burnout. Twelve reviews investigated burnout and of these, six focused on medical students (Chunming et al., 2017; Erschens et al., 2019; Frajerman et al., 2019; IsHak et al., 2013; Li et al., 2021; Pacheco et al., 2017) and six on trainee doctors and surgeons (Galaiya et al., 2020; Lawlor et al., 2022; Low et al., 2019; Naji et al., 2021; Shah et al., 2023; Zhou et al., 2020). Of the six reviews looking at medical students, four meta-analyses reported having a pooled prevalence rate of 13.1-to 45.9% (Chunming et al., 2017; Frajerman et al., 2019; Li et al., 2021; Pacheco et al., 2017). In the two reviews that reported only ranges, the prevalence rates were between 7.0-to 75.2% (Erschens et al., 2019; IsHak et al., 2013). The reasons for reporting ranges were using different measuring instruments (Erschens et al., 2019) and variable population characteristics such as life factors, learning environments and minority status (IsHak et al., 2013). The six remaining reviews considered trainee doctors and surgeons, and of these, three global reviews reported pooled prevalence rates from 43.1-to 51.0% (Low et al., 2019; Naji et al., 2021; Zhou et al., 2020) and a US review reported a prevalence rate of 58.6% (Lawlor et al., 2022). Two reviews reported only ranges from 22.2-to 86.0% (Galaiya et al., 2020; Shah et al., 2023), ; citing differing definitions of burnout in one review (Galaiya et al., 2020) and the use of varying Maslach-Burnout-Inventory-(MBI) versions in another (Shah et al., 2023). All reviews used the MBI or its modified forms. To the authors' knowledge, no reviews on burnout were conducted since the onset of the COVID-19 pandemic.

(c) Depression. All 12 reviews focused on medical students, with two of these comparing medical students to non-medical students (Lei et al., 2016; Puthran et al., 2016). Of the ten reviews that solely focused on medical students, the pooled prevalence rates were 11.0-to 37.9% in eight reviews (Bacchi & Licinio, 2015; Cuttilan et al., 2016; Jia et al., 2022; Lasheras et al., 2020; Pacheco et al., 2017; Rotenstein et al., 2016; Santabárbara et al., 2021; Zeng et al., 2019) and in the two reviews that reported only ranges, 6.0-to 76.1% (Hope & Henderson, 2014; Mao et al., 2019). Reasons for reporting ranges were variable qualities of included studies, using the same tool but different cut-off scores (Hope & Henderson, 2014) and utilising different assessment tools (Mao et al., 2019). For the Beck Depression Inventory (BDI), >14/63 diagnosed depression in one Pakistani study (Alvi et al., 2010) and another Macedonian >17/63 (Mancevska et al., 2008), with many not reporting their cut-off scores (Hope & Henderson, 2014). Two reviews compared medical students to non-medical students; there was no clear increasing trend when comparing the prevalence rates of depression in medical students, 27.5% (Lei et al., 2016) vs 28.0% (Puthran et al., 2016), and non-medical students, 22.4% (Lei et al., 2016)-vs 30.6% (Puthran et al., 2016). Additionally, three reviews on medical students assessed the prevalence of depression since the COVID-19 pandemic, and, generally, showed slightly higher prevalence rates (25.0 (Lasheras et al., 2020), 31.0% (Santabárbara et al., 2021). 37.9% (Jia et al., 2022)) compared to pre-COVID-19 pandemic (15.1% (Bacchi & Licinio, 2015), −11.0%, (Cuttilan et al., 2016), 27.2% (Rotenstein et al., 2016)). Most reviews used the-BDI measuring tool.

(d) Obsessive-compulsive disorder. One review looked at the prevalence of obsessive-compulsive disorder in medical students and reported a prevalence rate of 3.8% (Pacheco et al., 2017), using the Obsessive-Compulsive Inventory-Revised-(OCI-R) (Pacheco et al., 2017).

(e) Stress/psychological distress. Two reviews investigated the prevalence of stress (Pacheco et al., 2017) and psychological distress (Hope & Henderson, 2014) among medical students and one review looked at stress in trainee physicians (Zhou et al., 2020). Prevalence rates from the three reviews were 49.9% (Pacheco et al., 2017), 29.6% (Hope & Henderson, 2014)-and 44.6% (Zhou et al., 2020), respectively. The differences in prevalence rates can be explained by year of study as psychological distress is known to be more common as medical students progress through their course (Hope & Henderson, 2014). All reviews used the General-Health-Questionnaire-(GHQ)-instrument.

(f) Suicidal ideation/thoughts. Five reviews explored the prevalence of suicidal ideation in medical students and of these four reported pooled prevalence rates between 3.0%-to 11.1% (Cuttilan et al., 2016; Puthran et al., 2016; Rotenstein et al., 2016; Zeng et al., 2019). One review reported a range between 1.8%-and 53.6% reflecting the heterogeneity amongst its studies (e.g. different evaluation timeframes and

the use of various measuring tools) (Coentre & Góis, 2018). Measuring instruments included the BDI (Coentre & Góis, 2018; Cuttilan et al., 2016) and the Patient-Health-Questionnaire-(PHQ) (Coentre & Góis, 2018; Puthran et al., 2016; Rotenstein et al., 2016; Zeng et al., 2019).

Interventions

Common mental health problems are frequently targeted by different forms of public mental health interventions. Given the abundance of available interventions, it is essential that effective interventions are identified and implemented (Das et al., 2016). Table 4 provides details of the included reviews, which assessed the effects of interventions to tackle common mental health problems.

The definitions of mindfulness-based interventions, mindfulness-based stress-reduction-(MBSR) and other interventions are detailed in Appendix 9.

(a) Anxiety. Five reviews focused on interventions to treat anxiety among healthcare students (two reviews) (Kunzler et al., 2020; McConville et al., 2017), newly qualified doctors-(one review) (Krishnan et al., 2022), medical students-(one review) (Witt et al., 2019) and junior doctors and medical students (one review) (Sekhar et al., 2021). Two reviews used MBSR in healthcare students and medical students (McConville et al., 2017; Witt et al., 2019). Results showed a significant effect favouring MBSR in reducing anxiety levels (SMD–0.44, −95% CI–0.59-to–0.28 (McConville et al., 2017)-and-SMD–0.62, −95%-CI–1.63-to 0.38 (Witt et al., 2019), respectively). Additionally, a review on newly qualified doctors found statistically significant results in reducing anxiety by using mental practice-($p < 0.05$) and assistantship training-($p < 0.03$) (Krishnan et al., 2022). A review on psychological interventions in healthcare students reported that resilience training lowered levels of anxiety post-intervention (SMD–0.45, −95%-CI–0.84-to 0.06) (Kunzler et al., 2020). Conversely, a review on mindfulness-based interventions in junior doctors and medical students showed no substantial improvement in anxiety immediately post-intervention (SMD 0.09, 95%-CI–0.33-to 0.52) (Sekhar et al., 2021).

(b) Burnout. Seven reviews investigated interventions for burnout with four focusing on medical students (Daya & Hearn, 2018; Hathaisaard et al., 2022; Witt et al., 2019; Yogeswaran & El Morr, 2021) and three combining junior doctors and medical students (Regehr et al., 2014; Sekhar et al., 2021; Walsh et al., 2019). One review on mindfulness-based interventions in medical students found a significant reduction in burnout favouring meditation, and mindfulness body scans-($p = 0.001$) whereas physical/mental exercises were insignificant-($p = 0.204$) (Daya & Hearn, 2018). Additionally, mindfulness-based interventions were reported to be effective in medical students and residents (SMD–0.38, 95%-CI −0.49-to–0.26) (Regehr et al., 2014). A review on MBSR (didactic teaching, physical/mental exercises) in junior doctors and medical students found that most interventions reported improvements, however, duty hour

restrictions reported mixed findings (Walsh et al., 2019). A review of MBSR in medical students showed non-significant improvements post-intervention (SMD–0.13, 95%-CI–0.36-to 0.10) (Witt et al., 2019). Similarly, junior doctors and medical students using MBSR found no substantial difference post-intervention (SMD–0.42, 95%-CI–0.84-to 0.00) (Sekhar et al., 2021). Moreover, online mindfulness-based interventions in medical students showed no changes in the MBI-subscales of personal achievement-($p = 0.55$), emotional exhaustion-($p = 0.51$), and depersonalization-($p = 0.71$) (Yogeswaran & El Morr, 2021). Another review on mindfulness-based interventions in medical students reported inconclusive results (Hathaisaard et al., 2022).

(c) Depression.

Five reviews explored interventions for depression (Daya & Hearn, 2018; Kunzler et al., 2020; McConville et al., 2017; Sekhar et al., 2021; Witt et al., 2019); one review highlighted that MBSR in healthcare students showed a significant effect favouring mindfulness-based interventions for depression (SMD–0.54, 95%-CI–0.83-to–0.26) (McConville et al., 2017). Similarly, two reviews on mindfulness-based interventions in medical students reported a significant reduction in depression (Daya & Hearn, 2018) and suggested that MBSR interventions may be effective in reducing depression levels (SMD–0.62, 95%-CI–1.63-to 0.38) (Witt et al., 2019). Contrarily, one review showed a small-to-no effect of resilience training on depression among healthcare students (SMD–0.20, 95%-CI–0.52-to 0.22) (Kunzler et al., 2020) and another review showed no difference in depression levels among junior doctors and medical students after mindfulness-based interventions (SMD 0.06, 95%-CI–0.19-to 0.31) (Sekhar et al., 2021).

(d) Stress/psychological distress.

Ten reviews looked at stress/psychological distress with nine reporting positive findings (Hathaisaard et al., 2022; Krishnan et al., 2022; Kunzler et al., 2020; McConville et al., 2017; Regehr et al., 2014; Sekhar et al., 2021; Shiralkar et al., 2013; Witt et al., 2019; Yogeswaran & El Morr, 2021). Two reviews on mindfulness-based interventions in healthcare students found a significant effect favouring mindfulness-based interventions for stress (SMD–0.44, 95%-CI–0.57-to–0.31) (McConville et al., 2017) and resilience training with lower levels of stress (SMD–0.28, 95%-CI–0.48-to 0.09) (Kunzler et al., 2020). Similarly, four reviews on mindfulness-based interventions in medical students found it to be effective in reducing stress (Hathaisaard et al., 2022; Shiralkar et al., 2013; Witt et al., 2019; Yogeswaran & El Morr, 2021) (SMD–0.66, 95%-CI–1.32-to–0.00) (Witt et al., 2019), showed significant change at follow-up on the perceived stress scale ($p = 0.0005$) (Yogeswaran & El Morr, 2021) and highlighted its effectiveness in reducing short-and-long-term stress among medical students (SMD 0.29, 95%-CI 0.07-to 0.51), and at 6-month follow-up (SMD 0.31, 95%-CI 0.06-to 0.55) (Hathaisaard et al., 2022). Another two reviews on junior doctors and medical students found MBSR techniques to have significant positive results on stress (SMD–0.55,

95%-CI–0.74-to–0.36 (Regehr et al., 2014)-and-SMD–0.36, 95%-CI–0.60-to 0.13 (Sekhar et al., 2021), respectively). A further review on newly qualified doctors found mindfulness courses and mental practice to decrease stress levels-($p = 0.04$)-and-($p < 0.05$) (Krishnan et al., 2022). Contrastingly, a review assessing MBSR to reduce stress among medical students reported mixed results (Daya & Hearn, 2018).

(e) Suicidal ideation/thoughts.

One review found that interventions designed to prevent depression among medical students had unclear effects on suicidal ideation (OR 0.07, 95%-CI 0.05-to 1.36) (Witt et al., 2019).

Discussion

This overview aimed to investigate the worldwide prevalence of common mental health problems among junior doctors and medical students. Twenty-five published systematic reviews from 2012 with a pooled population of 531,556 medical students and 173,030 junior doctors were assessed. Across systematic reviews, the prevalence of anxiety ranged from 7.04 to 88.30%, burnout from 7.0 to 86.0%, depression from 11.0 to 66.5%, stress from 29.6 to 49.9%, suicidal ideation from 3.0 to 53.9% and one obsessive-compulsive disorder review reported a prevalence of 3.8%. Mindfulness-based interventions were the most used interventions, with mixed findings for each common mental health problem.

Findings show high prevalence rates of common mental health problems, with the peak age for onset occurring between adolescence and early adulthood (Jurewicz, 2015) owing to establishing independence, risk-taking behaviours and neurodevelopmental changes rendering it a vulnerable period for the development of common mental health problems (Colizzi et al., 2020). This, coupled with general university stresses, heavy workloads, challenging clinical environments, and career planning uncertainties, further increases the risk of common mental health problems (Card, 2018; Jafari et al., 2012).

Clear links between financial pressures over repaying debt whilst at medical school and the development of common mental health problems have been described (Dossey, 2007; Pisaniello et al., 2019), especially in rural students (Kwong et al., 2005). Medical students from disadvantaged socioeconomic backgrounds have reported higher risks of suicidal ideation (Seo et al., 2021).

The prevalence of anxiety, depression and stress is higher in junior doctors and medical students (32.9%, 30.6%, –49.9%) (Pacheco et al., 2017) compared to the general population (26.9%, 28.0%, and 36.5%) (Nochaiwong et al., 2021). The prevalence of depression among undergraduate university students was 25% (Sheldon et al., 2021), which is relatively similar to that of non-medical students reported in two of the included reviews (22.4%-and 28.7%) (Lei et al., 2016; Puthran et al., 2016). Heavier academic pressures, tense junior-senior relationships, high-intensity internships, and consequent sleep deprivation may explain this discrepancy. Common mental health problems can lead to undesirable consequences, including suicidal ideation, poor academic

Table 2. Basic characteristics of systematic reviews and meta-analysis included in the overview – interventions.

Author, Year	Country	Number of participants and Population	Search dates	Databases	No of studies	Intervention Type	Common Mental Health Problem
Regehr et al., 2014	• **Global*** • Europe: Spain, Norway • North America: USA • South America: Argentina, • Oceania: Tasmania	1,034 Medical Students Residents and Physicians	• Inception – 21 February 2013	• Cochrane Database of Systematic Reviews • Medline • Embase • PsycINFO • ERIC • Applied Social Science Abstracts • Social Sciences Abstracts • Social Work Abstracts • Dissertation Abstracts International	**12** 6 RCT 3 parallel cohort control 3 pre-post no control)	• Cognitive Behavioural/ Counselling • Mindfulness-based Interventions • Stress management/ Wellness Intervention	• Burnout • Stress
Shiralkar et al., 2013	• USA • UK • Germany • New Zeeland	3,011 Medical Students	• February 2010 – November 2011	• PsycINFO • PubMed	**13** 5 RCT 8 non-RCT	• Self-Hypnosis • Pre-clinical curriculum changes (length and type) • Meditation • Health Habits feedback • Educational Discussion groups on Self-Care • Mind-body-medicine stress-reduction classes • Mindfulness-Based Stress Reduction • Reflective Writing Courses • Changing Curriculum Grading in the Science Subjects	• Stress
McConville et al., 2017	• North America: USA, Canada • Asia: Korea, Malaysia, Thailand	1,815 Healthcare Professional Students	• Inception – June 2016	• CENTRAL • Medline • CINAHL • Embase • PsycINFO • ERIC	**19** 12 RCT 7 non-RCT	• Mindfulness Training and Programs • Mindful awareness activities • Didactic teaching on theory of stress • Mindful Movement • Application of Mindfulness • Home practices	• Anxiety • Depression • Stress
Daya & Hearn, 2018	• **Global*** • North America: USA, Canada • Europe: Norway • Oceania: Australia, Tasmania • Asia: Malaysia	1,197 Medical Students	• October 1996 – 10 November 2016	• Embase • PubMed • PsycINFO • Medline	**12** 7 Pre-test-Post-test 4 RCT 1 non-RCT	• Mindfulness Interventions • Mindfulness-Based Stress Reduction • Mindfulness-Based Cognitive Therapy • Mindfulness Integrated with CD and DVD-delivered interventions	• Burnout • Depression • Fatigue • Stress
Walsh et al., 2019	• North America: USA • Europe: Norway • Oceania: Australia	1,552 Medical Students Junior Doctors	• Inception – 21 September 2016	• PubMed • Embase • CENTRAL • Scopus • Web of Science • CINAHL • ERIC • Education Source • PsycINFO • Academic Source Complete	**14** 4 single group pre-post studies 6 non-RCTs 4 RCTs	• Wellness Curriculum • Duty Hours Changes • Exercise Program • Professional Development Coaching Programme • Stress Management Programme • Complementary and Alternative Medicine Course • Debriefing Curriculum • Mindfulness-Based Stress Reduction • Psychotherapeutic Training in BATHE Technique	• Burnout

Table 2. Continued.

Author, Year	Country	Number of participants and Population	Search dates	Databases	No of studies	Intervention Type	Common Mental Health Problem
Witt et al., 2019	• **Global*** • North America: USA, Canada • South America: Mexico, Brazil • Europe: Norway, Germany, UK • Oceania: New Zealand, Australia • Asia: Malaysia, India • Middle East: Saudi Arabia	7,387 Medical Students	• Inception – 1 December 2017	• Embase • Medline • PsycINFO	**39** 13 RCTs 6 non-RCT 3 controlled studies 12 uncontrolled studies 5 curriculum-based interventions	• Mindfulness-based principles • Stress Management Training • Relaxation Training • Yoga • Telephone Counselling • Visual Journaling • Consumption of Omega-3-Fatty Acids	• Anxiety • Burnout • Depression • Stress • Suicidal Ideation, Behaviour
Kunzler et al., 2020	• **Global*** • North America: USA, Canada • Middle East: Iran • Oceania: Australia • Europe: Germany, UK, Belgium, Switzerlan-d, the Netherland-s • Asia: China, India	2,680 Healthcare Students	• 1990 – June 2019	• CENTRAL • Medline • Embase • PsycINFO • CINAHL • PSYNDEX EBSCOhost • Web of Science • International Bibliography of the Social Sciences ProQuest • Applied Social Sciences Index and Subtracts ProQuest • ProQuest Dissertation and Theses, • Cochrane Database of Systematic Reviews • Database of Abstracts of Reviews of Effects • Epistemonikos • ERIC EBSCOhost • Current Controlled Trials now ISTRCN registry • ClinicalTrials.gov • WHO International Clinical Trials Registry	**30** in SA and 19 in MA 30 parallel-group designs	• Resilience Training • Mindfulness-based resilience interventions • Unspecific resilience interventions • Combined resilience interventions • Positive Psychology • Cognitive-behavioural therapy • Coaching Approaches	• Anxiety • Depression • Stress or Stress Perception
Sekhar et al., 2021	• **Global*** • North America: USA, Canada • South America: Brazil • Oceania: Australia • Asia: Thailand, Malaysia • Europe: Netherlands	731 Medical Students Junior Doctors	• Inception – October 2021	• CENTRAL • Medline • Embase • PsycINFO • CINAHL • ERIC • Scopus • ClinicalTrials.gov • WHO • Grey Literature	**10** 10 RCTs	• Mindfulness-Based Stress Reduction • Meditation Groups • Mindfulness-Based Management • Headspace App • PITSTOP Group • Mindfulness-Based Cognitive Therapy	• Anxiety • Burnout • Depression • Stress

(Continued)

Table 2. Continued.

Author, Year	Country	Number of participants and Population	Search dates	Databases	No of studies	Intervention Type	Common Mental Health Problem
Yogeswaran & El Morr, 2021	• Canada • Australia	99 Medical Students	• Inception – 28 October 2020	• ProQuest • Medline • PubMed • PsycINFO • Web of Science • IEEE Explore • Cochrane • CINAHL	**2** 2 RCTs	• Online Mindfulness Interventions • Mindfulness Training Programme • Mind-Med Intervention	• Burnout • Stress
Hathaisaard et al.,2022	• **Global*** • South America: Brazil • North America: USA • Europe: Germany, Norway • Asia: Malaysia, China • Oceania: Australia	689 Medical Students	• Inception – December 2019	• Embase • Ovid • CINAHL	**Total 9,** Included in MA = 6 • 9 RCTs	• Mindfulness-Based Interventions • Mobile Mindfulness • Mindfulness-Based Stress Reduction and Management • Mindfulness Techniques • Hypnosis • Tai Chi Chuan	• Burnout • Stress
Krishnan et al., 2022	• UK	330 Newly Qualified Doctors	• August 2004 – December 2019 • Updated search 15 Oct 2020	• Embase • PsycINFO • PubMed • CINAHL • Medline	**7** 1 quantitative (randomised-controlled design) 2 mixed methods 4 quantitative	• Mentorship Programmes with senior trainees • Mindfulness Courses • Clinical Preparation • Mental Practice	• Anxiety • Stress

*Global – is defined as reviews that include studies from 4 or more continents.
RCT – randomised controlled trials, non-RCT – non-randomised controlled trial, MA – Meta-Analysis.

performance, and compromised patient safety (Zeng et al., 2019).

When understanding common mental health problems, it is vital to be aware of the wider social context and cultural aspects that may influence treatment-seeking behaviours (Doll et al., 2021). This overview found that when comparing the prevalence of anxiety in medical students across different continents, the Middle East and Asia had the highest prevalence of anxiety (Quek et al., 2019). Cultural differences across countries may explain this; in the Middle East, emotions are often concealed due to the associated stigma (Abdullah & Brown, 2011), and in Asia, common mental health problems are considered a shame to one's family (Littlewood et al., 2007). In contrast, Caucasians may experience less stigmatisation than other sociocultural groups (Rao et al., 2007). Therefore, it is important to consider these unique socio-cultural contexts when dealing with common mental health problems, which can be considered when treating and designing public health interventions.

The COVID-19 pandemic is thought to have increased the prevalence of anxiety and depression in the general population (Sousa et al., 2021), with medical students particularly reported to have higher prevalence rates (33.7% (Jia et al., 2022)-and 37.9% (Jia et al., 2022)) than the general population-(27.7%-and 26.9) (Sousa et al., 2021). Reasons for this could include the change to inherent training models of medical schools, limited clinical experience, and online learning (Jia et al., 2022; Natalia & Syakurah, 2021).

This overview highlighted that the most common forms of public mental health interventions for common mental health problems are mindfulness-based interventions and MBSR. Results show that mindfulness-based interventions significantly reduced stress, which is consistent across reviews

despite the interventions being undertaken in different countries with varying lengths and components (e.g. meditation, cognitive restructuring) (Hathaisaard et al., 2022). These results are comparable to those of an earlier review that assessed interventions to reduce burnout in doctors (SMD 0.38, 95%-CI 0.26-to–0.46) (Regehr et al., 2014). Other approaches, namely mental practice and assistantship training, have also reported promising findings (Krishnan et al., 2022).

It is evident from the included reviews that there is a lack of consensus on the definitions of common mental health problems. For example, "burnout" has been defined differently over time with several validated measuring tools being used. The Copenhagen Burnout Inventory highlights fatigue and exhaustion as the main characteristics of the problem (Kristensen et al., 2005), whilst other tools describe it as a depressive disorder (Bianchi et al., 2014). Even when using the MBI, there is no consensus on the definition of burnout, which limits the interpretation and generalisability of findings (Galaiya et al., 2020). The way forward may be to separate depersonalisation and emotional exhaustion to determine those at most risk for each component and design targeted interventions (Eckleberry-Hunt et al., 2018). Duty hour restrictions have shown mixed results on burnout; however, debriefing curriculums that foster professional development and enhance the quality of care seem to be beneficial (DeChant et al., 2019).

Strengths

This overview included the use of comprehensive literature searches, the assessment of a large body of evidence (1,143 primary studies across systematic reviews) worldwide and of several common mental health problems. All included

Table 3. Summary of results on the prevalence of common mental health problems across systematic reviews.

Author, year	No of studies (sample size)	Population	Prevalence Rates (%)	AMSTAR-2 judgement
Anxiety				
Hope & Henderson, 2014	11 (3,801)	Medical Students	7.7 − 65.5%	M
Cuttilan et al., 2016	6 (1,420)	Medical Students	7.04%	CL
Pacheco et al., 2017	12 (3,850)	Medical Students	32.9%	L
Mao et al., 2019	11 (8,923)	Medical Students	8.54 − 88.30% with a mean of 27.22%	H
Quek et al., 2019	69 (40,348)	Medical Students	33.8%	H
Zeng et al., 2019	3 (14,215)	Medical Students	21.0%	H
Lasheras et al., 2020	8 (11,710)	Medical Students	28.0%	H
Jia et al., 2022	37 (34,285)	Medical Students	33.7%	CL
Burnout				
IsHak et al., 2013	9 (8,453)	Medical Students	45.0 − 71.0 %	CL
Chunming et al., 2017	33 (14,774)	Medical Students	37.7%	CL
Pacheco et al., 2017	3 (979)	Medical Students	13.1%	L
Erschens et al., 2019	58 (35,166) 12 in MA	Medical Students	7.0 − 75.2%	CL
Frajerman et al., 2019	24 (17,431)	Medical Students	44.2%	H
Low et al., 2019	47 (22,778)	Medical and Surgical Residents	51.0%	H
Galaiya et al., 2020	62 (69,423)	Surgeons and Trainee Surgeons	22.2 − 85.1%	CL
Zhou et al., 2020	27 (28,611)	Trainee Physicians	43.1%	H
Li et al., 2021	48 (29,020)	Medical Students	45.9%	H
Naji et al., 2021	114 (31,210)	Postgraduate Medical Trainee	47.3%	H
Lawlor et al., 2022	9 (1,228)	Otolaryngology Trainees	58.6%	CL
Shah et al., 2023	94 (12,125)	Surgical Residents	35.0 − 86.0%	CL
Depression				
Bacchi & Licinio, 2015	12 (10,344)	Medical Students	15.1%	CL
Hope & Henderson, 2014	14 (4,244)	Medical Students	6.0 − 66.5%	M
Cuttilan et al., 2016	9 (10,147)	Medical Students	11.0%	CL
Lei et al., 2016	39 (32,694) Medical Students: 11 (9,054) Non-medical Students: 28 (23,660)	University Students	Medical Students 27.5% (95% CI 19.8% − 38.3%) Non-medical Students: 22.4% (95% CI 17.9% − 28.1%)	H
Puthran et al., 2016	77 (64,573) Medical Students: 64 (62,728) Non-Medical Students 13 (1,845)	Medical and Non-Medical Students	Medical Students: 28.0% Non-medical Students: 30.6% when compared to Medical Students: 28.7%	H
Rotenstein et al., 2016	183 (122,356)	Medical Students	27.2%.	H
Pacheco et al., 2017	25 (8,778)	Medical Students	30.6%	L
Mao et al., 2019	15 (35,160)	Medical Students	Mean prevalence 32.74% (range 13.10 − 76.1%)	H
Zeng et al., 2019	6 (23,473)	Medical Students	29.0%	H
Lasheras et al., 2020	3 (205)	Medical Students	25.0%	H
Santabárbara et al., 2021	11 (6,576)	Medical Students	31.0%	H
Jia et al., 2022	31 (29,036)	Medical Students	37.9%	CL
Obsessive Compulsive Disorder				
Pacheco et al., 2017	1 (471)	Medical Students	3.8%	L
Stress and/or Psychological Distress				
Hope & Henderson, 2014	16 (6,859)	Medical Students	Weighted mean prevalence: 29.6% (range 12.2% − 96.7%)	M
Pacheco et al., 2017	6 (1,662)	Medical Students	49.9%	L
Zhou, 2020	22 (7,756)	Trainee Physicians	44.6%	H
Suicidal Thoughts/Ideation				
Cuttilan et al., 2016	1 (165)	Medical Students	3.0%	CL
Puthran et al., 2016	8 (6,583)	Medical Students	5.8%	H
Rotenstein et al., 2016	24 (21,002)	Medical Students	11.1%	H
Coentre & Góis, 2018	17 (13,244)	Medical Students	1.8% to 53.6%	CL
Zeng et al., 2019	3 (3,086)	Medical Students	11.0%	H

MA = Meta-Analysis, OR = Odds Ratio; H = High, M = Moderate, L = Low, CL = Critically Low.

systematic reviews were published from 2012, making the observed findings more applicable to current junior doctors and medical students.

Limitations

Some limitations must be acknowledged. The information gathered from existing systematic reviews varied in terms of study designs, screening tools, demographics of the assessed populations and eligibility criteria. The prevalence of the common mental health problems cannot be precisely determined due to the heterogenous screening tools, student/trainee populations and low methodological rigour of some reviews. It is worth noting that the nature of psychiatric screening tools relies on subjective and self-reported measures with varying cut-off values and, therefore, the reliability and validity of these measures must be interpreted with caution.

Table 4. Summary of the findings of systematic reviews assessing interventions to tackle common mental health problems.

Author, year	CMHP	Intervention(s) and Comparator(s)	No of studies (sample size) Population	Effect Measure	Effect Size (95% CI)	Results	AMSTAR-2 judgement
Regehr et al., 2014	• **Burnout** • **Stress**	**Burnout:** • Burnout workshop vs no treatment • MSBR no comparator • Mindful communications course no comparator • One day counselling session no comparator **Stress:** • Mindfulness meditation vs no treatment • Stress management vs no treatment • Wellness intervention vs no treatment • SMART no comparator • Mind-body skills course vs students who did not enrol on course • MBSR vs students in alternative medicine seminar	Total: 12 (1,034) Medical Students Residents Physicians **Burnout: 4 (359)** **Stress: 8 (636)**	SMD	**Burnout:** SMD −0.38 (−0.49 to −0.26) **Stress and anxiety in physicians:** SMD −1.07 (−1.39 to −0.74) **Stress and anxiety in medical students:** SMD −0.55 (−0.74 to −0.36)	• The results from 4 studies on burnout highlight a significant difference from pre-test to post-test with a moderate effect size. • The results are significant for the 4 studies conducted on cognitive, behavioural, and mindfulness-based studies against the control group for the outcome of anxiety and stress in physicians. • The results are significant for the 4 studies conducted on cognitive,	M
Shiralkar et al., 2013	• **Stress**	**Stress** • Self-hypnosis vs controls • 2 vs 3-year pre-clinical curriculum • Meditation based stress reduction vs wait list control • Self-care vs educational written feedback • Mindfulness-based stress reduction (MBSR) vs control • Reformed track vs traditional track • Writing about emotions vs writing about goals vs controls • 5-interval grading system vs Pass/Fail grading system • 10-session elective on "mind-body medicine" • Shortened academic year (47 vs 42 weeks) • >3 interval grading system vs Pass/Fail grading system • Guided CD of mindfulness vs usual-care control	Total: 13 (3,011) Medical Students	Not reported	Not reported	• Self-hypnosis: less distress at exam time • Pre-clinical curriculum: lower stress with a longer curriculum • Meditation based stress: reduced anxiety, depression and overall psychological distress • Self-care: favoured over written feedback in changing health habits • MBSR: greater improvement in mood • Reformed track: felt more supported • Writing about emotions: no psychological and physical differences in between groups • 5-year interval grading vs Pass/Fail: less perceived stress with pass/fail system • Mind-body medicine: no group differences in anxiety, mood, and stress • Interval grading vs pass/fail: increase in wellbeing with quality of medical education with pass/fail grading • Shortened academic year, no between group differences in stress levels • >3 interval grading system vs pass/fail: decrease in stress with pass/fail system • Guided CD of mindfulness: reduced stress and anxiety scores in experimental group vs controlsOverall, interventions that reduced stress in medical students included MBSR or meditation techniques, pass/fail grading, and self-hypnosis.	CL

Author, year	CMHP	Intervention(s) and Comparator(s)	No of studies (sample size) Population	Effect Measure	Effect Size (95% CI)	Results	AMSTAR-2 judgement
McConville et al.,2017	• **Anxiety** • **Depression** • **Stress**	**Anxiety:** • Mindfulness-based stress reduction: • Behaviour Medicine i.e. med-body scan, sitting meditation, hatha yoga and didactic presentations on stress vs wait list control • Didactic teaching, mindful and loving kindness meditation, gratitude, mindful movement in medical student's vs no control • Fourth year medicine (psychiatry rotation) vs no control • Sessions on mindfulness-based stress management via mindful gym program DVD in first – third year medicine vs no control • Formal mindfulness practice/application, hatha yoga, loving kindness, mindful listening in Pre-med, first- and second-year medical students vs enrichment elective • Thirty-minute guided mindfulness practice CD and adherence diary in medical students last 2 years vs usual care • Mind-body skills course: • Weekly large group presentation and homework in second year medical student's vs no control • Greater mindful awareness of breath meditation • In medical students (psychiatry rotation) vs activity in another room **Depression:** • Mindfulness-based stress reduction: • Behavioural medicine (Kabat Zinn) vs waitlist control • Didactic teaching, mindful and loving kindness meditation, gratitude, mindful movement in fourth-year medicine (psychiatry rotation) vs no control • DVD delivered mindfulness-based stress management in first to third year medical students vs no control • Pre-med, first-, and second-year medical students vs wait list control • 30 minute-guided mindfulness practice CD and adherence diary vs usual care • Greater mindful awareness of breath meditation in medical students (psychiatry rotation) vs activity in another room e.g. reading **Stress:** • Mind-body skills course: • Weekly large group presentations 30 minutes and	Total: 19 (1,815) Healthcare Professional Students **Anxiety:** 11 (679) **Depression:** 7(430) **Stress:** 11 (954)	SMD	**Anxiety:** SMD −0.44 (−0.59 to −0.28) **Depression:** SMD −0.54 (−0.83 to −0.26) **Stress:** SMD −0.44 (−0.57 to −0.31)	• MA showed a significant effect favouring mindfulness-based stress reduction for anxiety. • MA found a significant effect in favour of mindfulness as an intervention for depression. • MA showed a significant effect favouring mindfulness as an intervention for stress.	M

Author, year	CMHP	Intervention(s) and Comparator(s)	No of studies (sample size) Population	Effect Measure	Effect Size (95% CI)	Results	AMSTAR-2 judgement
Daya & Hearn, 2018	• **Burnout** • **Depression** • **Stress**	**Burnout:** Mindfulness based stress reduction: • Body scans, mindful movement, hatha yoga, sitting meditation, mindful awareness of daily routines) vs control • Physical and mental exercises increasing mindfulness, didactic teaching on mindfulness, stress management vs control Body scan, sitting meditation, yoga meditation, home practice vs no control **Depression:** Mindfulness based courses: • Meditation, guided imagery, journal writing vs control • MBSR: body scan, raisin exercise, awareness of breath, yoga, walking with waitlist control • Mindfulness based medical practice course: body scan, sitting meditation, yoga, meditation, group discussion vs no control • Health Enhancement program: mindfulness practices, related cognitive strategies vs no control • Mindfulness meditation: body scan, sitting meditation, Hatha yoga, walking meditation vs control • Mindful-Gym: DVD delivered mindfulness vs control • MBSR: body scans, breath awareness, mindful stretching, eating, meditation vs no control • MBSR: sitting meditation, body scan, hatha yoga vs control Audio-guided mindfulness vs control. **Stress:** Mindfulness based stress reduction: • Yoga postures, breathing techniques, meditation, stress management techniques) vs no control • Meditation, guided imagery, journal writing vs control • Body scan, raisin exercise, awareness of breath, yoga, walking, meditation, loving kindness vs waitlist control • Physical and mental exercises increasing mindfulness, didactic teaching on mindfulness vs control • MBSR course: Body scan, sitting meditation, yoga meditation, home practice exercises vs no control • Health Enhancement Program: Mindfulness practices, related cognitive strategies, raise awareness to underpinning stress vs no control • DVD delivered mindful body stretching and relaxation, mindful breathing vs control • Sitting meditation, body scan, hatha yoga, loving kindness, and forgiveness meditation Audio-guided mindfulness vs control	Total: 12 (1,197) Medical Students **Burnout:** **3 (374)** **Depression: 9 (854)** **Stress: 11 (1,169)**	p-value	Not reported	**Burnout:** • Two studies reported no significant reduction in burnout: • (p=0.204) for physical and mental exercises and (p value not reported) • One study reported the burnout subscale to be significantly reduced (p=0.001) for body scan, sitting meditation etc. **Depression:** • Five studies reported significant reductions in depression: • (p=0.001) for MBSR body scan, sitting meditation etc • (p=0.01) for Health Enhancement Program • (p=0.003) for Mindful-Gym DVD delivered mindfulness • (p=0.09) for MBSR: body scans, breath awareness, mindful stretching • (p=<0.006) for MBSR sitting meditation, body scan etc. **Stress:** • Four studies reported an improvement in stress levels, 2 reported no change and 1 reported an increase in stress. • (p=0.019) for MBSR: body scan, raisin exercise, awareness breath • (p=0.001) for mindfulness-based medical practice course: body scan, sitting meditation • (p=0.006) for Mindful-Gym • (p=0.05) for audio-guided mindfulness Mindfulness-based interventions had mixed evidence in reducing burnout, depression, and stress in undergraduate medical students.	M

Author, year	CMHP	Intervention(s) and Comparator(s)	No of studies (sample size) Population	Effect Measure	Effect Size (95% CI)	Results	AMSTAR-2 judgement
Walsh et al., 2019	**Burnout**	• Wellness curriculum • Duty hours changes • Exercise program • Professional development coaching programme • Stress management programme • Complementary and alternative medicine course • Debriefing curriculum • Mindfulness-based stress reduction • Psychotherapeutic training in BATHE technique**No comparison groups**	Total: 14 (1,552) Medical Students Junior Doctors	p-value	Not reported	• Wellness curriculum – no significant differences in the MBI categories. • Duty hours changes: significant worsening in DP (p=0.03) and EE (p=0.02) and significant improvement in overall burnout (p=0.007), and EE (p=0.056) • Professional development coaching programme: no significant differences in MBI categories. • Exercise program: no significant differences in MBI categories. • Complementary and alternative medicine course: significant improvement p<0.01 • Respiratory one method program: significant improvement in EE (p<0.05) • Stress management program: no significant differences in MBI scales • Debriefing curriculum: no significant differences in MBI scales • Mindfulness-based stress reduction program: no significant changes in any MBI categories. • Self-administered psychotherapeutic training in BATHE technique showed no significant changes in MBI categories.Six out of the 14 included studies found statistically significant changes to burnout scores, with five reporting improvement and one reporting worsening of burnout.	M

Author, year	CMHP	Intervention(s) and Comparator(s)	No of studies (sample size) Population	Effect Measure	Effect Size (95% CI)	Results	AMSTAR-2 judgement
Witt et al., 2019	**Anxiety** • **Burnout** • **Depression** • **Stress** • **Suicidal Ideation / Behaviour**	**Anxiety** • Six-sessions of manualised group-based stress management vs standard university courses with no intervention • Daily omega-3 fatty acids supplementation vs capsules containing mixture palm, olive, soy, canola, and coco butter oils • Four-month course of stress management and relaxation program vs wait-list control • Six-week course of weekly mindfulness sessions vs treatment as usual • Eight-week course of mindfulness vs no intervention • Counselling and relaxation vs no intervention • Eight-week CD guided mindfulness with waitlist vs no control • Nineteen-week self-hypnosis and relaxation programme vs no specific intervention but controls completed a daily diary • Stress management training vs single seminar on stress management • Three-week stress management program vs no specific intervention • Ten-week course of mind-body skills training vs sessions of complementary and alternative medicine • One-month program of daily yoga vs no control • Psychoeducational lecture vs no controls • Mind-body skills training vs no control • Mindfulness based intervention for the prevention of stress • Muscle relaxation training intervention vs no controls • Visual journaling vs no controls **Burnout** • Mindfulness-based stress reduction program with no treatment for the prevention of burnout in medical student's vs standard university courses with no intervention • Mindfulness programmes vs no controls • Semester long program for the prevention of burnout vs no controls	Total: 39 (7,387) Medical Students **Anxiety:** **22 (3,011)** **Burnout:** **3 (388)** **Depression** **26 (5,320)** **Stress:** **16 (1,324)** **Suicidal Ideation:** **1 (102)**	OR SMD	**Anxiety** SMD −0.62 (−1.63 to 0.38) **Burnout** SMD − 0.13 (−0.36 to 0.10)	Mindfulness-based stress management interventions may be effective in reducing anxiety, depression, and stress levels in medical students in both the short-term and long-term, however, the effects on suicidal ideation are still unclear. No evidence was reported of any significant effect on burnout.	H

Author, year	CMHP	Intervention(s) and Comparator(s)	No of studies (sample size) Population	Effect Measure	Effect Size (95% CI)	Results	AMSTAR-2 judgement
		Depression			**Depression**		
		• Psycho-educational intervention with no treatment for prevention of depression in 1st and 2nd year medical student's vs wait-list			SMD		
		• Daily omega-3 fatty acids supplementation vs capsules containing mixture palm, olive, soy, canola and coco butter oils			− 0.52 (−1.18 to 0.13)		
		• Six-week course of weekly mindfulness sessions vs treatment as usual					
		• Eight-week course of mindfulness vs no intervention					
		• Counselling and relaxation vs no intervention					
		• Eight-week CD guided mindfulness with waitlist vs no control					
		• Nineteen-week self-hypnosis and relaxation programme vs no specific intervention but controls completed a daily diary					
		• Four-hour psychoeducational and problem-oriented stress management program vs no specific intervention					
		• Mind-body skills training with no treatment vs no specific intervention					
		• Stress management training vs single seminar on stress management					
		• Ten-week course of mind-body skills training vs sessions of complementary and alternative medicine					
		• Psychoeducation intervention vs no specific intervention					
		• Interventions designed to prevent depression vs no intervention					
		• One-month program of daily yoga vs no control					
		• Psychoeducational lecture vs no controls					
		• Mind-body skills training vs no control					
		• Mindfulness based intervention for the prevention of stress					
		• Muscle relaxation training intervention vs no controls					

Author, year	CMHP	Intervention(s) and Comparator(s)	No of studies (sample size) Population	Effect Measure	Effect Size (95% CI)	Results	AMSTAR-2 judgement
		Stress • Manualised mindfulness-based stress reduction program with wait-list control • Mindfulness-based stress reduction program with no treatment for the prevention of stress in medical student's vs standard university courses with no intervention • Five-week mindfulness-based stress reduction program vs intervention materials in full on DVD • Eight-week CD guided mindfulness with waitlist vs no control • Four-hour psychoeducational and problem-oriented stress management program vs no specific intervention • Mind-body skills training with no treatment vs no specific intervention • Stress management training vs single seminar on stress management • Self-development program to prevent stress vs no specific intervention • Eleven session program of manualised mind-body skills training vs no control • Psychoeducational lecture vs no controls • Establishment of a dedicated hotline for the prevention of stress vs no controls • Hatha yoga vs no controls **Suicidal Ideation** • Interventions designed to prevent depression vs no intervention			**Stress** SMD −0.66 (−1.32 to −0.00) **Suicidal Ideation** OR 0.07 (0.05 to 1.36)		

Author, year	CMHP	Intervention(s) and Comparator(s)	No of studies (sample size) Population	Effect Measure	Effect Size (95% CI)	Results	AMSTAR-2 judgement
Kunzler et al., 2020	• **Anxiety** • **Depression** • **Stress**	**Anxiety, Depression and Stress:** • Guided mindfulness practice via CDs no control intervention • Your Enlightened Side (YESplus) vs attention control "wisdom on wellness" • RCI session vs no intervention • Psycho-educative seminar+individual coaching vs no intervention • Guided mindfulness practice vs TAU **Anxiety and Depression** • Multidimensional stress intervention/prevention programme vs waitlist control • Stress-management based cognitive behavioural group treatment vs wait-list control • Positive psychological oriented group counselling vs unspecific control group **Depression** • Mindset intervention vs attention control • Persona Model of Resilience vs attention control and wait-list control **Stress:** • Brief Mindfulness-based Compassion vs waitlist control • NURSE (Nurture Nurse, Use resources, foster resilience, stress, and environment management) vs active control (booklet or worksheet, self-guided) • Abridged MBSR vs no intervention • Brief MBSR programme vs wait-list control • Resilience curriculum vs wait-list control • Educational Intervention by Twitter to enhance resilience vs attention control • Positive psychological intervention vs and informative stress intervention vs wait list control	Total: 30 (2,680) Healthcare Students **Anxiety** **9 (362)** **Depression** **10 (332)** **Stress** **13 (420)**	SMD	**Anxiety post intervention:** SMD −0.45 (−0.84 to −0.06) **Depression:** SMD −0.20 (−0.52 to 0.22) **Stress or stress perception:** SMD −0.28 (−0.48 to −0.09)	Healthcare students who underwent resilience training reported greater levels of resilience and decreased levels of anxiety, stress, and perceived stress. There was little to no proof that resilience training had any impact on depression.	H

Author, year	CMHP	Intervention(s) and Comparator(s)	No of studies (sample size) Population	Effect Measure	Effect Size (95% CI)	Results	AMSTAR-2 judgement
Sekhar et al., 2021	• **Anxiety** • **Burnout** • **Depression** • **Stress**	Mindfulness Interventions: **Anxiety, Burnout and Stress** • PITSTOP Group (Pause, Inhale, take note of your Self and Task at hand, observe experience without judgement and Proceed with the task or activity when ready) vs control Tweak Your Weekly Group (YouTube videos) **Anxiety, Depression and Stress** • Mindfulness course given over 6 weeks to large groups during two-hour encounters vs theoretical content shown through organisational aspects of medical school • Mindfulness Meditation Program (MMP) vs waiting list control **Stress** • Mindfulness-Based Stress Reduction study group vs no intervention • Mindfulness-Based stress management, 2hours per week and at home self-directed meditation vs control group who received the program in the form of a DVD 6 months later • Headspace Smartphone Application vs controls completed all questionnaire at the same time points as the intervention group and placed on a waiting list to receive Headspace subscription. **Burnout and Stress** • Mindfulness 2-weekly, one hour workshops vs extra hour break time in the middle of each of the day each week. **Burnout, Depression and Stress** • Modified mindfulness-based stress reduction weekly 2-hour classes vs similar protected class time, home practice requirements and retreat-hike information. **Anxiety and Depression** • Meditation group – breathing meditation concept based on the Buddhist Anapanasti Meditation vs control subjects went about activities (reading, chatting, napping) in another room. **Depression** • Mindfulness Stress Reduction Training once weekly, 2-hour sessions vs control (nil active intervention or mindfulness-based therapy for 8 weeks)	Total: 10 (731) Medical Students Junior doctors **Anxiety:** **4 (255)** **Burnout:** **3 (91)** **Depression:** **4 (250)** **Stress:** **8 (707)**	SMD	**Anxiety:** SMD 0.09 (−0.33 to 0.52) **Burnout:** SMD −0.42 (−0.84 to 0.00) **Depression:** SMD 0.06 (−0.19 to 0.31) **Stress immediately post-intervention:** SMD −0.36 (−0.60 to −0.13) **Stress at later time points:** SMD −0.43 (−0.69 to −0.17)	**Anxiety:** mindfulness therapies did not provide any substantial difference immediately post-intervention. **Burnout:** There was no significant difference immediately post-intervention. **Depression:** There was no significant difference immediately post-intervention. **Stress:** Immediately post intervention, there was a small substantial difference for stress in favour of mindfulness therapies.	H

Author, year	CMHP	Intervention(s) and Comparator(s)	No of studies (sample size) Population	Effect Measure	Effect Size (95% CI)	Results	AMSTAR-2 judgement
Yogeswar-an & El Morr, 2021	• **Burnout** • **Stress**	**Online Mindfulness interventions** **Burnout** • MIND-MED: 7 online modules on the basics of mindfulness with **no control group** **Stress** • Mindfulness Training Program: Mini lectures and a guided mindfulness meditation session with **no control group**	Total: 2 (99) Medical Students **Burnout: 1 (52)** **Stress: 1 (47)**	**Burnout:** **Personal Achievement: (p=0.55)** **Emotional Exhaustion: (p=0.51)** **Depersonalisation: (p=0.71)** **Stress:** **SCS scores increased in 8-week and 4-month follow up (p=0.05)**	Not reported Not reported	**Burnout:** • There was no significant change in all aspects of the MBI. **Stress:** • There was a significant change at follow-up in Perceived Stress Scale • Participants with more stress at baseline had a more significant reduction in stress levels at four-month follow-up (p=0.0005)	M
Hathaisaard et al, 2022	• **Burnout** • **Stress**	**Mindfulness-based interventions:** • Mobile mindfulness (taking notice of the body at rest, breathing with intention, sensing emotions, acknowledging thoughts without judgement) • MBSR (meditation, body scans, managing stress) • Mindfulness based stress prevention training for medical students (meditation, observing thoughts, self-tolerance skills, acceptance etc) • Mindfulness based stress management: relaxing, grateful moments in life, mindful stretching • Mindfulness techniques: discussion, exercise and body scans, awareness of thoughts, breathing exercise, etc) • Audio-guided mindfulness practice • Hypnosis • Tai Chi Chuan	Total: 6 (689) Medical Students **Burnout: 1 (288)** **Stress: 6 (689)**	**Burnout:** Not reported **Stress:** **SMD** Immediate effect: p=0.01 6-month follow up: p=0.02	**Burnout:** Not reported **Stress:** **Immediate effect:** SMD 0.29 (0.07 to 0.51), **6-month follow up:** SMD 0.31 (0.06 to 0.55)	Mindfulness-based interventions are effective in reducing short- and long-term subjective stress in medical students and its effects on burnout are presently inconclusive.	M
Krishnan et al, 2022	• **Anxiety** • **Stress**	**Anxiety** • Mental Practice • Preparation for Practice Course • Undergoing Assistantship prior to starting FY2 **Stress** • Mental Practice • Mindfulness course delivered by Breathworks • Mentorship (assistantship) programme with senior trainees	Total: 7 (330) Newly Qualified Doctors **Anxiety: 3 (218)** **Stress: 3 (82)**	p-value	Not reported	**Anxiety:** • Mental practice decreased anxiety and was statistically significant (p<0.05) • Undergoing assistantship was statistically significant in reducing anxiety (p<0.03) **Stress:** • Mental practice decreased stress and was statistically significant (p<0.05) • Mindfulness course delivered by Breathworks decreased stress and was statistically significant (p=0.04) • Mindfulness courses, clinical preparation courses, and mentorship programmes were identified to improve stress or anxiety.	M

MA=Meta-Analysis, SDM/SMD=standardised difference in means, OR=odds ratio; H=high, M=moderate, L=low, CL=critically low.

Full diagnostic interviews are a more reliable assessment method. The heterogeneous study populations varied widely in locations, course structure and cultures, which may introduce various confounding variables that may influence the participation in studies and reporting of common mental health problems. Similarly, the intervention reviews had varying lengths of follow-up times and often, the absence of comparators made it challenging to draw reliable conclusions. Due to time constraints, only English language publications were included, therefore, one non-English review with no translation was not considered; this is acknowledged as a limitation of this overview. Only two reviews compared prevalence rates across groups (i.e. students from other faculties). The degree of overlap between reviews in terms of included studies was not quantified. Finally, the definitions of mindfulness-based interventions and MBSR varied considerably across reviews and between studies included in the same reviews rendering it challenging to make proper comparisons and draw conclusions. Apart from mindfulness-based interventions and MBSR, few attempts have been made to explore other possible interventions.

Future directions and conclusions

Implications for practice

Medical training establishments should recognise that junior doctors and medical students are susceptible to high prevalence rates of common mental health problems. Interventions to mitigate common mental health problems should be offered to junior doctors and medical students, incorporated into medical curricula, and tailored to cultural contexts.

Implications for research

For future research, a consensus on common mental health problem definitions, valid cut-off scores, and validated outcome measures should be consistent across the field; this can be achieved by following the WHO and ICD-10 standardised definitions. Additionally, screening for co-morbid psychiatric disorders (e.g. eating disorders), and accurately reporting the data by following the Strengthening the Reporting of Observational Studies in Epidemiological guidelines (von Elm et al., 2008).

There is a need to standardise the definitions of mindfulness-based interventions, MBSR and for improved comparators to allow for fair comparisons between interventions and controls. There is a suggested benefit of extending intervention durations to up to 8-weeks (Yusoff, 2014) along with implementing longer follow-up periods to understand the long-term effects (Rotenstein et al., 2016). Comprehensive baseline diagnostics i.e. clinical interviews may be beneficial to enhance the reporting of pre-existing common mental health problems. Enhanced reporting of intervention studies is required, by following the international CONSORT statement (Schulz et al., 2010). Evidence suggests that mindfulness-based interventions may play a role in addressing common mental health problems and, therefore, future research should focus on this theoretical-based intervention and provide more robust evidence on its effects.

Finally, future studies should recruit more males and be conducted in low-middle-income countries to reach robust conclusions. Research on different formats of interventions (mobile-based, online) (Haberer et al., 2013) is also desirable.

Unsurprisingly, junior doctors and medical students have high prevalence rates of common mental health problems, which reinforces the need for more focused mental health strategies. Mental health improvements could be achieved by appropriate interventions that would result in a stronger and healthier medical workforce.

Notes

1. Component of PICO.
2. Review Protocol.
3. Explanation for study design.
4. Comprehensive literature search strategy.
5. Study selection in duplicate.
6. Data extraction in duplicate.
7. List of excluded studies and justification for the exclusions.
8. Study characteristics.
9. Satisfactory technique for assessing the risk of bias.
10. Sources of funding.
11. Appropriate methods.
12. Assess potential impact of risk of bias on results.
13. Account for risk of bias when interpreting the results.
14. Satisfactory explanation for, and discussion of any heterogeneity.
15. Publication bias assessed and discussed.
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32. Potential sources of conflict of interest.

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Appendix 1. Table of acronyms.

Acronym	Definition
AMSTAR-2	A Critical Appraisal Tool for Systematic Reviews 2
BAI	Beck Anxiety Inventory
BDI	Beck Depression Inventory
CBT	Cognitive Behavioural Therapy
CI	Confidence Interval
CONSORT	Consolidated Standards of Reporting Trials
COVID-19	Coronavirus 19 Pandemic
GAD-7	Generalised Anxiety Assessment
GHQ	General Health Questionnaire
ICD-10	International Classification of Disease 10th revision
MBI	Maslach Burnout Inventory
MBSR	Mindfulness-based Stress Reduction
MeSH	Medical Subject Headings
NHS	National Health Service
OCI-R	Obsessive Compulsive Inventory – Revised
OR	Odds Ratio
PHQ	Patient Health Questionnaire
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
SCL-90	Symptom Checklist-90
SMD	Standardised Mean Difference
UK	United Kingdom
US	United States
WHO	World Health Organisation

Appendix 2. Search strategy MEDLINE (ovid).

Prevalence

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions <1946 to May 16, 2022>

#	Query	Results from 17 May 2022
1	exp Students, Medical/	40,804
2	(student adj3 doctor).tw.	216
3	(student adj3 physician).tw.	354
4	(junior adj3 doctor).tw.	626
5	((foundation or trainee) adj3 doctor).tw.	124
6	exp "Internship and Residency"/	57,450
7	1 or 2 or 3 or 4 or 5 or 6	94,953
8	exp Mental Health/	54,097
9	exp Mental Disorders/	1,380,221
10	(mental adj3 distress).tw.	3,540
11	exp Depression/	142,040
12	depressive symptoms.tw.	59,017
13	(low adj3 mood).tw.	1,356
14	exp Anxiety/	103,962
15	exp Anxiety Disorders/	87,161
16	exp Stress Disorders, Post-Traumatic/	38,869
17	PTSD.tw.	29,403
18	stress.tw.	871,150
19	exp Burnout, Psychological/	16,031
20	exp Psychological Distress/	5,996
21	exp Suicidal Ideation/	10,959
22	(suicidal adj3 thoughts).tw.	3,549
23	8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22	2,349,593
24	exp "Systematic Review"/	200,514
25	exp Meta-Analysis/	163,294
26	24 or 25	277,368
27	7 and 23 and 26	94

Interventions

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions <1946 to May 16, 2022>

#	Query	Results from 17 May 2022
1	exp Students, Medical/	40,804
2	(student adj3 doctor).tw.	216
3	(student adj3 physician).tw.	354
4	((junior or foundation or trainee) adj3 doctor).tw.	626
5	exp "Internship and Residency"/	57,450
6	1 or 2 or 3 or 4 or 5	94,860
7	exp Mental Health/	54,097
8	exp Mental Disorders/	1,380,221
9	(mental adj3 distress).tw.	3,540
10	exp Depression/	142,040
11	(depressive adj3 symptoms).tw.	62,634
12	(low adj3 mood).tw.	1,356
13	exp Anxiety/	103,962
14	exp Anxiety Disorders/	87,161
15	exp Stress Disorders, Post-Traumatic/	38,869
16	PTSD.tw.	29,403
17	stress.tw.	871,150
18	exp Burnout, Psychological/	16,031
19	exp Psychological Distress/	5,996
20	exp Suicidal Ideation/	10,959
21	(suicidal adj3 thoughts).tw.	3,549
22	7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21	2,350,233
23	interventions.tw.	563,212
24	counselling.tw.	30,731
25	exp Cognitive Behavioral Therapy/	34,435
26	CBT.tw.	12,959
27	exp Mindfulness/	5,488
28	(mindfulness-based adj3 interventions).tw.	1,196
29	(wellness adj3 interventions).tw.	193
30	23 or 24 or 25 or 26 or 27 or 28 or 29	619,489
31	exp "Systematic Review"/	200,514
32	exp Meta-Analysis/	163,294
33	31 or 32	277,368
34	6 and 22 and 30 and 33	43

Appendix 3. Data extraction forms.

Prevalence

Review ID (Review Title, Author, Year, Journal)	Publication Dates	Scope of the Review	Target Population/ Population Description	Number of Participants	Number of Included Studies	Type of CMHP	Review Outcomes / Findings

Interventions

Review ID (Review Title, Author, Year, Journal)	Publication Dates	Scope of the Review	Target Population/ Population Description	Number of Participants	Number of Included Studies	Type of CMHP	Intervention(s)	Comparator(s)	Outcome Measures	Review Outcomes / Findings

Appendix 4. Summary Table on the mental health outcome measuring tools – prevalence.

Author, Year	CMHP	Validity of Reporting Measure(s)	Mental Health Outcome Measuring Tools			
IsHak et al., 2013	**Burnout**	Validated	• MBI • GHQ • Primary Care Evaluation of Mental Disorders	• HP5-I • PBSE-scale	• OLBI • HESI	• MDI • MINI
Bacchi & Licinio, 2015	**Depression**	Validated	• DAS-21 • HADS	• PHQ-9 • PHQ	• MDI • BDI	• HRSR
Hope & Henderson, 2014	**Anxiety**	Mixture of validated and non-validated	• BAI • DASS • HADS	• EST-Q • BSI-ANX	• SIAS • SWLS GAD	• IPAT anxiety scale • BDI TMAS
	Depression		• BDI • DASS • HADS	• MDI • MINIPMSS	• BSI-DEP • DDRS • HAM-D	• PHQ • SDS • SRQ-20 • CES-D
	Psychological Distress		• SRQ-20 • DASS • GHQ-12 SOC	• Stress vulnerability scale • BSI-DEP • GHQ-28	• AKUADS • K10 • GHQ	• MHI-5 • BMA student survey questionnaire
Cuttilan et al., 2016	**Anxiety**	Mixture of validated and non-validated	• BAI • HAD	• AKUADS	• ISSH	• SCL-90
	Depression		• AKUADS • BDI	• HADS • ISSH	• SDS • SCL-90	• ZDS
	Suicidal thoughts		• BDI			
Lei et al., 2016	**Depression**	Mixture of validated and non-validated	• BDI • CES-D	• DEQ • DSI	• SDS • HAMD	• PHQ • SCL-90-R
Puthran et al., 2016	**Depression**	Validated	• BDI • Oxford Happiness Inventory	• Zung Depression Scale	• GHQ-12	• Coping strategies scale
	Suicidal Ideation		• PHQ-9	• Suicide Behaviours Questionnaire	• Social Demographic survey	
Rotenstein et al., 2016	**Depression or Depressive Symptom**	Mixture of validated and non-validated	• HADS • AKUADS • BDI • Brief symptom inventory depression scale • Center for Epidemiological Studies Depression Scale • 21-item Depression Anxiety Stress Scale, Emotional State Questionnaire	• Derogatis Stress Profile Score • General Depression Scale Short Form • 12-Item General Health Questionnaire • 28-Item General Health Questionnaire • Health Related Self-Reported Score • Kessler Psychological Distress Score	• Kutcher Adolescent Depression Scale • Major Depression Inventory • Mini International Neuropsychiatric Interview • Minnesota Multiphasic Personality Inventory-Depression Scale • 9-Item Patient Health Questionnaire • Primary Care Evaluation of Mental Disorders	• Patient Reported Outcomes Measurement Information System Score • Quick Inventory of Depressive Symptomatology • 90-Item Symptom Checklist • Thai Depression Inventory Scale • Zhung Self Rating Depression Scale • Zhung Self-Rated Depression Scale Short Form
	Suicidal Thoughts		• Beck Scale for Suicidal Ideation • Mini International Neuropsychiatric Interview	• Revised Suicidal Behaviours Questionnaire	• Suicidal Ideation Over Past Month • Suicidal Ideation over Past 12 months (28-GHQ, Meehan Inventory, Paykel Inventory)	• Suicidal Ideation over Past 2 weeks (9-PHQ, Primary Care Evaluation of Mental Disorders)
Chunming et al., 2017	**Burnout**	Validated	• MBI-GS • LRS	• MBI-SS • Li et al. 2021 Burnout scale	• MBI-HSS	• MBI (version not stated).
Pacheco et al., 2017	**Anxiety** **Burnout** **Depression** **Obsessive Compulsive Disorder**	Mixture of validated and non-validated	• STAI-T • MBI-HSS • BDI • OCI-R	• HADS	• STAI • BDI-II	• BAI
	Stress		• LSSI		• GHQ	

Author, Year	CMHP	Validity of Reporting Measure(s)	Mental Health Outcome Measuring Tools			
Coentre & Góis, 2018	**Suicidal Ideation**	Mixture of validated and non-validated	• BDI • BSI	• Suicide Behaviours Questionnaire	• PHQ-9	• Kutcher Adolescent Depression Scale • GHQ
Erschens et al., 2019	**Burnout**	Validated	• MBI-HSS • MBI-SS	• MBI0GS • AVEM	• OLBI • CBI	
Frajerman et al., 2019	**Burnout**	Validated	• MBI		• CBI	
Low et al., 2019	**Burnout**	Validated	• MBI	• Abbreviated MBI		
Mao et al., 2019	**Anxiety**	Mixture of validated and non-validated	• BAI • HAMA	• SAS • SLS	• SCL-90	• PSSS
	Depression		• BDI • CES-D • SDS	• EPQ • LES • SLS	• HAMA • SCL-90 • PSSS	• ASLEC • CCSAS
Quek et al., 2019	**Anxiety**	Mixture of validated and non-validated	• DASS-21 • ZSAS	• BAI-21 • EST-Q	• HADS-A • GAD-7	• STAI • SQ-48-A
Zeng et al., 2019	**Anxiety**	Mixture of validated and non-validated	• Zung's Self-Rating Anxiety Scale	• BAI	• SCL-90	
	Depression		• BDI • SDS	• Center for Epidemiologic Studies Depression Scale	• PHQ-9	• SCL-90
	Suicidal Ideation		• Beck Hopelessness Scale	• PHQ-9	• US National Comorbidity Survey	
Galaiya et al., 2020	**Burnout**	Mixture of validated and non-validated	• MBI			
Lasheras et al., 2020	**Anxiety** **Depression**	Validated	• GAD-7 • PHQ-9	• STAI-6 • BDI	• BAI • DASS-21	• DASS-21
Zhou et al., 2020	**Burnout**	Mixture of validated and non-validated	• MBI • GHQ • 1,3-Single-item scale for burnout validated against MBI, professional quality of life scale	• 1,2 Professional Quality of Life Scale • Copenhagen Burnout Inventory and work satisfaction • 1,3, MBI and GHQ	• Own burnout questionnaire • 1,2-item burnout measure validated again MBI	• 2,3, Depression Anxiety Stress Scale • Measuring emotional state every 90 mins throughout duty shift
	Stress		• Kessler-10 psychological distress instrument • Workplace Stress Scale	• Recovery Stress Questionnaire • Sources and amount of perceived stress • GHQ • Cooper Job Stress Questionnaire (modified version)	• Measures perception and sources of stress and perception of wellbeing • Perception of stress • 4-iten academic stress scale • 2, List of stressors	• Occupational Stress Index • General work-related psychological strain • Recovery stress questionnaire
Li et al., 2021	**Burnout**	Mixture of validated and non-validated	• MBI-SS • Maslach C	• Rong Lian scale	• Yongxin Li	• Qizhi Zhang
Naji et al., 2021	**Burnout**	Validated	• MBI			
Santabárbara et al., 2021	**Depression**	Validated	• PHQ-9	• BDI-II	• CES-D	• DASS-21
Jia et al., 2022	**Anxiety**	Mixture of validated and non-validated	• BAI-21 • HADS	• GAD-7 • DASS-21	• DASS-42 • SAS	• STAI-A
	Depression		• PHQ-9 • HADS	• DASS-21 • DASS-42	• SDS • BDI-II	• GAD-7 • CES-D
Lawlor et al., 2022	**Burnout**	Validated	• MBI	• Mini-Z Burnout Assessment		
Shah et al., 2023	**Burnout**	Mixture of validated and non-validated	• MBI • MBI-HSS • PHQ-9 • EPWBI • ESS	• PWBI • 90-item questionnaire • OBI • Resident wellbeing index • Utrecht WES	• Job Descriptive Index • PROMIS-29 • MHI-5 • Self-reported burnout • CBI	• 16-item questionnaire • 1-item questionnaire • QOLS • SPFI • PSS

Legend:.

- AKUADS – Aga Khan University Anxiety and Depression Scale.
- ASLEC – Adolescents Self-Rating Life Events Checklist.
- AVEM – Arbeitsbezogene Verhaltens- und Erlebensmuster i.e. The Measure of Coping Capacity Questionnaire.
- BAI – Beck's Anxiety Inventory.
- BDI – Beck's Depression Inventory.
- BDI TMAS – Beck's Depression Inventory Taylor Manifest Anxiety Scale.
- BSI – Beck's Scale for Suicide Ideation.
- BSI-ANX – Brief Symptom Inventory Anxiety.
- BSI-DEP – Brief Symptom Inventory Depression.
- CBI – Copenhagen Burnout Inventory.
- CCSAS – Chinese College Student Adjustment Scale.
- CES-D – Centre for Epidemiology Studies Depression Scale.
- DAS-21 – Depression Anxiety and Stress Scale-21.
- DDRS – Depression Rate Scale.
- DEQ – Depression Experience Questionnaire.
- DSI – Depression Screening Instrument.
- EPQ – Extended Project Qualification.
- EPWBI and PWBI – Expanded Physician Well Being index.
- EST-Q – Emotional State Questionnaire.
- GAD-7 – Generalised anxiety Disorder Scale.
- GHQ – General Health Questionnaire.
- GHQ-12 SOC – the Twelve Item General Health Questionnaire Sense of Coherence.
- HADS – Hospital Anxiety and Depression Scale.
- HAM-A – Hamilton Anxiety Rate Scale.
- HAM-D – Hamilton Depression Rate Scale.
- HESI – Higher Education Stress Inventory.
- HP5-I – Health Personality perspective inventory.
- HRSR – Health related self-report.
- IPAT – Anxiety Scale Intensive Care Psychological Assessment Tool Anxiety Scale.
- K10 – Kessler Psychological Distress Scale.
- LRS – Lian Rong Survey.
- LSSI – Lipp's Stress Symptoms Inventory.
- MBI – Maslach Burnout inventory.
- MBI-HSS – Maslach Burnout Inventory-Human Services Survey.
- MBI-SS – Maslach Burnout Inventory-Student Survey.
- MDI – Major Depression Inventory.
- MHI-5 – Mental Health Inventory.
- Mini – Mini Z Instrument.
- OCI-R – Obsessive Compulsive Inventory-Revised.
- OLBI – Oldenburg Burnout Inventory.
- PBSE-scale – Performance-based self -esteem.
- PHQ-9 – Patient Health Questionnaire-9.
- PSS – Perceived Stress Scale.
- QOLS – Quality of Life Scale.
- SAS – Self-Rating Anxiety Scale.
- SCL-90 – Symptom Checklist -90.
- SDS – Self-rate Depression Scale.
- SIAS – Social Interaction Anxiety Scale.
- SPFI – Suicide Prevention Fundamental instructions.
- SQ-48-A – Symptom Questionnaire 48 Anxiety.
- SRQ-20 – Self Reporting Questionnaire.
- STAI/STAI-T – Sate-Tait Anxiety Inventory-Trait Scale.
- SWLS GAD – Satisfaction with Life Scale Generalised Anxiety Disorder Scale.
- ZDS – Zung Depression Scale.
- ZSAS – Zung Self-Rating Depression Scale.

Appendix 5. Summary Table on the mental health outcome measuring tools – interventions.

Author, Year	CMHP	Validity of Reporting Measure(s)	Mental Health Outcome Measuring Tools			
Regehr et al., 2014	**Burnout** **Stress**	Validated	• MBI • PSS • STAI	• POMS • ESSI	• MBI SCL-5 • SCL-90	• POMS
Shiralkar et al., 2013	**Stress**	Validated	• POMS • BSI • UCLA Loneliness Scale • PSS • TAI • MOSSF-8	• MBI • GHQ • Stress Incident Record • PCS • DASS	• Hopkins Symptoms Checklist • STAI-1 Empathy Construct Rating • SCL-90	• BD-II • MEQL • Perceived Stress and Support
McConville et al., 2017	**Anxiety** **Depression** **Stress**	Mixture of validated and non-validated	• STAI-1 • DASS-21 • POMS	• DASS-21	• POMS • DASS-21	
Daya & Hearn, 2018	**Burnout** **Depression** **Stress**	Mixture of validated and non-validated	• MBI • Symptom Checklist-90 Revised • PSS	• DASS-21 • DASS-21	• BDI • PMSS	• GHQ
Sekhar et al., 2021	**Anxiety** **Burnout** **Depression** **Stress**	Mixture of validated and non-validated	• DASS-21 • CBI • DASS-21 • DASS-21			
Walsh et al., 2019	**Burnout**	Validated	• MBI (EE, DP, PA, MBI GS)			
Witt et al., 2019	**Anxiety**	Mixture of validated and non-validated	• DASS • STAI • POMS • State-Trait Anxiety Index	• Spielberger Trait Anxiety Inventory	• BAI • BSI • GHQ-28	• GAD-7 • SCL-90 • SCL-90-R • General Wellbeing Scale
	Burnout		• MBI	• Human Services Survey	• Burnout Symptoms Scale	• BOS-II
	Depression		• BDI-II • SCL-90-R • POMS • General Wellbeing Scale	• DASS • BSI • CES-D • Brief Symptom Index	• CES-D • DI-2 • GHQ-28	• PHQ-9 • Zung's Self Rating Depression Scale
	Stress		• DASS • Jenkins Activity Schedule	• PSS • PMSS • General Wellbeing Scale	• MSSQ-20 • Crohn's Perceived Stress Scale	• PSMS • 10-point idiosyncratic scale • Perceived Medical School Stress
	Suicidal Ideation/ Behaviour		• PRIME-MD			
Kunzler et al., 2020	**Anxiety**	Mixture of validated and non-validated	• DASS • SCL-90	• MASQ • BAI	• GAD • STAI	• HADS-D
	Depression		• DASS • SCL-90	• MASQ	• HADS	• BDI
	Stress or Stress Perception		• DASS		• PSS	
Yogeswaran & El Morr, 2021	**Burnout** **Stress**	Validated	• MBI • PSS			
Hathaisaard et al., 2022	**Burnout** **Stress**	Mixture of validated and non-validated	• MBI • DASS • PMSS	• PSS	• SSCS	• Chinese Perceived Stress Scale
Krishnan et al., 2022	**Anxiety** **Depression** **Stress**	Mixture of validated and non-validated	• State Trait Anxiety Intervention • BDI • Imperial Stress Assessment	• GHQ		

Legend:.

- BAI – Beck's Anxiety Inventory.
- BDI – Beck's Depression Inventory.
- BOS-II – Burnout Screening Scale.
- BSI – Brief Symptom Inventory.
- BSI – Brief Symptom Inventory.
- CBI – Copenhagen Burnout Inventory.
- CES-D – Centre for Epidemiology Studies Depression Scale.
- DASS – Depression Anxiety and Stress Scale.
- ESSI – Stress System Instrument.
- GAD-7 – Generalised anxiety Disorder Scale.
- GHQ – General Health Questionnaire.
- HADS – Hospital Anxiety and Depression Scale.
- MASQ – Mood and Anxiety Symptom Questionnaire.
- MBI – Maslach Burnout inventory.
- MBI SCL-5 – Maslach Burnout inventory Symptom Checklist 5.
- MSSQ-20 – Medical Student Stress Questionnaire.
- PCS – Physical Component Summary.
- PHQ-9 – Patient Health Questionnaire-9.
- PMSS – Perceived Medical School Stress Instrument.
- POMS – Profile of Mood State.
- PRIME-MD – Primary Care Evaluation of Mental Disorders.
- PSMS – Perceived Stress Management Skills.
- PSS – Perceived Stress Scale.
- SCL-90 – Symptom Checklist -90.
- SSCS – Stress-Strain Coping Support Model.
- STAI – Sate-Trait Anxiety Inventory.
- TAI – Trait Anxiety Inventory.

Appendix 6. AMSTAR-2 quality assessment summary – prevalence.

Author, year	1[1]	2[2]	3[3]	4[4]	5[5]	6[6]	7[7]	8[8]	9[9]	10[10]	11[11]	12[12]	13[13]	14[14]	15[15]	16[16]	Overall Confidence Rating
IsHak et al., 2013	N	N	N	N	Y	Y	N	N	N	N	NMC	NMC	N	N	NMC	Y	Critically Low
Bacchi & Licinio, 2015	Y	PY	Y	PY	Y	Y	PY	PY	N	Y	NMC	NMC	N	Y	NMC	N	Critically Low
Hope & Henderson, 2014	Y	PY	Y	Y	Y	Y	PY	Y	Y	Y	NMC	NMC	Y	Y	NMC	Y	Moderate
Cuttilan et al., 2016	Y	PY	Y	PY	Y	Y	PY	Y	N	N	NMC	NMC	N	N	NMC	Y	Critically Low
Lei et al., 2016	Y	Y	Y	PY	Y	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y	N	High
Puthran et al., 2016	Y	Y	Y	PY	Y	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Rotenstein et al., 2016	Y	Y	Y	Y	Y	Y	PY	Y	PY	Y	Y	Y	Y	Y	Y	Y	High
Chunming et al., 2017	Y	PY	Y	PY	Y	Y	N	PY	N	Y	NMC	NMC	N	Y	NMC	Y	Critically Low
Pacheco et al., 2017	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Low
Coentre & Góis, 2018	Y	PY	Y	Y	Y	Y	N	Y	N	N	NMC	NMC	N	N	NMC	Y	Critically Low
Erschens et al., 2019	Y	Y	Y	Y	Y	Y	N	Y	PY	Y	Y	Y	N	Y	N	Y	Critically Low
Frajerman et al., 2019	Y	Y	N	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Low et al., 2019	Y	Y	Y	PY	Y	Y	PY	PY	Y	Y	Y	Y	Y	Y	Y	Y	High
Mao et al., 2019	Y	Y	Y	Y	Y	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Quek et al., 2019	Y	PY	Y	PY	Y	Y	Y	PY	PY	Y	Y	Y	Y	Y	Y	Y	High
Zeng et al., 2019	Y	Y	Y	PY	Y	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Galaiya et al., 2020	Y	PY	N	PY	Y	Y	PY	PY	N	N	NMC	NMC	N	N	NMC	N	Critically Low
Lasheras et al., 2020	Y	Y	Y	Y	Y	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Zhou et al., 2020	Y	Y	Y	Y	Y	Y	PY	PY	Y	Y	Y	Y	Y	Y	Y	Y	High
Li et al., 2021	Y	Y	Y	PY	Y	Y	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y	High
Naji et al., 2021	Y	PY	Y	PY	Y	Y	PY	PY	Y	Y	Y	Y	Y	Y	Y	Y	High
Santabárbara et al., 2021	Y	PY	Y	Y	Y	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Jia et al., 2022	Y	PY	N	Y	Y	Y	N	PY	PY	N	Y	Y	N	Y	Y	Y	Critically Low
Lawlor et al., 2022	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	N	N	Y	N	Y	Critically Low
Shah et al., 2023	Y	PY	N	PY	Y	Y	PY	Y	N	Y	NMC	NMC	N	N	NMC	Y	Critically Low

Y = Yes, N = No, PY = Partial Yes, NMC = No meta-analysis conducted.

Appendix 7. AMSTAR-2 quality assessment summary – interventions.

Author, year	1[17]	2[18]	3[19]	4[20]	5[21]	6[22]	7[23]	8[24]	9[25]	10[26]	11[27]	12[28]	13[29]	14[30]	15[31]	16[32]	Overall Confidence Rating
Regehr et al., 2014	Y	Y	Y	PY	Y	Y	PY	PY	PY	N	Y	Y	Y	Y	Y	N	Moderate
Shiralkar et al., 2013	Y	N	Y	PY	Y	Y	PY	PY	N	N	NMC	NMC	N	Y	NMC	N	Critically Low
McConville et al., 2017	Y	Y	Y	Y	Y	Y	PY	PY	Y	N	Y	Y	Y	Y	Y	N	Moderate
Daya & Hearn, 2018	Y	PY	Y	PY	Y	Y	PY	Y	Y	N	NMC	NMC	Y	N	NMC	Y	Moderate
Walsh et al., 2019	Y	PY	Y	PY	Y	Y	PY	Y	Y	Y	NMC	NMC	Y	Y	NMC	Y	Moderate
Witt et al., 2019	Y	Y	Y	PY	Y	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Kunzler et al., 2020	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Sekhar et al., 2021	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Yogeswaran & El Morr, 2021	Y	PY	Y	PY	Y	Y	PY	Y	Y	N	NMC	NMC	Y	Y	NMC	N	Moderate
Hathaisaard et al., 2022	Y	Y	Y	PY	Y	Y	Y	PY	Y	N	Y	Y	Y	Y	Y	N	Moderate
Krishnan et al., 2022	Y	PY	Y	PY	Y	Y	PY	PY	PY	N	NMC	NMC	Y	N	NMC	N	Moderate

Y = Yes, N = No, PY = Partial Yes, NMC = No meta-analysis conducted.

Appendix 8. Definitions of CMHP and prevalence.

CMHP Terminology	Definition
Anxiety	• Anxiety disorders are a spectrum of physical, mental, and behavioural symptoms that appear on a continuum of severity and are characterized by overwhelming and uncontrollable worry (NICE, 2022b).
Burnout	• Burnout is an occupational phenomenon that develops gradually as a result of chronic workplace stress that is not controlled effectively (NICE, 2022c); it is characterized by the triad of depersonalisation, decreased sense of accomplishment and emotional exhaustions (IsHak et al., 2013).
Common Mental Health Problem (CMHP)	• Are characterised by clinically significant impairment to behaviour, emotional control, and individual intellect; it is typically linked to functional impairment and the most prevalent are, anxiety disorders, depression, obsessive-compulsive disorder (OCD), and post-traumatic stress disorder (PTSD) (NICE, 2022a).
Depression	• Depression is characterized by constant low mood and anhedonia in most activities with symptoms that are persistent for at least two weeks and are associated with a vast range of depressive symptoms (thought disturbances, irritability, reduced appetite, and weight alterations to name a few) (NICE, 2022c).
Prevalence	• Prevalence is an epidemiological measure that assesses how frequently a disease occurs in a population at a specific point in time (Jadhakhan et al., 2019).
Obsessive Compulsive Disorder	• OCD, a type of anxiety disorder, consists of either obsessions or compulsions, but typically both; these symptoms cause severe distress and functional impairment (NICE, 2022d).
Stress/Psychological Distress	• Stress and psychological distress are interchangeable terms that refer to negative emotional states that may reflect impaired mental health (McKenzie & Harris, 2013).
Suicidal Ideation	• Suicidal ideation/thoughts are preoccupations, contemplations, and wishes of suicide and death; it is a recognised symptom of anxiety and depression (Harmer et al., 2022).

Appendix 9. Definitions of interventions.

Intervention Terminology	Definition
Assistantship Training	• Is a training period where medical students act as junior doctors and perform certain tasks under appropriate supervision and guidance (Wells et al., 2019). For example, final year medical students undertaking assistantship training aligned with their first post as foundation doctors (Wells et al., 2019).
Body Scan	• Involves paying close attention to the physical sensation to all areas of the body when lying flat (Kelly J Rohan, 2003).
Didactic Teaching	• Didactic input on stress is a core part of MBSR and revolves around patterns of reactivity and stress physiology that equip individuals to apply mindfulness practices to address their life stressors (Rose et al., 2018).
Duty Hour Changes	• In the USA, the Accreditation Council for Graduate Medical Education applied regulations to national duty hours for resident physicians and in 2011 updated these regulations with a limit of a maximum of 16 consecutive hours for first-year residents and 28 hours for other trainees (Jena et al., 2014).
Mental Practice	• It is a type of psychological rehearsal that proceeds the performance of a particular task (Frank et al., 2014).
Mindfulness Based Courses	• Is an umbrella term that includes mind-body skills courses, mindfulness-based stress reduction, mindful self in school relationships, breathing meditation and yoga (McConville et al., 2017).
Mindfulness-based Interventions	• Focus on acceptance and non-judgmental mental self-awareness in the current moment and can take on many forms which aim to decrease emotional reactivity (Carlson, 2012; Regehr et al., 2014); these include practicing meditation, self-awareness of emotions and thoughts, body scanning, and breathing exercises (Carlson, 2012; McConville et al., 2017).
Mindfulness-based Stress Reduction	• Is a well-established standardised form of MI (Chi et al., 2018), which is widely used in the mitigation of stress, depression, and anxiety by encouraging self-awareness, developing coping strategies for stressful situations, and making better life judgements (Virgili, 2015).
Physical and Mental Exercises	• Are used to promote mindful experiences in the current moment and range from mindful breathing, relaxation, body-scan, yoga, tai chi, gi gong, or meditation (de Vibe et al., 2013).
Resilience Training	• Are mental and behavioural processes that offer protection from possible negative consequences of stressors by promoting personal assets (Fox et al., 2018). • Resilience training incorporates a variety of evidence-based skills which control emotional distress and strengthens positive outcomes such as cognitive behavioural therapy, acceptance and commitment therapy, mindfulness therapy, attention and interpretation therapy, problem solving therapy, stress inoculation therapy and multimodal resilience training (Bennion et al., 2022; Kunzler et al., 2020).
Sitting Meditation	• Is a form of exercise that brings awareness to one's breathing, whether at rest or with movement and help return attention to its primary focus when thoughts begin and wander (Goodman & Schorling, 2012).