

BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email info.bmjopen@bmj.com

BMJ Open

Effects of mobile-based mindfulness meditation for mental health of Nurses: a protocol for systematic review and meta-analysis

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-058686
Article Type:	Protocol
Date Submitted by the Author:	28-Oct-2021
Complete List of Authors:	Chen, Bin; Affiliated Hospital of Nanjing University of Chinese Medicine; Sichuan University West China Hospital Yang, Ting; Affiliated Hospital of Nanjing University of Chinese Medicine Song, Yuqing; Sichuan University West China Hospital Tao, Lin; Sichuan University West China Hospital Wang, Yan; Affiliated Hospital of Nanjing University of Chinese Medicine Xiao, Lei; Affiliated Hospital of Nanjing University of Chinese Medicine Xu, Changxia; Affiliated Hospital of Nanjing University of Chinese Medicine Chen, Hong ; Sichuan University,
Keywords:	MENTAL HEALTH, PSYCHIATRY, Medical physics < RADIOLOGY & IMAGING

SCHOLARONE™
Manuscripts

Title page

(a) Title: Effects of mobile-based mindfulness meditation for mental health of Nurses: a protocol for systematic review and meta-analysis

(b) Authors' full names and affiliations:

Bin Chen, MSN, CNS, RN ^{1,2,3*}

Ting Yang, BSC, RN ^{1*}

Lin Tao, MSN, RN, Ph.D. candidate ^{4*}

Yuqing Song, MSN, RN, Ph.D. candidate ^{2*}

Yan Wang, BSC, RN ¹

Lei Xiao, BSC, RN ¹

Changxia Xu, BSC, RN ¹

Hong Chen, MD, Professor ²

1. Department of Nursing, Affiliated Hospital of Nanjing University of Chinese Medicine, Nanjing, PR China

2. West China School of Nursing/West China Hospital Sichuan University, Chengdu, PR China.

3. Evidence Based Nursing Center, Affiliated Hospital of Nanjing University of Chinese Medicine, Nanjing, PR China

4. Department of Breast Surgery/West China Hospital, Sichuan University, Chengdu, PR China.

**These authors contributed to the work equally and should be regarded as the co-first author.*

(c) Correspondence: Prof. Hong Chen, West China School of Nursing/West China Hospital Sichuan University, No. 37, Guoxuexiang, Wuhou District, Chengdu, Sichuan 610041, China. Email: 1366109878@qq.com.

(d) Acknowledgment

We thank Professor Peibei Duan and Chunqin Zhu, Department of Nursing, Professor Man Zheng, Weiqian Tian and Fangbing Ji, Department of Anesthesiology, from Affiliated Hospital of Nanjing University of Chinese Medicine, for giving advices on this manuscript.

The first author thanks his lovely and sensible son Chen Shi, for devoting the author himself to scientific research in his spare time, and apologizing for not being able to grow up with Chen Shi.

Effects of mobile-based mindfulness meditation for mental health of Nurses: a protocol for systematic review and meta-analysis

Abstract

Introduction: Existing studies have shown that mobile-based mindfulness meditation (MMM) can have a certain impact on nurses' mental health problems, but its specific effect and the effect on specific mental health problems such as stress, anxiety, depression, mindfulness, well-being, and resilience are not clear.

Methods and analysis: This study protocol follows the Preferred Reporting Items for Systematic Review and Meta-analysis Protocols (PRISMA-P) guidelines. Electronic search through PubMed, Web of Science, EBSCO, Cochrane Library, CINAHL, PsycINFO, ERIC, EMBASE, and three Chinese databases namely CNKI, Wan Fang, and Chinese Biology Medicine disc (CBM). The inclusion criteria follow the PICO principle, registered nurses, pre-registered nurses, mid-wives, and nursing students will all be included, studies using MMM as intervention to improve mental health of nurses, compared to waitlist controls or traditional methods groups, outcomes assessment of stress, anxiety, depression, mindfulness, well-being, and resilience will meet the inclusion criteria. Studies designed randomized controlled trails (RCT) of quasi-experimental and written in English or Chinese will be eligible. Two reviewers screen and assess studies for inclusion, and extract data

1
2
3
4 independently, any dispute will be settled through discussion. If the
5
6 discussion still fails, the third author will make a decision. For RCT, risk
7
8 of bias will be assessed using Cochrane risk-of-bias tool for randomized
9
10 trials (RoB 2), and for non-RCT studies, risk of bias in non-randomized
11
12 studies of interventions (ROBINS-I) tool will be performed. Meta-analysis
13
14 will be performed using RevMan software if sufficient number of
15
16 comparable studies are retrieved.
17
18
19
20
21

22 **Ethics and dissemination:** This is a study protocol of meta-analysis, no
23
24 primary data will be collected, no ethics assessment is required. The study
25
26 results will be presented in a peer-reviewed scientific publication.
27
28
29

30 **PROSPERO registration number:** CRD42021277932.
31
32
33
34

35 **Strengths and limitations of this study**

36
37

38 This study protocol designs a plan for the systematic review of the effects
39
40 of MMM on the mental health, which will be the first systematic review
41
42 study of the effects of MMM on the mental health of nurses.
43
44

45 Findings from this review will help illuminate the impact of MMM
46
47 intervention on nurses.
48
49

50 Studies written in English or Chinese language will be consideration for
51
52 inclusion. There are 5 million clinical nurses in China, which is highly
53
54 representative in the world clinical nursing field. However, due to the
55
56 language limitation, some other important studies will be missed, which
57
58
59
60

1
2
3
4 may produce the possibility of bias to the results.
5
6
7

8 9 **Introduction**

10
11 The insufficient human resources, high work pressure, frequent night
12 shift, long-term direct or indirect exposure to environmental stimulation of
13 patients' pain, sadness, and even death, low salary, heavy workload,
14 violent injuries from patients and their families, COVID-19 effects, and a
15 series of other factors[1-7], seriously affect the mental health of
16 nurses[8]. In addition, the long-term lack of effective mental health
17 support has caused serious mental health problems for nurses[9], which are
18 manifested in a series of anxiety, depression, and even job burnout[10, 11].
19 This complication may reduce the nursing quality and patient satisfaction,
20 increase the medical error rate[12], and affect the clinical nursing
21 outcome[13]. Therefore, some interventions are necessary to improve the
22 mental health of nurses[14].
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42

43 The intervention research on nurses' mental health is mainly about
44 mindfulness meditation, which was initiated by American scholar Kabat
45 Zinn in 1979[15]. It aims to deal with stress and pain through mindfulness
46 meditation, including self-regulation, looking at problems from different
47 angles, increasing the acceptance of current experience[16], and
48 promoting them to form a mentality of self-acceptance and recognition,
49 to improve their mental health[17]. Numerous studies have shown that
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4 mindfulness meditation can help nurses to cope with psychological
5
6 pressure and prevent job burnout[18–21]. Therefore, for nurses,
7
8 mindfulness meditation is a strategy to prevent and manage stress, anxiety,
9
10 and job burnout effectively and improve their mental health [22]. However,
11
12 for such a specific group of nurses, due to busy daily work, minimal rest
13
14 time, the particularity of scheduling, COVID-19 prevention and control
15
16 requirements, and prohibition of mass gathering, convening everyone at
17
18 the same time is difficult.
19
20
21
22
23

24
25 Through mobile devices (such as smart phones), online
26
27 communication and learning can be carried out anytime and anywhere
28
29 without time and space constraints[23], which solves this problem well.
30
31 Reports have shown that by 2020, the internet users in China have reached
32
33 800 million, of which 97.5% use smartphones and other mobile devices to
34
35 surf the Internet, indicating that smartphones and other mobile devices
36
37 have high popularity and acceptance. Mobile-based mindfulness
38
39 meditation (MMM) can effectively improve nurses' negative emotions,
40
41 such as anxiety and depression, reduce pressure, and enhance nurses'
42
43 mental health. It plays an irreplaceable role in improving clinical nursing
44
45 quality and maintaining the stability of nursing teams [24].
46
47
48
49
50
51
52

53
54 Nevertheless, the effects of MMM on the mental health of nurses have
55
56 been controversial. Some studies have shown that MMM can significantly
57
58 improve the resilience and release post-traumatic stress disorder (PTSD)
59
60

1
2
3
4 of nurses[25, 26], whereas another study have presented no statistical
5
6 difference[27]. Although MMM has many potential advantages for
7
8 resolving mental health problems, evidence confirming the effects of
9
10 MMM on the mental health of nurses is currently lacking.
11
12

13
14 To the best of our knowledge, no meta-analysis of the effect of MMM
15
16 on the mental health of nurses have been conducted. One systematic
17
18 review[28] has reported that MMM significantly improves mental health.
19
20 However, their study population included various subjects, such as
21
22 healthcare students and professionals, rather than limited to nurses who
23
24 have mental health problems. Stefanopoulou et al.[29] reported that
25
26 various digital interventions, including dialectical behavioral therapy
27
28 (DBT), cognitive behavioral therapy (CBT), and problem solving therapy
29
30 (PST), are effective in reducing the mental health problems of nurses,
31
32 rather than only MMM intervention. Therefore, the effectiveness of MMM
33
34 on mental health of nurses should be determined. In this study, we aim to
35
36 evaluate the effects of MMM on the stress, anxiety, depression,
37
38 mindfulness, well-being, and resilience of nurses systematically.
39
40
41
42
43
44
45
46
47
48
49

50 51 **Methods**

52
53 This systematic review and meta-analysis protocol was conducted in
54
55 accordance with the Preferred Reporting Items for Systematic Review and
56
57 Meta-analysis Protocols (PRISMA-P) guidelines[30]. This study protocol
58
59
60

1
2
3
4 has been registered in the International Prospective Register of Systematic
5
6 Reviews (PROSPERO), registration number was CRD42021277932.
7
8
9

10 11 **Eligibility criteria**

12 *Study characteristics*

13 *Population*

14
15 We will include registered nurses, preregistered nurses, midwives,
16
17 and nursing students. Registered nurses comprise all kinds of nurses in
18
19 different hospitals and departments. Nursing students consist of nursing
20
21 students studying in college and nurse interns.
22
23
24
25
26
27
28

29 *Intervention*

30
31 We will include studies using mindfulness meditation, such as
32
33 mindfulness-based stress reduction (MBSR), mindfulness-based cognitive
34
35 therapy (MBCT), through mobile-based devices, such as smartphones, and
36
37 personal digital assistants (PDA). The intervention is used to improve the
38
39 mental health of nurses.
40
41
42
43
44

45 *Comparator*

46
47 We will include studies using waitlist controls or traditional methods.
48
49 Traditional methods include face-to-face, and online mindfulness
50
51 meditation methods.
52
53
54

55 *Outcomes*

56
57 We will assess the outcomes of stress, anxiety, depression,
58
59
60

1
2
3
4 mindfulness, well-being, and resilience. Stress can be assessed by using
5
6 different instruments, such as the Depression, anxiety, and stress scale
7
8 (DASS-21), and the Perceived Stress Scale (PSS-10). Anxiety will be
9
10 measured using the General Health Questionnaire (GHQ-28), or State-
11
12 Trait Anxiety Inventory (STAI). Depression can be assessed using the
13
14 Quick Inventory of Depressive Symptomatology Self-Report (QIDS-SR),
15
16 the Patient Health Questionnaire (PHQ-9), and the short German form of
17
18 the Center for Epidemiological Studies' Depression Scale (CES-D).
19
20 Mindfulness will be evaluated through the Five Facet Mindfulness
21
22 Questionnaire (FFMQ). Well-being can be evaluated using, for example,
23
24 the Warwick-Edinburgh mental wellbeing scale (WEMWBS), the WHO-
25
26 Five Well-Being Index (WHO-5), and the General Well-Being Schedule
27
28 (GWBS). Resilience will be measured using the Wagnild Resilience Scale
29
30 (WRS), and the Resilience Scale.
31
32
33
34
35
36
37
38
39

40 *Study design*

41
42 We will include randomized controlled trials (RCTs) and quasi-
43
44 experimental studies, focusing on mobile-based mindfulness meditation
45
46 groups versus other traditional mindfulness meditation or wait-list control
47
48 groups.
49
50
51

52 *Setting*

53
54 No restriction is imposed on specific treatment process and outcome
55
56 measurement, although these data may be included for further analysis.
57
58
59
60

Time frame

There is no restriction on intervention duration and follow-up duration, although these data may be included for further analysis.

Report characteristics

We will include studies written in English or Chinese language. No restriction of publication year is applied. We will include research reported as intervention studies, gray literature, and conference abstracts. Studies that contain sufficient information to assess eligibility for inclusion criteria will also be included.

Information sources

An electronic literature search will be conducted using PubMed, Web of Science, EBSCO, Cochrane Library, CINAHL, PsycINFO, ERIC, EMBASE, and three Chinese databases namely CNKI, Wan Fang, and Chinese Biology Medicine disc (CBM). The references of included studies will be searched to identify additional eligible studies. For gray literature, several databases, such as WHO database, PhD thesis/dissertation databases, and OpenGrey, will be systematically searched. For studies without full text or lacking of original data, we will try to contact the original author.

Search strategy

By consulting the literature and pre-searching PubMed, we established the search terms. Search terms related to “mobile” contain: “mobile applications”, “cell phone”, “cell phone use”, “mobile”, “mobile applications”, “mobile based”, “mobile-based”, “distance counseling”, “app”, “app based”, “app-based”, “software”, “electronic”, “digital”, “smartphone”, “phone”, “online”, “internet”, “web”, “e-health”, “telehealth”, “tele-based”, “telemedicine”. We will use the Boolean operator “OR” to combine the above words, with different syntaxes being adapted to each database.

Search terms related to “mindfulness meditation” include: “mindfulness”, “meditation”, “mindfulness-based intervention”, “MBSR”, “mindfulness-based stress reduction”, “mindfulness-based cognitive therapy”, “vipassana”. The Boolean operator “OR” will be used to combine the search terms, and different syntaxes will be adapted to each database.

The keywords used to capture the concept of “nurse” are: “nurses”, “nursing”, “nurse midwives”, “students, nursing”, “nurs*”, “nurse”, “nurses”, “nursing staff”, “clinical nurse”, “nursing”, “nursing personnel”, “registered nurse”, “nursing students”, “nurse interns”. Similarly, the Boolean operator “OR” will be used to combine the search terms, and different syntaxes will be adapted to each database.

We will use the Boolean operator “AND” to combine the above three

1
2
3
4 search terms, namely, “mobile”, “mindfulness meditation”, and “nurse”.
5
6 The retrieval time limitation is from the inception of each database to the
7
8 present. Language will be restricted to English and Chinese. The references
9
10 of included studies and any relevant systematic reviews will be searched
11
12 for additional identified studies. For unsupported data or ongoing studies,
13
14 we will try to contact the original authors. The search strategy of PubMed
15
16 is shown in the Appendix.
17
18
19
20
21
22
23
24

25 **Data management**

26
27 The retrieved data results will be downloaded to the document-
28
29 processing software EndNote X9, to have access to titles and abstracts. We
30
31 will remove duplicate literature by comparing article titles and authors
32
33 through the function “Find duplicates” of EndNote X9.
34
35
36
37
38
39
40

41 **Selection process**

42
43 Two reviewers (CB and YT) will conduct the study selection process
44
45 independently. The first step is preliminary screening. The citation
46
47 information of the detected literature, such as title and abstract, is read to
48
49 eliminate the obviously unqualified literature, and the full text of the
50
51 potentially qualified literature is further screened. The second step is full-
52
53 text screening. For the literature that may be qualified after preliminary
54
55 screening, the methodological part of the full text should be carefully read
56
57
58
59
60

1
2
3
4 and evaluated, and the relevant information in the literature should be
5
6 extracted to determine whether the literature meets the inclusion criteria
7
8 and whether the literature is included. The third step is to obtain additional
9
10 information. Sometimes, even if the full text of the literature is obtained, it
11
12 may still be impossible to determine whether to include it because the
13
14 information provided is incomprehensive. Therefore, the literature with
15
16 questions or differences should be included first, and then the author is
17
18 contacted to obtain additional information before deciding on the choice or
19
20 conducting further evaluation in the later selection process. The two
21
22 authors will independently select the literature, including determining
23
24 whether it is to be included and recording the reasons for exclusion. Any
25
26 dispute will be settled through discussion. If the discussion still fails, a third
27
28 author will make a decision. The selection process is carried out in strict
29
30 accordance with the PRISMA flowchart.
31
32
33
34
35
36
37
38
39
40
41
42

43 **Data collection process**

44
45 Two authors will complete the data collection by filling in the data
46
47 extraction form. Data collection includes the following information: 1.
48
49 basic information of the included research, such as, the number of included
50
51 research, year of publication, citation, first author, and contact informatio;
52
53
54 2. research methods and possible bias, such as, information related to
55
56 literature quality evaluation, including grouping, and blind methods; 3.
57
58
59
60

1
2
3
4 characteristics of the research object, such as demographic characteristics,
5
6 including the age and gender of the research object; 4. characteristics of
7
8 intervention measures, such as mobile mindfulness intervention methods,
9
10 approaches, duration of each intervention, and intervention cycle; 5.
11
12 research results, such as, sample size, grouping, result measurement
13
14 method, data type, statistical data, and results; 6. other information, such
15
16 as, important citations, funding agencies, and potential conflicts of interest.
17
18 Any dispute will be settled through discussion. If the discussion still fails,
19
20 a third author will make a decision. The collected data will be input into
21
22 the system evaluation management software RevMan 5.3 for result
23
24 analysis and reporting.
25
26
27
28
29
30
31
32
33
34

35 **Data items**

36
37 We will extract the following study characteristics and outcomes:

- 38 1. Methods: study design, duration of study and run-in period, number of
39
40 study centers and location, study setting, withdrawals, and date of study.
41
42
- 43 2. Participants: number, mean age, age range, gender, inclusion and
44
45 exclusion criteria, and reported differences between intervention and
46
47 comparison groups.
48
49
- 50 3. Interventions: duration of mindfulness meditation, number of
51
52 meditations, existence of defined standards of meditation, comparator, and
53
54 concomitant intervention.
55
56
57
58
59
60

1
2
3
4 4. Outcomes: primary and secondary outcomes specified and collected, and
5
6 time points reported.

7
8
9 5. Notes: funding for study, and notable conflicts of interest of all authors.
10
11

12 13 14 **Outcomes and prioritization**

15
16
17 We will set stress, anxiety, and depression as the primary outcome,
18
19 assessed using different measurements, such as DASS-21 or PSS-10.
20
21 Stress is a natural reflection of people in the face of tension, which will
22
23 lead to individual worries and restless[31]. Anxiety refers to an unpleasant
24
25 complex emotional state, such as, tension, uneasiness, and worry caused
26
27 by an individual's imminent and possible danger or threat[32]. The clinical
28
29 characteristics of depression are mainly manifested in depressed mood,
30
31 slow thinking, reduced language and movement, and retardation[33].
32
33 Stress, anxiety, and depression can significantly indicate the mental health
34
35 level of nurses[34]. Outcome data will be expressed as mean \pm standard
36
37 deviation ($M \pm SD$). If data are offered in other forms such as median–
38
39 range or median–interquartile range, $M \pm SD$ will be calculated following
40
41 the recommendations of the Cochrane Handbook for Systematic Reviews
42
43 of Interventions[35].
44
45
46
47
48
49
50
51

52
53 Secondary outcomes will be set as mindfulness, well-being, and
54
55 resilience. These three outcomes have a close positive correlation with
56
57 mental health[36]. Improving mindfulness, well-being, and resilience will
58
59
60

1
2
3
4 help nurses efficiently handle mental health problems, such as, stress,
5
6 anxiety, and depression[37].
7
8
9

10 11 **Risk of bias in individual studies** 12

13
14 Two reviewers will assess the risk of bias for each included study
15 independently. For randomized controlled trials (RCTs), the risk of bias
16 will be assessed using Cochrane risk-of-bias tool for randomized trials
17 (RoB 2)[38], which includes seven criteria: random sequence generation,
18 allocation concealment, blinding of participants and personnel, blinding of
19 outcome assessment, incomplete data outcomes, selective outcome
20 reporting, and other biases. Each criterion will be graded as high, unclear,
21 or low risk of bias. For non-RCT studies, the risk of biases in
22 nonrandomized studies of interventions (ROBINS-I) tool will be
23 determined[39]. The biases include bias due to confounding, bias in the
24 selection of study participants, bias in the classification of interventions,
25 bias due to deviations from intended interventions, bias due to missing data,
26 bias in the measurement of outcomes, bias in the selection of the reported
27 result, and overall bias.
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49

50 Anticipated methods for assessing the risk of bias of individual studies
51 will be described, including whether the assessment will be done at the
52 outcome or study level or both; and how the information will be used in
53
54
55
56
57
58
59
60 data synthesis. Any dispute will be settled through discussion. If the

1
2
3
4 discussion still fails, a third author will make a decision.
5
6
7
8

9 **Data synthesis**

10
11 Meta-analysis will be conducted using RevMan 5.3 software. The
12 weighted mean difference (MD) model will be used to analyze continuous
13 data if all outcomes are measured using identical methods; otherwise, the
14 standardized mean difference (SMD) will be used. I^2 test will be conducted
15 to assess the degree of heterogeneity of included studies. $I^2 > 50\%$ is
16 identified as significant heterogeneity in accordance with the Cochrane
17 handbook. The values of P and I^2 will be used to determine which model
18 to choose. A fixed-effect model will be chosen if $P > 0.1$ and $I^2 < 50\%$,
19 whereas a random-effect model will be selected if $P < 0.1$ and $I^2 > 50\%$. In
20 addition, sensitivity analysis through the leave-one-out method and
21 subgroup analysis will be performed within significant heterogeneity. All
22 effective quantities will be expressed by 95% confidence intervals (CI). P
23 < 0.05 will define statistical significance. If significant heterogeneity ($I^2 >$
24 50%) founded, sensitivity analysis will be performed through the leave-
25 one-out method. If sensitivity analysis still indicates great heterogeneity
26 after removing any research results, then subgroup analysis will be carried
27 out. They will be divided into subgroups via intervention methods,
28 intervention duration, or sample sized. If the source of heterogeneity
29 cannot be found, it will be described in narrative terms.
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Meta-bias

For all included studies, we will check if a registered study protocol is available and whether the protocol has been registered before the study is initialized. Moreover, we will screen the outcomes documented in the protocol against the reported outcomes to evaluate potential reporting bias. If more than or equal to 10 studies are available for meta-analysis, a funnel plot will be used to quantify the extent of publication bias for the primary outcome by assessing funnel plot asymmetry visually and using Egger's test at a significance level of 5%[40]. If included studies are less than 10 in this meta-analysis, we will assess publication bias qualitatively on the basis of the characteristics of the included studies.

Confidence in cumulative evidence

The confidence of the final included studies will be assessed using the GRADE (Grading of Recommendations Assessment, Development and Evaluation) rating scale[41].

Patient and public involvement

There was no patient or public involvement in the development in this protocol study.

Discussion

This study protocol designs a plan for the systematic review and meta-analysis of the effects of MMM on the mental health, such as stress, anxiety, depression, mindfulness, well-being, and resilience of nurses. With the constant attention paid to the mental health of nurses[42] and the rapid development of mobile technology[23], mindfulness decompression therapies based on mobile technology have been applied to the research of nurses' mental health. However, as far as we know, no systematic review exists at present. Therefore, our research will be the first systematic review on the effects of MMM on the mental health of nurses. Findings from this review will help illuminate the impact of MMM intervention on nurses. We will further analyze which aspects of MMM have a positive impact, no impact, or even a reverse effect on mental health of nurses, and explore the possible reasons. We aim to provide more scientific intervention methods and theoretical bases for the mental health of nurses.

Contributors: CB, YT, TL, and SYQ designed the study and drafted the manuscript protocol. WY, XL, and XCX registered the methods on the PROSPERO website. CH critically revised the protocol and manuscript submitted. All authors read and approved the final manuscript.

Competing interests: All authors declare that there is no conflict of interests.

1
2
3
4 **Funding:** None.
5

6 **Data sharing statement:** None declared.
7

8
9 **Ethics approval statement:** Not required.
10

11 12 13 14 **References**

- 15
16
17 1. Liu Y, Wang H, Chen J, Zhang X, Yue X, Ke J, et al. Emergency
18 management of nursing human resources and supplies to respond to
19 coronavirus disease 2019 epidemic. *International Journal of Nursing*
20 *Sciences*. 2020;7(2):135-8. doi: 10.1016/j.ijnss.2020.03.011.
21
22
23
24
25
26
27 2. Khan HM. Workload pressure of nurses at an emergency satellite
28 hospital in Peshawar Pakistan. *Eur J Public Health*.
29 2020;30(Supplement_5). doi: 10.1093/eurpub/ckaa166.626.
30
31
32
33
34
35
36
37 3. Hassani MR, Behnamian J. A scenario-based robust optimization with
38 a pessimistic approach for nurse rostering problem. *Journal of*
39 *Combinatorial Optimization*. 2020;40(4):1-27. doi: 10.1007/s10878-020-
40 00667-0.
41
42
43
44
45
46
47
48 4. Alyami HM, Chan RJ, New K. End-of-life care preferences for people
49 with advanced cancer and their families in intensive care units: a systematic
50 review. *Support Care Cancer*. 2019;27(9):3233–44.
51
52
53
54 5. Marcia A Lowe, Aoyjai Prapanjaroensin, Marie A Bakitas, Lisle Hites,
55 Lori A Loan, Dheeraj Raju, et al. An exploratory study of the influence of
56 perceived organizational support, coworker social support, the nursing
57
58
59
60

1
2
3
4 practice environment, and nurse demographics on burnout in palliative care
5
6 nurses. *J Hosp Palliat Nurs.* 2020;22(6):465-72. doi:
7
8 10.1097/NJH.0000000000000686.
9
10

11 6. Farid M, Purdy N, Neumann WP. Using system dynamics modelling
12 to show the effect of nurse workload on nurses' health and quality of care.
13
14 *Ergonomics.* 2020;63(8):952-64. doi: 10.1080/00140139.2019.1690674.
15
16
17

18 7. Msc NS, Wei L, Shic S, Jiao D, Ma L, Wang H, et al. A qualitative
19 study on the psychological experience of caregivers of COVID-19 patients.
20
21 *Am J Infect Control.* 2020;48(6):592-8. doi: 10.1016/j.ajic.2020.03.018.
22
23
24

25 8. Harris LS, Atif B, Abdullah H, Zoia K. Violence breeds violence:
26 burnout as a mediator between patient violence and nurse violence. *Int J*
27
28 *Occup Saf Ergon.* 2019;25(4):604-13. doi:
29
30 10.1080/10803548.2018.1429079.
31
32
33

34 9. Sawyer AT, Bailey AK, Green JF, Sun J, Robinson PS. Resilience,
35 insight, self-compassion, and empowerment (RISE): A randomized
36 controlled trial of a psychoeducational group program for nurses. *J Am*
37
38 *Psychiatr Nurses Assoc.* 2021(6):107839032110333. doi:
39
40 10.1177/10783903211033338.
41
42
43

44 10. Lee H, Chiang H, Kuo H. Relationship between authentic leadership
45 and nurses' intent to leave: The mediating role of work environment and
46
47 burnout. *J Nurs Manag.* 2019;27(1):52–65. doi: 10.1111/jonm.12648.
48
49
50

51 11. Salvarani V, Rampoldi G, Ardenghi S, Bani M, Blasi P, Ausili D, et al.
52
53
54
55
56
57
58
59
60

1
2
3
4 Protecting emergency room nurses from burnout: The role of dispositional
5 mindfulness, emotion regulation and empathy. *J Nurs Manag.*
6
7 2019;27(4):765–74. doi: 10.1111/jonm.12771.
8
9

10
11 12. Dodek PM, Norena M, Ayas N, Wong H. Moral distress is associated
12 with general workplace distress in intensive care unit personnel. *J Crit Care.*
13
14 2018;50:122-5. doi: 10.1016/j.jcrc.2018.11.030.
15
16

17
18 13. Dodek P, Norena M, Ayas N, Dhingra V, Wong H. Moral distress in
19 intensive care unit personnel is not consistently associated with adverse
20 medication events and other adverse events. *J Crit Care.* 2019;53:258-63.
21
22 doi: 10.1016/j.jcrc.2019.06.023.
23
24

25
26 14. Bailey AK, Sawyer AT, Robinson PS. A psychoeducational group
27 intervention for nurses: Rationale, theoretical framework, and
28 development. *J Am Psychiatr Nurses Assoc.* 2021:10783903211001116.
29
30 doi: 10.1177/10783903211001116. PubMed PMID: 34154451.
31
32

33
34 15. Bostock S, Crosswell AD, Prather AA, Steptoe A. Mindfulness on-the-
35 go: Effects of a mindfulness meditation app on work stress and well-being.
36
37 *Occup Health Psychol.* 2018;24(1):127-38. doi: 10.1037/ocp0000118.
38
39

40
41 16. Paulson S, Davidson R, Jha A, Kabat-Zinn J. Becoming conscious: the
42 science of mindfulness. *Ann N Y Acad Sci.* 2013;1303:87-104. doi:
43
44 10.1111/nyas.12203.
45
46

47
48 17. Yang J, Tang S, Zhou W. Effect of mindfulness-based stress reduction
49 therapy on work stress and mental health of psychiatric nurses. *Psychiatra*
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3
4 Danubina. 2018;30(2):189-96. doi: 10.24869/psyd.2018.189.
5
6
7 18. Laurence , Guillaumie, Olivier , Boiral, Julie , Champagne. A
8
9 mixed-methods systematic review of the effects of mindfulness on nurses.
10
11 J Adv Nurs. 2017;73(5):1017-34. doi: 10.1111/jan.13176.
12
13
14 19. Ruiz-Fernández MD, Ortíz-Amo R, Ortega-Galán nM, Ibáez-Masero
15
16 O, Rodríguez-Salvador MdM, Ramos-Pichardo JD. Mindfulness therapies
17
18 on health professionals. Int J Ment Health Nurs. 2020;29(2):127-40. doi:
19
20 10.1111/inm.12652.
21
22
23 20. Ghawadra SF, Abdullah KL, Yuen CW, Kar PCJJoCN. Mindfulness-
24
25 based stress reduction for psychological distress among nurses: A
26
27 systematic review. J Clin Nurs. 2019;28(21):1-10. doi:
28
29 10.1111/jocn.14987.
30
31
32 21. Suleiman - Martos N, Gomez - Urquiza JL, Aguayo - Estremera R,
33
34 Fuente GACDL, Fuente-Solana EIDL, Albendín-García L. The effect of
35
36 mindfulness training on burnout syndrome in nursing: A systematic review
37
38 and meta-analysis. J Adv Nurs. 2020;76(5):1-16. doi: 10.1111/jan.14318.
39
40
41 22. Mallory T, Hageman JR, Melanie B. A Mindfulness Intervention for
42
43 Residents: Relevance for Pediatricians. *Pediatr Ann*. 2016;45(10):e373-e6.
44
45 doi: 10.3928/19382359-20160912-01.
46
47
48 23. Chen B, Wang Y, Xiao L, Xu C, Shen Y, Qin Q, et al. Effects of mobile
49
50 learning for nursing students in clinical education: A meta-analysis. *Nurse*
51
52 *Educ Today*. 2020;97:1-9. doi: 10.1016/j.nedt.2020.104706.
53
54
55
56
57
58
59
60

- 1
2
3
4 24. Gozalo RMG, Tarrés JMF, Ayora AA. Application of a mindfulness
5 program among healthcare professionals in an intensive care unit: Effect
6 on burnout, empathy and self-compassion. *Med Intensiva*. 2018;43(4):207-
7 16. doi: 10.1016/j.medin.2018.02.005.
8
9
10
11
12
13
14 25. Reyes AT. A mindfulness mobile app for traumatized COVID-19
15 healthcare workers and recovered patients: A response to “The Use of
16 Digital Applications and COVID-19”. *Community Ment Health J*.
17 2020;56(7):1204-5. doi: 10.1007/s10597-020-00690-9.
18
19
20
21
22
23
24 26. Reyes AT, Song H, Bhatta TR, Kearney CA. Exploring the
25 relationships between resilience, mindfulness, and experiential avoidance
26 after the use of a mindfulness- and acceptance-based mobile app for
27 posttraumatic stress disorder. *Perspectives in Psychiatric Care*. 2021:1-9.
28 doi: 10.1111/ppc.12848.
29
30
31
32
33
34
35
36
37
38 27. Fiol-Deroque MA, Serrano-Ripoll MJ, Jiménez R, Zamanillo-Campos
39 R, Ricci-Cabello I. A mobile phone-based intervention to reduce mental
40 health problems in healthcare workers during the COVID-19 pandemic
41 (PsyCovidApp): Randomized controlled trial. *JMIR mhealth uhealth*.
42 2021;9(5):e27039. doi: 10.2196/27039.
43
44
45
46
47
48
49
50
51 28. Pospos S, Young IT, Downs N, Iglewicz A, Depp C, Chen JY, et al.
52 Web-based tools and mobile applications to mitigate burnout, depression,
53 and suicidality among healthcare students and professionals: A systematic
54 review. *Acad Psychiatry*. 2018;42(1):109-20. doi: 10.1007/s40596-017-
55
56
57
58
59
60

1
2
3
4 0868-0.
5

6 29. Stefanopoulou E, Hogarth H, Taylor M, Russell-Haines K, Lewis D,
7 Larkin J. Are digital interventions effective in reducing suicidal ideation
8 and self-harm? A systematic review. *Journal of Mental Health*.
9 2020;29(2):207-16. doi: 10.1080/09638237.2020.1714009.
10
11

12 30. Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M,
13 et al. Preferred reporting items for systematic review and meta-analysis
14 protocols (PRISMA-P) 2015 statement. *Systematic reviews*. 2015;4(1):1.
15 doi: 10.1186/2046-4053-4-1.
16

17 31. Balmus IM, Robea M, Ciobica A, Timofte D. Perceived stress and
18 gastrointestinal habits in college students. *Acta Endocrinol (Copenh)*.
19 2019;15(2):274-5. doi: 10.4183/aeb.2019.274. PubMed PMID: 31508190.
20
21

22 32. Michela B, Fedele C, Leonardo C, Beth F. Assessment of anxiety in
23 older adults: A review of self-report measures. *Clin Interv Aging*.
24 2018;13:573-93. doi: 10.2147/CIA.S114100.
25
26

27 33. Hammen, Constance. Risk factors for depression: An autobiographical
28 review. *Annu Rev Clin Psychol*. 2018;14:1-28. doi: 10.1146/annurev-
29 clinpsy-050817-084811.
30
31

32 34. Zerbini G, Ebigo A, Reiche Rts P, Kunz M, Mes Sm Ann H.
33 Psychosocial burden of healthcare professionals in times of COVID-19—a
34 survey conducted at the University Hospital Augsburg. *German medical
35 science : GMS e-journal*. 2020;18. doi: 10.3205/000281.
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3
4 35. Mihai-Calin P, Raquel C, Laia E, Robert M, Erik LM, Ma R A, et al.
5
6 The effect of preoperative chemotherapy on liver regeneration after portal
7
8 vein embolization/ligation or liver resection in patients with colorectal
9
10 liver metastasis: a systematic review protocol. *Systematic reviews*.
11
12 2020;9:279. doi: 10.1186/s13643-020-01545-w.
13
14
15
16 36. Litvin S, Saunders R, Maier MA, Lüttke S. Gamification as an
17
18 approach to improve resilience and reduce attrition in mobile mental health
19
20 interventions: A randomized controlled trial. *PLoS One*.
21
22 2020;15(9):e0237220. doi: 10.1371/journal.pone.0237220.
23
24
25
26 37. Eaves JL, Payne N. Resilience, stress and burnout in student midwives.
27
28 *Nurse Educ Today*. 2019;79:188-93. doi: 10.1016/j.nedt.2019.05.012.
29
30
31
32 38. Sterne J, Savovi J, Page MJ, Elbers RG, Higgins J. RoB 2: A revised
33
34 tool for assessing risk of bias in randomised trials. *BMJ Clinical Research*.
35
36 2019;366:l4898. doi: 10.1136/bmj.l4898.
37
38
39
40 39. Sterne JA, Hernán MA, Reeves BC, Savovi? J, Berkman ND,
41
42 Viswanathan M, et al. ROBINS-I: a tool for assessing risk of bias in non-
43
44 randomised studies of interventions. *The BMJ*. 2016;355:i4919. doi:
45
46 10.1136/bmj.i4919.
47
48
49
50 40. Sterne JAC, Sutton AJ, Ioannidis JPA, Terrin N, Jones DR, Lau J, et
51
52 al. Recommendations for examining and interpreting funnel plot
53
54 asymmetry in meta-analyses of randomised controlled trials. *BMJ*.
55
56 2011;343:d4002. doi: 10.1136/bmj.d4002.
57
58
59
60

- 1
2
3
4 41. Yang B, Mustafa RA, Bossuyt PM, Brozek J, Langendam MW.
5
6 GRADE guidelines: 31. Assessing the certainty across a body of evidence
7
8 for comparative test accuracy. *J Clin Epidemiol.* 2021;136:146-56. doi:
9
10 10.1016/j.jclinepi.2021.04.001.
11
12
13
14 42. Zeller JM, Johnson AM, Hoffman A, Hoyem RL, Alexander MB,
15
16 Yudkowsky R, et al. Mindfulness training to improve nurse clinical
17
18 performance: A pilot study. *West J Nurs Res.* 2021;43(3):250-60. doi:
19
20 10.1177/0193945920964938. PubMed PMID: 33073733.
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Appendix:

Search strategies

PubMed

#1. mobile applications [MeSH Terms]

#2. cell phone [MeSH Terms]

#3. cell phone use [MeSH Terms]

#4. (((((((((((((((((((((((mobile [Title/Abstract])) OR (mobile applications [Title/Abstract])) OR (mobile based [Title/Abstract])) OR (mobile-based [Title/Abstract])) OR (distance counseling [Title/Abstract])) OR (app [Title/Abstract])) OR (app based [Title/Abstract])) OR (app-based [Title/Abstract])) OR (software [Title/Abstract])) OR (electronic [Title/Abstract])) OR (digital [Title/Abstract])) OR (smartphone [Title/Abstract])) OR (phone [Title/Abstract])) OR (online [Title/Abstract])) OR (internet [Title/Abstract])) OR (web [Title/Abstract])) OR (ehealth [Title/Abstract])) OR (telehealth [Title/Abstract])) OR (telebased [Title/Abstract])) OR (tele-based [Title/Abstract])) OR (telemedicine [Title/Abstract]))

#5. #1 OR #2 OR #3 OR #4

#6. Mindfulness [MeSH Terms]

#7. ((((((mindfulness [Title/Abstract])) OR (meditation [Title/Abstract])) OR (mindfulness-based intervention [Title/Abstract])) OR (MBSR [Title/Abstract])) OR (mindfulness-based stress reduction [Title/Abstract])) OR (mindfulness-based cognitive therapy [Title/Abstract])) OR (vipassana [Title/Abstract]))

#8. #6 OR #7

#9. Nurses [MeSH Terms]

#10. Nursing [MeSH Terms]

#11. nurse midwives [MeSH Terms]

#12. students, nursing [MeSH Terms]

#13. ((((((((((nurs* [Title/Abstract])) OR (nurse [Title/Abstract])) OR (nurses [Title/Abstract])) OR (nursing staff [Title/Abstract])) OR (clinical nurse [Title/Abstract])) OR (nursing [Title/Abstract])) OR (nursing personnel [Title/Abstract])) OR (registered nurse [Title/Abstract])) OR (nursing students [Title/Abstract])) OR (nurse interns [Title/Abstract]))

#14. #9 OR #10 OR #11 OR #12 OR #13

#15. #5 AND #8 AND #14

1
2
3
4 Dear Prof. Adrian Aldcroft,
5

6 We would like to submit the enclosed manuscript entitled “**Effects of**
7 **mobile-based mindfulness meditation for mental health of Nurses: a**
8 **protocol for systematic review and meta-analysis**” for possible
9 publication in the *BMJ OPEN*.
10
11
12
13
14
15
16
17
18
19

20 No conflict of interest exists at the time of submission of this
21 manuscript. The contents of this manuscript will not be copyrighted,
22 submitted, or published elsewhere, while acceptance by the *BMJ OPEN* is
23 under consideration. All authors have read and approved the final
24 submitted version; all individuals listed as authors were eligible for
25 authorship.
26
27
28
29
30
31
32
33
34
35
36
37

38 Existing studies have shown that mobile-based mindfulness
39 meditation (MMM) can have a certain impact on nurses' mental health
40 problems, but its specific effect and the effect on specific mental health
41 problems such as stress, anxiety, depression, mindfulness, well-being, and
42 resilience are not clear. This study protocol follows the Preferred Reporting
43 Items for Systematic Review and Meta-analysis Protocols (PRISMA-P)
44 guidelines. Electronic search through PubMed, Web of Science, EBSCO,
45 Cochrane Library, CINAHL, PsycINFO, ERIC, EMBASE, and three
46 Chinese databases namely CNKI, Wan Fang, and Chinese Biology
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4 Medicine disc (CBM). The inclusion criteria follow the PICO principle,
5
6 registered nurses, pre-registered nurses, mid-wives, and nursing students
7
8 will all be included, studies using MMM as intervention to improve mental
9
10 health of nurses, compared to waitlist controls or traditional methods
11
12 groups, outcomes assessment of stress, anxiety, depression, mindfulness,
13
14 well-being, and resilience will meet the inclusion criteria. Studies designed
15
16 randomized controlled trails (RCT) of quasi-experimental and written in
17
18 English or Chinese will be eligible. Two reviewers screen and assess
19
20 studies for inclusion, and extract data independently, any dispute will be
21
22 settled through discussion. If the discussion still fails, the third author will
23
24 make a decision. For RCT, risk of bias will be assessed using Cochrane
25
26 risk-of-bias tool for randomized trials (RoB 2), and for non-RCT studies,
27
28 risk of bias in non-randomized studies of interventions (ROBINS-I) tool
29
30 will be performed. Meta-analysis will be performed using RevMan
31
32 software if sufficient number of comparable studies are retrieved. resuThis
33
34 study protocol designs a plan for systematic review and meta-analysis that
35
36 effects of MMM on mental health such as stress, anxiety, depression,
37
38 mindfulness, well-being, and resilience of nurses. Findings from this
39
40 review study will help illuminate the impact of MMM intervention on
41
42 nurses, and to provide more scientific intervention methods and theoretical
43
44 basis for mental health of nurse.
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4 We deeply appreciate your consideration of our manuscript. We look
5
6 forward to receiving comments from the reviewers. If you have any queries,
7
8 please do not hesitate to contact me at the address below. Thank you in
9
10 advance.
11
12
13
14
15
16

17 Best regards,
18
19

20
21
22 Prof. Hong Chen
23
24
25
26

27 Address: West China School of Nursing/West China Hospital Sichuan
28
29 University, No. 37, Guoxuexiang, Wuhou District, Chengdu, Sichuan,
30
31 610041, China.
32
33

34
35 Tel: 86 18980601733
36
37

38 Email: 1366109878@qq.com.
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

BMJ Open

Effects of mobile-based mindfulness meditation for mental health of Nurses: a protocol for systematic review and meta-analysis

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-058686.R1
Article Type:	Protocol
Date Submitted by the Author:	22-Mar-2022
Complete List of Authors:	Chen, Bin; Affiliated Hospital of Nanjing University of Chinese Medicine; Sichuan University West China Hospital Yang, Ting; Affiliated Hospital of Nanjing University of Chinese Medicine Tao, Lin; Sichuan University West China Hospital Song, Yuqing; Sichuan University West China Hospital Liu, Ying; Sichuan University West China Hospital School of Nursing Wang, Yan; Affiliated Hospital of Nanjing University of Chinese Medicine Xiao, Lei; Affiliated Hospital of Nanjing University of Chinese Medicine Xu, Changxia; Affiliated Hospital of Nanjing University of Chinese Medicine Chen, Hong ; Sichuan University,
Primary Subject Heading:	Nursing
Secondary Subject Heading:	Mental health
Keywords:	MENTAL HEALTH, PSYCHIATRY, Medical physics < RADIOLOGY & IMAGING

SCHOLARONE™
Manuscripts

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1 **Title page**

2 **(a) Title:** Effects of mobile-based mindfulness meditation for mental health of Nurses:
3 a protocol for systematic review and meta-analysis

4 **(b) Authors' full names and affiliations:**

5 Bin Chen, MSN, CNS, RN ^{1,2,3*}

6 Ting Yang, BSC, RN ^{1*}

7 Lin Tao, MSN, RN, Ph.D. candidate ^{4*}

8 Yuqing Song, MSN, RN, Ph.D. candidate ^{2*}

9 Ying Liu, MSN, RN, Ph.D. candidate ^{2*}

10 Yan Wang, BSC, RN ¹

11 Lei Xiao, BSC, RN ¹

12 Changxia Xu, BSC, RN ¹

13 Hong Chen, MD, Professor ²

14 1. Department of Nursing, Affiliated Hospital of Nanjing University of Chinese
15 Medicine, Nanjing, PR China

16 2. West China School of Nursing/West China Hospital Sichuan University, Chengdu,
17 PR China.

18 3. Evidence Based Nursing Center, Affiliated Hospital of Nanjing University of
19 Chinese Medicine, Nanjing, PR China

20 4. Department of Breast Surgery/West China Hospital, Sichuan University, Chengdu,
21 PR China.

22 **These authors contributed to the work equally and should be regarded as the co-first
23 author.*

24 **(c) Correspondence:** Prof. Hong Chen, West China School of Nursing/West China
25 Hospital Sichuan University, No. 37, Guoxuexiang, Wuhou District, Chengdu, Sichuan
26 610041, China. Email: 1366109878@qq.com.

27 **(d) Acknowledgment**

28 We thank Professor Peibei Duan and Chunqin Zhu, Department of Nursing, Professor
29 Man Zheng, Weiqian Tian and Fangbing Ji, Department of Anesthesiology, from
30 Affiliated Hospital of Nanjing University of Chinese Medicine, for giving advices on
31 this manuscript.

32 The first author thanks his lovely and sensible son Eric Chen, for devoting the author

1
2
3
4 33 himself to scientific research in his spare time, and apologizing for not being able to
5 34 grow up with Eric Chen.
6
7 35
8
9 36
10 37

11 38 **Effects of mobile-based mindfulness meditation for mental health of**
12
13 39 **Nurses: a protocol for systematic review and meta-analysis**

14
15 40 **Abstract**

16 41 **Introduction:** Existing studies have shown that mobile-based mindfulness
17 42 meditation (MMM) can have a certain impact on nurses' mental health
18 43 problems, but its specific effect and the effect on specific mental health
19 44 problems such as stress, anxiety, depression, mindfulness, well-being, and
20 45 resilience are not clear.

21
22
23
24 46 **Methods and analysis:** This study protocol follows the Preferred
25 47 Reporting Items for Systematic Review and Meta-analysis Protocols
26 48 (PRISMA-P) guidelines. Electronic search through PubMed, Web of
27 49 Science, EBSCO, Cochrane Library, CINAHL, PsycINFO, ERIC,
28 50 EMBASE, and three Chinese databases namely CNKI, Wan Fang, and
29 51 Chinese Biology Medicine disc (CBM). The inclusion criteria follow the
30 52 PICO principle, registered nurses, pre-registered nurses, mid-wives, and
31 53 nursing students will all be included, studies using MMM as intervention
32 54 to improve mental health of nurses, compared to waitlist controls or
33 55 traditional methods groups, outcomes assessment of stress, anxiety,
34 56 depression, mindfulness, well-being, and resilience will meet the inclusion
35 57 criteria. Studies designed randomized controlled trails (RCT) of quasi-
36 58 experimental and written in English or Chinese will be eligible. Search
37 59 time was from inception of each database to July 2022. Two reviewers
38 60 screen and assess studies for inclusion, and extract data independently, any
39 61 dispute will be settled through discussion. If the discussion still fails, the
40 62 third author will make a decision. For RCT, risk of bias will be assessed
41 63 using Cochrane risk-of-bias tool for randomized trials (RoB 2), and for
42 64 non-RCT studies, risk of bias in non-randomized studies of interventions
43 65 (ROBINS-I) tool will be performed. Meta-analysis will be performed using
44 66 RevMan software if sufficient number of comparable studies are retrieved.

45
46
47
48
49
50
51
52
53
54
55
56
57
58 67 **Ethics and dissemination:** This is a study protocol of meta-analysis, no
59 68 primary data will be collected, no ethics assessment is required. The study
60

69 results will be presented in a peer-reviewed scientific publication.

70 **PROSPERO registration number:** CRD42021277932.

71

72 **Strengths and limitations of this study**

73 This study protocol will be the first systematic review study on the
74 effects of MMM on the mental health of nurses.

75 This study adheres to the recommendations of the Cochrane handbook
76 for systematic reviews of interventions strictly.

77 A thorough and transparent approach will minimize the risk of
78 possible biases.

79 The quality of the evidence will be assessed to provide confidence in
80 the effect estimate.

81 One limitation is that due to the language limitation, some other
82 important studies will be missed, which may produce the possibility of bias
83 to the results.

84

85 **Introduction**

86 The insufficient human resources, high work pressure, frequent night
87 shift, long-term direct or indirect exposure to environmental stimulation of
88 patients' pain, sadness, and even death, low salary, heavy workload,
89 violent injuries from patients and their families, COVID-19 effects, and a
90 series of other factors¹⁻⁷, seriously affect the mental health of nurses⁸. In
91 addition, the long-term lack of effective mental health support has caused
92 serious mental health problems for nurses⁹, which are manifested in a series
93 of anxiety, depression, and even job burnout^{10 11}. This complication may
94 reduce the nursing quality and patient satisfaction, increase the medical
95 error rate¹², and affect the clinical nursing outcome¹³. Therefore, some
96 interventions are necessary to improve the mental health of nurses¹⁴.

97 The intervention research on nurses' mental health is mainly about
98 mindfulness meditation, which was initiated by American scholar Kabat
99 Zinn in 1979¹⁵. It aims to deal with stress and pain through mindfulness
100 meditation, including self-regulation, looking at problems from different
101 angles, increasing the acceptance of current experience¹⁶, and promoting
102 them to form a mentality of self-acceptance and recognition, to improve
103 their mental health¹⁷. Numerous studies have shown that mindfulness
104 meditation can help nurses to cope with psychological pressure and prevent

1
2
3
4 105 job burnout¹⁸⁻²¹. Therefore, for nurses, mindfulness meditation is a strategy
5 106 to prevent and manage stress, anxiety, and job burnout effectively and
6 107 improve their mental health²². However, for such a specific group of nurses,
7 108 due to busy daily work, minimal rest time, the particularity of scheduling,
8 109 COVID-19 prevention and control requirements, and prohibition of mass
9 110 gathering, convening everyone at the same time is difficult.

11 111 Through mobile devices (such as smart phones), online
12 112 communication and learning can be carried out anytime and anywhere
13 113 without time and space constraints²³, which solves this problem well.
14 114 Reports have shown that by 2020, the internet users in China have reached
15 115 800 million, of which 97.5% use smartphones and other mobile devices to
16 116 surf the Internet, indicating that smartphones and other mobile devices
17 117 have high popularity and acceptance. Mobile-based mindfulness
18 118 meditation (MMM) can effectively improve nurses' negative emotions,
19 119 such as anxiety and depression, reduce pressure, and enhance nurses'
20 120 mental health. It plays an irreplaceable role in improving clinical nursing
21 121 quality and maintaining the stability of nursing teams²⁴.

22 122 Nevertheless, the effects of MMM on the mental health of nurses have
23 123 been controversial. Some studies have shown that MMM can significantly
24 124 improve the resilience and release post-traumatic stress disorder (PTSD)
25 125 of nurses^{25 26}, whereas another study have presented no statistical
26 126 difference²⁷. Although MMM has many potential advantages for resolving
27 127 mental health problems, evidence confirming the effects of MMM on the
28 128 mental health of nurses is currently lacking.

29 129 To the best of our knowledge, no meta-analysis of the effect of MMM
30 130 on the mental health of nurses have been conducted. One systematic
31 131 review²⁸ has reported that MMM significantly improves mental health.
32 132 However, their study population included various subjects, such as
33 133 healthcare students and professionals, rather than limited to nurses who
34 134 have mental health problems. Stefanopoulou et al.²⁹ reported that various
35 135 digital interventions, including dialectical behavioral therapy (DBT),
36 136 cognitive behavioral therapy (CBT), and problem solving therapy (PST),
37 137 are effective in reducing the mental health problems of nurses, rather than
38 138 only MMM intervention. Therefore, the effectiveness of MMM on mental
39 139 health of nurses should be determined. In this study, we aim to evaluate the
40 140 effects of MMM on the stress, anxiety, depression, mindfulness, well-

1
2
3 141 being, and resilience of nurses systematically.
4
5 142

6
7 143 **Methods**

8 144 This systematic review and meta-analysis protocol was conducted in
9
10 145 accordance with the Preferred Reporting Items for Systematic Review and
11 146 Meta-analysis Protocols (PRISMA-P) guidelines³⁰. This study protocol has
12
13 147 been registered in the International Prospective Register of Systematic
14 148 Reviews (PROSPERO), registration number was CRD42021277932.
15
16 149

17
18 150 **Eligibility criteria**

19 151 *Study characteristics*

20 152 *Population*

21
22 153 We will include registered nurses, preregistered nurses, midwives,
23 154 and nursing students. Registered nurses comprise all kinds of nurses in
24 155 different hospitals and departments, and primary care nurses. Nursing
25 156 students consist of nursing students studying in college and nurse interns.
26
27 157

28 157 *Intervention*

29
30 158 We will include studies using mindfulness meditation, such as
31 159 mindfulness-based stress reduction (MBSR), mindfulness-based cognitive
32 160 therapy (MBCT), through mobile-based devices, such as smartphones, and
33 161 personal digital assistants (PDA). The intervention is used to improve the
34 162 mental health of nurses.
35
36 163

37 163 *Comparator*

38
39 164 We will include studies using waitlist controls or traditional methods.
40 165 Traditional methods include face-to-face, and online mindfulness
41 166 meditation methods.
42
43 167

44 167 *Outcomes*

45
46 168 We will assess the outcomes of stress, anxiety, depression,
47 169 mindfulness, well-being, and resilience. Stress can be assessed by using
48 170 different instruments, such as the Depression, Anxiety, and Stress Scale
49 171 (DASS-21), the Perceived Stress Scale (PSS-10), et al. Anxiety will be
50 172 measured using the General Health Questionnaire (GHQ-28), State-Trait
51 173 Anxiety Inventory (STAI), and so on. Depression can be assessed using
52 174 the Quick Inventory of Depressive Symptomatology Self-Report (QIDS-
53 175 SR), the Patient Health Questionnaire (PHQ-9), the short German form of
54 176 the Center for Epidemiological Studies' Depression Scale (CES-D), et al.
55
56
57
58
59
60

1
2
3
4 177 Mindfulness will be evaluated through the Five Facet Mindfulness
5 178 Questionnaire (FFMQ), Mindful Attention Awareness Scale (MAAS), et
6 179 al. Well-being can be evaluated using, for example, the Warwick-
7 180 Edinburgh mental wellbeing scale (WEMWBS), the WHO-Five Well-
8 181 Being Index (WHO-5), the General Well-Being Schedule (GWBS), et al.
9 182 Resilience will be measured using the Wagnild Resilience Scale (WRS),
10 183 the Resilience Scale, the Connor-Davidson Resilience Scale, et al. Results
11 184 produced by other scales that can also be applied to this outcome
12 185 measurements, will be included in the study.

186 *Study design*

187 We will include randomized controlled trials (RCTs) and quasi-
188 experimental studies, focusing on mobile-based mindfulness meditation
189 groups versus other traditional mindfulness meditation or wait-list control
190 groups.

191 *Setting*

192 No restriction is imposed on specific treatment process and outcome
193 measurement, although these data may be included for further analysis.

194 *Time frame*

195 There is no restriction on intervention duration and follow-up duration,
196 although these data may be included for further analysis.

197

198 **Report characteristics**

199 We will include studies written in English or Chinese language. No
200 restriction of publication year is applied, and search time was from
201 inception of each database to July 2022. We will include research reported
202 as intervention studies, gray literature, and conference abstracts. Studies
203 that contain sufficient information to assess eligibility for inclusion criteria
204 will also be included.

205

206 **Information sources**

207 An electronic literature search will be conducted using PubMed, Web
208 of Science, EBSCO, Cochrane Library, CINAHL, PsycINFO, ERIC,
209 EMBASE, and three Chinese databases namely CNKI, Wan Fang, and
210 Chinese Biology Medicine disc (CBM). The references of included studies
211 will be searched to identify additional eligible studies. For gray literature,
212 several databases, such as WHO database, PhD thesis/dissertation

1
2
3 213 databases, and OpenGrey, will be systematically searched. For studies
4 214 without full text or lacking of original data, we will try to contact the
5 215 original author.
6
7
8

9 216

10 217 **Search strategy**

11 218 By consulting the literature and pre-searching PubMed, we
12 219 established the search terms. Search terms related to “mobile” contain:
13 220 “mobile applications”, “cell phone”, “cell phone use”, “mobile”, “mobile
14 221 applications”, “mobile based”, “mobile-based”, “distance counseling”,
15 222 “app”, “app based”, “app-based”, “software”, “electronic”, “digital”,
16 223 “smartphone”, “phone”, “online”, “internet”, “web”, “e-health”,
17 224 “telehealth”, “tele-based”, “telemedicine”. We will use the Boolean
18 225 operator “OR” to combine the above words, with different syntaxes being
19 226 adapted to each database.
20

21 227 Search terms related to “mindfulness meditation” include:
22 228 “mindfulness”, “meditation”, “mindfulness-based intervention”, “MBSR”,
23 229 “mindfulness-based stress reduction”, “mindfulness-based cognitive
24 230 therapy”, “vipassana”. The Boolean operator “OR” will be used to combine
25 231 the search terms, and different syntaxes will be adapted to each database.
26

27 232 The keywords used to capture the concept of “nurse” are: “nurses”,
28 233 “nursing”, “nurse midwives”, “students, nursing”, “nurs*”, “nurse”,
29 234 “nurses”, “nursing staff”, “clinical nurse”, “nursing”, “nursing personnel”,
30 235 “registered nurse”, “nursing students”, “nurse interns”. Similarly, the
31 236 Boolean operator “OR” will be used to combine the search terms, and
32 237 different syntaxes will be adapted to each database.
33

34 238 We will use the Boolean operator “AND” to combine the above three
35 239 search terms, namely, “mobile”, “mindfulness meditation”, and “nurse”.
36 240 The retrieval time limitation is from the inception of each database to the
37 241 present. Language will be restricted to English and Chinese. The references
38 242 of included studies and any relevant systematic reviews will be searched
39 243 for additional identified studies. For unsupported data or ongoing studies,
40 244 we will try to contact the original authors. The search strategy of PubMed
41 245 is shown in the Appendix.
42

43 246

44 247 **Data management**

45 248 The retrieved data results will be downloaded to the document-
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4 249 processing software EndNote X9, to have access to titles and abstracts. We
5 250 will remove duplicate literature by comparing article titles and authors
6 251 through the function “Find duplicates” of EndNote X9.
7
8
9

10 252

11 253 **Selection process**

12 254 Two reviewers (CB and YT) will conduct the study selection process
13 255 independently. The first step is preliminary screening. The citation
14 256 information of the detected literature, such as title and abstract, is read to
15 257 eliminate the obviously unqualified literature, and the full text of the
16 258 potentially qualified literature is further screened. The second step is full-
17 259 text screening. For the literature that may be qualified after preliminary
18 260 screening, the methodological part of the full text should be carefully read
19 261 and evaluated, and the relevant information in the literature should be
20 262 extracted to determine whether the literature meets the inclusion criteria
21 263 and whether the literature is included. The third step is to obtain additional
22 264 information. Sometimes, even if the full text of the literature is obtained, it
23 265 may still be impossible to determine whether to include it because the
24 266 information provided is incomprehensive. Therefore, the literature with
25 267 questions or differences should be included first, and then the author is
26 268 contacted to obtain additional information before deciding on the choice or
27 269 conducting further evaluation in the later selection process. The two
28 270 authors will independently select the literature, including determining
29 271 whether it is to be included and recording the reasons for exclusion. Any
30 272 dispute will be settled through discussion. If the discussion still fails, a third
31 273 author will make a decision. The selection process is carried out in strict
32 274 accordance with the PRISMA flowchart.
33
34
35
36
37
38
39
40
41
42
43
44
45

46 275

47 276 **Data collection process**

48 277 Two authors will complete the data collection by filling in the data
49 278 extraction form. Data collection includes the following information: 1.
50 279 basic information of the included research, such as, the number of included
51 280 research, year of publication, citation, first author, and contact informatio;
52 281 2. research methods and possible bias, such as, information related to
53 282 literature quality evaluation, including grouping, and blind methods; 3.
54 283 characteristics of the research object, such as demographic characteristics,
55 284 including the age and gender of the research object; 4. characteristics of
56
57
58
59
60

1
2
3 285 intervention measures, such as mobile mindfulness intervention methods,
4 286 approaches, duration of each intervention, and intervention cycle; 5.
5 287 research results, such as, sample size, grouping, result measurement
6 288 method, data type, statistical data, and results; 6. other information, such
7 289 as, important citations, funding agencies, and potential conflicts of interest.
8 290 Any dispute will be settled through discussion. If the discussion still fails,
9 291 a third author will make a decision. The collected data will be input into
10 292 the system evaluation management software RevMan 5.3 for result
11 293 analysis and reporting.
12
13 294

19 295 **Data items**

21 296 We will extract the following study characteristics and outcomes:

- 22 297 1. Methods: study design, duration of study and run-in period, number of
23 298 study centers and location, study setting, withdrawals, and date of study.
- 24 299 2. Participants: number, mean age, age range, gender, inclusion and
25 300 exclusion criteria, and reported differences between intervention and
26 301 comparison groups.
- 27 302 3. Interventions: duration of mindfulness meditation, number of
28 303 meditations, existence of defined standards of meditation, comparator, and
29 304 concomitant intervention.
- 30 305 4. Outcomes: primary and secondary outcomes specified and collected, and
31 306 time points reported.
- 32 307 5. Notes: funding for study, and notable conflicts of interest of all authors.

41 309 **Outcomes and prioritization**

43 310 We will set stress, anxiety, and depression as the primary outcome,
44 311 assessed using different measurements, such as DASS-21 or PSS-10.
45 312 Stress is a natural reflection of people in the face of tension, which will
46 313 lead to individual worries and restless³¹. Anxiety refers to an unpleasant
47 314 complex emotional state, such as, tension, uneasiness, and worry caused
48 315 by an individual's imminent and possible danger or threat³². The clinical
49 316 characteristics of depression are mainly manifested in depressed mood,
50 317 slow thinking, reduced language and movement, and retardation³³. Stress,
51 318 anxiety, and depression can significantly indicate the mental health level
52 319 of nurses³⁴. Outcome data will be expressed as mean \pm standard deviation
53 320 (M \pm SD). If data are offered in other forms such as median–range or
54
55
56
57
58
59
60

1
2
3
4 321 median–interquartile range, $M \pm SD$ will be calculated following the
5 322 recommendations of the Cochrane Handbook for Systematic Reviews of
6 323 Interventions³⁵.

8 324 Secondary outcomes will be set as mindfulness, well-being, and
9 325 resilience. These three outcomes have a close positive correlation with
11 326 mental health³⁶. Improving mindfulness, well-being, and resilience will
13 327 help nurses efficiently handle mental health problems, such as, stress,
15 328 anxiety, and depression³⁷.

16 329

17 330 **Risk of bias in individual studies**

19 331 Two reviewers will assess the risk of bias for each included study
21 332 independently. For randomized controlled trials (RCTs), the risk of bias
22 333 will be assessed using Cochrane risk-of-bias tool for randomized trials
24 334 (RoB 2)³⁸, which includes seven criteria: random sequence generation,
25 335 allocation concealment, blinding of participants and personnel, blinding of
27 336 outcome assessment, incomplete data outcomes, selective outcome
28 337 reporting, and other biases. Each criterion will be graded as high, unclear,
30 338 or low risk of bias. For non-RCT studies, the risk of biases in
31 339 nonrandomized studies of interventions (ROBINS-I) tool will be
33 340 determined³⁹. The biases include bias due to confounding, bias in the
35 341 selection of study participants, bias in the classification of interventions,
36 342 bias due to deviations from intended interventions, bias due to missing data,
37 343 bias in the measurement of outcomes, bias in the selection of the reported
38 344 result, and overall bias.

41 345 Anticipated methods for assessing the risk of bias of individual studies
42 346 will be described, including whether the assessment will be done at the
43 347 outcome or study level or both; and how the information will be used in
44 348 data synthesis. Any dispute will be settled through discussion. If the
45 349 discussion still fails, a third author will make a decision.

49 350

51 351 **Data synthesis**

52 352 Meta-analysis will be conducted using RevMan 5.3 software. The
53 353 weighted mean difference (MD) model will be used to analyze continuous
54 354 data if all outcomes are measured using identical methods; otherwise, the
55 355 standardized mean difference (SMD) will be used. I^2 test will be conducted
56 356 to assess the degree of heterogeneity of included studies. $I^2 > 50\%$ is

1
2
3 357 identified as significant heterogeneity in accordance with the Cochrane
4 358 handbook. The values of P and I^2 will be used to determine which model
5 359 to choose. A fixed-effect model will be chosen if $P > 0.1$ and $I^2 < 50\%$,
6 360 whereas a random-effect model will be selected if $P < 0.1$ and $I^2 > 50\%$. In
7 361 addition, sensitivity analysis through the leave-one-out method and
8 362 subgroup analysis will be performed within significant heterogeneity. All
9 363 effective quantities will be expressed by 95% confidence intervals (CI). P
10 364 < 0.05 will define statistical significance. If significant heterogeneity ($I^2 >$
11 365 50%) founded, sensitivity analysis will be performed through the leave-
12 366 one-out method. If sensitivity analysis still indicates great heterogeneity
13 367 after removing any research results, then subgroup analysis will be carried
14 368 out. They will be divided into subgroups via intervention methods,
15 369 intervention duration, or sample sized. If the source of heterogeneity
16 370 cannot be found, it will be described in narrative terms.

371

372 **Meta-bias**

373 For all included studies, we will check if a registered study protocol
374 is available and whether the protocol has been registered before the study
375 is initialized. Moreover, we will screen the outcomes documented in the
376 protocol against the reported outcomes to evaluate potential reporting bias.
377 If more than or equal to 10 studies are available for meta-analysis, a funnel
378 plot will be used to quantify the extent of publication bias for the primary
379 outcome by assessing funnel plot asymmetry visually and using Egger's
380 test at a significance level of 5%⁴⁰. If included studies are less than 10 in
381 this meta-analysis, we will assess publication bias qualitatively on the basis
382 of the characteristics of the included studies.

383

384 **Confidence in cumulative evidence**

385 The confidence of the final included studies will be assessed using the
386 GRADE (Grading of Recommendations Assessment, Development and
387 Evaluation) rating scale⁴¹.

388

389 **Patient and public involvement**

390 There was no patient or public involvement in the development in this
391 protocol study.

392

393 Discussion

394 This study protocol designs a plan for the systematic review and
395 meta-analysis of the effects of MMM on the mental health, such as stress,
396 anxiety, depression, mindfulness, well-being, and resilience of nurses.
397 With the constant attention paid to the mental health of nurses⁴² and the
398 rapid development of mobile technology²³, mindfulness decompression
399 therapies based on mobile technology have been applied to the research of
400 nurses' mental health. However, as far as we know, no systematic review
401 exists at present. Therefore, our research will be the first systematic review
402 on the effects of MMM on the mental health of nurses. Findings from this
403 review will help illuminate the impact of MMM intervention on nurses.
404 We will further analyze which aspects of MMM have a positive impact, no
405 impact, or even a reverse effect on mental health of nurses, and explore the
406 possible reasons. We aim to provide more scientific intervention methods
407 and theoretical bases for the mental health of nurses.

408

409 **Ethics and dissemination:** This is a meta-analysis research protocol
410 program, which does not collect raw data and requires no ethical evaluation.
411 The research results will be published in peer-reviewed scientific
412 publications.

413

414 **Contributors:** CB, YT, TL, SYQ, and LY designed the study and drafted
415 the manuscript protocol. WY, XL, and XCX registered the methods on the
416 PROSPERO website. CH critically revised the protocol and manuscript
417 submitted. All authors read and approved the final manuscript.

418 **Competing interests:** All authors declare that there is no conflict of
419 interests.

420 **Funding:** None.

421 **Data sharing statement:** None declared.

422 **Ethics approval statement:** Not required.

423

424 References

- 425 1. Liu Y, Wang H, Chen J, et al. Emergency management of nursing human
426 resources and supplies to respond to coronavirus disease 2019
427 epidemic. *International Journal of Nursing Sciences* 2020;7(2):135-
428 38. doi: 10.1016/j.ijnss.2020.03.011

- 1
2
3 429 2. Khan HM. Workload pressure of nurses at an emergency satellite
4 430 hospital in Peshawar Pakistan. *Eur J Public Health*
5 431 2020;30(Supplement_5) doi: 10.1093/eurpub/ckaa166.626
- 6
7
8 432 3. Hassani MR, Behnamian J. A scenario-based robust optimization with a
9 433 pessimistic approach for nurse rostering problem. *Journal of*
10 434 *Combinatorial Optimization* 2020;40(4):1-27. doi: 10.1007/s10878-
11 435 020-00667-0
- 12
13
14 436 4. Alyami HM, Chan RJ, New K. End-of-life care preferences for people
15 437 with advanced cancer and their families in intensive care units: a
16 438 systematic review. *Support Care Cancer* 2019;27(9):3233–44.
- 17
18
19 439 5. Marcia A Lowe, Aoyjai Prapanjaroensin, Marie A Bakitas, et al. An
20 440 exploratory study of the Influence of perceived organizational
21 441 support, coworker social support, the nursing practice environment,
22 442 and nurse demographics on burnout in palliative care nurses. *J Hosp*
23 443 *Palliat Nurs* 2020;22(6):465-72. doi:
24 444 10.1097/NJH.0000000000000686
- 25
26
27 445 6. Farid M, Purdy N, Neumann WP. Using system dynamics modelling to
28 446 show the effect of nurse workload on nurses' health and quality of
29 447 care. *Ergonomics* 2020;63(8):952-64. doi:
30 448 10.1080/00140139.2019.1690674
- 31
32
33 449 7. Msc NS, Wei L, Shic S, et al. A qualitative study on the psychological
34 450 experience of caregivers of COVID-19 patients. *Am J Infect Control*
35 451 2020;48(6):592-98. doi: 10.1016/j.ajic.2020.03.018
- 36
37
38 452 8. Harris LS, Atif B, Abdullah H, et al. Violence breeds violence: burnout
39 453 as a mediator between patient violence and nurse violence. *Int J*
40 454 *Occup Saf Ergon* 2019;25(4):604-13. doi:
41 455 10.1080/10803548.2018.1429079
- 42
43
44 456 9. Sawyer AT, Bailey AK, Green JF, et al. Resilience, insight, self-
45 457 compassion, and empowerment (RISE): A randomized controlled
46 458 trial of a psychoeducational group program for nurses. *J Am*
47 459 *Psychiatr Nurses Assoc* 2021(6):107839032110333. doi:
48 460 10.1177/10783903211033338
- 49
50
51 461 10. Lee H, Chiang H, Kuo H. Relationship between authentic leadership
52 462 and nurses' intent to leave: The mediating role of work environment
53 463 and burnout. *J Nurs Manag* 2019;27(1):52–65. doi:
54 464 10.1111/jonm.12648

- 1
2
3
4 465 11. Salvarani V, Rampoldi G, Ardenghi S, et al. Protecting emergency
5 466 room nurses from burnout: The role of dispositional mindfulness,
6 467 emotion regulation and empathy. *J Nurs Manag* 2019;27(4):765–74.
7 468 doi: 10.1111/jonm.12771
8
9 469 12. Dodek PM, Norena M, Ayas N, et al. Moral distress is associated with
10 470 general workplace distress in intensive care unit personnel. *J Crit*
11 471 *Care* 2018;50:122-25. doi: 10.1016/j.jcrc.2018.11.030
12
13 472 13. Dodek P, Norena M, Ayas N, et al. Moral distress in intensive care unit
14 473 personnel is not consistently associated with adverse medication
15 474 events and other adverse events. *J Crit Care* 2019;53:258-63. doi:
16 475 10.1016/j.jcrc.2019.06.023
17
18 476 14. Bailey AK, Sawyer AT, Robinson PS. A psychoeducational group
19 477 intervention for nurses: Rationale, theoretical framework, and
20 478 development. *J Am Psychiatr Nurses Assoc*
21 479 2021;10783903211001116. doi: 10.1177/10783903211001116
22
23 480 15. Bostock S, Crosswell AD, Prather AA, et al. Mindfulness on-the-go:
24 481 Effects of a mindfulness meditation app on work stress and well-
25 482 being. *Occup Health Psychol* 2018;24(1):127-38. doi:
26 483 10.1037/ocp0000118
27
28 484 16. Paulson S, Davidson R, Jha A, et al. Becoming conscious: the science
29 485 of mindfulness. *Ann N Y Acad Sci* 2013;1303:87-104. doi:
30 486 10.1111/nyas.12203
31
32 487 17. Yang J, Tang S, Zhou W. Effect of mindfulness-based stress reduction
33 488 therapy on work stress and mental health of psychiatric nurses.
34 489 *Psychiatria Danubina* 2018;30(2):189-96. doi:
35 490 10.24869/psyd.2018.189
36
37 491 18. Laurence , Guillaumie, Olivier , Boiral, Julie , Champagne. A
38 492 mixed-methods systematic review of the effects of mindfulness on
39 493 nurses. *J Adv Nurs* 2017;73(5):1017-34. doi: 10.1111/jan.13176
40
41 494 19. Ruiz - Fern á ndez MD, Ort í z - Amo R, Ortega - Gal á n nM, et al.
42 495 Mindfulness therapies on health professionals. *Int J Ment Health*
43 496 *Nurs* 2020;29(2):127-40. doi: 10.1111/inm.12652
44
45 497 20. Ghawadra SF, Abdullah KL, Yuen CW, et al. Mindfulness-based stress
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 498 reduction for psychological distress among nurses: A systematic
4 499 review. *J Clin Nurs* 2019;28(21):1-10. doi: 10.1111/jocn.14987
5
6
7 500 21. Suleiman-Martos N, Gomez-Urquiza JL, Aguayo-Estremera R, et al.
8
9 501 The effect of mindfulness training on burnout syndrome in nursing:
10
11 502 A systematic review and meta-analysis. *J Adv Nurs* 2020;76(5):1-
12
13 503 16. doi: 10.1111/jan.14318
14
15 504 22. Mallory T, Hageman JR, Melanie B. A Mindfulness Intervention for
16
17 505 Residents: Relevance for Pediatricians. *Pediatr Ann*
18
19 506 2016;45(10):e373-e76. doi: 10.3928/19382359-20160912-01
20
21 507 23. Chen B, Wang Y, Xiao L, et al. Effects of mobile learning for nursing
22
23 508 students in clinical education: A meta-analysis. *Nurse Educ Today*
24
25 509 2020;97:1-9. doi: 10.1016/j.nedt.2020.104706
26
27 510 24. Gozalo RMG, Tarrés JMF, Ayora AA. Application of a mindfulness
28
29 511 program among healthcare professionals in an intensive care unit:
30
31 512 Effect on burnout, empathy and self-compassion. *Med Intensiva*
32
33 513 2018;43(4):207-16. doi: 10.1016/j.medin.2018.02.005
34
35 514 25. Reyes AT. A mindfulness mobile app for traumatized COVID-19
36
37 515 healthcare workers and recovered patients: A response to “The Use
38
39 516 of Digital Applications and COVID-19”. *Community Ment Health J*
40
41 517 2020;56(7):1204-05. doi: 10.1007/s10597-020-00690-9
42
43 518 26. Reyes AT, Song H, Bhatta TR, et al. Exploring the relationships
44
45 519 between resilience, mindfulness, and experiential avoidance after
46
47 520 the use of a mindfulness- and acceptance-based mobile app for
48
49 521 posttraumatic stress disorder. *Perspectives in Psychiatric Care*
50
51 522 2021;1-9. doi: 10.1111/ppc.12848.
52
53 523 27. Fiol-Deroque MA, Serrano-Ripoll MJ, Jiménez R, et al. A mobile
54
55 524 phone-based intervention to reduce mental health problems in
56
57 525 healthcare workers during the COVID-19 pandemic (PsyCovidApp):
58
59 526 Randomized controlled trial. *JMIR mhealth uhealth*
60
527 2021;9(5):e27039. doi: 10.2196/27039
528
529 28. Pospos S, Young IT, Downs N, et al. Web-based tools and mobile
530
531 529 applications to mitigate burnout, depression, and suicidality among
532
533 530 healthcare students and professionals: A systematic review. *Acad*
534
535 531 *Psychiatry* 2018;42(1):109-20. doi: 10.1007/s40596-017-0868-0

- 1
2
3 532 29. Stefanopoulou E, Hogarth H, Taylor M, et al. Are digital interventions
4 533 effective in reducing suicidal ideation and self-harm? A systematic
5 534 review. *Journal of Mental Health* 2020;29(2):207-16. doi:
6 535 10.1080/09638237.2020.1714009
- 7
8
9 536 30. Moher D, Shamseer L, Clarke M, et al. Preferred reporting items for
10 537 systematic review and meta-analysis protocols (PRISMA-P) 2015
11 538 statement. *Systematic reviews* 2015;4(1):1. doi: 10.1186/2046-4053-
12 539 4-1
- 13
14
15 540 31. Balmus IM, Robea M, Ciobica A, et al. Perceived stress and
16 541 gastrointestinal habits in college students. *Acta Endocrinol (Copenh)*
17 542 2019;15(2):274-75. doi: 10.4183/aeb.2019.274
- 18
19
20 543 32. Michela B, Fedele C, Leonardo C, et al. Assessment of anxiety in older
21 544 adults: A review of self-report measures. *Clin Interv Aging*
22 545 2018;13:573-93. doi: 10.2147/CIA.S114100
- 23
24
25 546 33. Hammen, Constance. Risk factors for depression: An autobiographical
26 547 review. *Annu Rev Clin Psychol* 2018;14:1-28. doi: 10.1146/annurev-
27 548 clinpsy-050817-084811
- 28
29
30 549 34. Zerbini G, Ebigbo A, Reiche Rts P, et al. Psychosocial burden of
31 550 healthcare professionals in times of COVID-19—a survey conducted
32 551 at the University Hospital Augsburg. *German medical science :
33 552 GMS e-journal* 2020;18 doi: 10.3205/000281
- 34
35
36 553 35. Mihai-Calin P, Raquel C, Laia E, et al. The effect of preoperative
37 554 chemotherapy on liver regeneration after portal vein
38 555 embolization/ligation or liver resection in patients with colorectal
39 556 liver metastasis: a systematic review protocol. *Systematic reviews*
40 557 2020;9:279. doi: 10.1186/s13643-020-01545-w
- 41
42
43 558 36. Litvin S, Saunders R, Maier MA, et al. Gamification as an approach to
44 559 improve resilience and reduce attrition in mobile mental health
45 560 interventions: A randomized controlled trial. *PLoS One*
46 561 2020;15(9):e0237220. doi: 10.1371/journal.pone.0237220
- 47
48
49 562 37. Eaves JL, Payne N. Resilience, stress and burnout in student midwives.
50 563 *Nurse Educ Today* 2019;79:188-93. doi:
51 564 10.1016/j.nedt.2019.05.012
- 52
53
54 565 38. Sterne J, Savovi J, Page MJ, et al. RoB 2: A revised tool for assessing
55 566 risk of bias in randomised trials. *BMJ Clinical Research*
56 567 2019;366:14898. doi: 10.1136/bmj.14898
- 57
58
59
60

- 1
2
3 568 39. Sterne JA, Hernán MA, Reeves BC, et al. ROBINS-I: a tool for
4 569 assessing risk of bias in non-randomised studies of interventions.
5 570 *The BMJ* 2016;355:i4919. doi: 10.1136/bmj.i4919
6
7 571 40. Sterne JAC, Sutton AJ, Ioannidis JPA, et al. Recommendations for
8 572 examining and interpreting funnel plot asymmetry in meta-analyses
9 573 of randomised controlled trials. *BMJ* 2011;343:d4002. doi:
10 574 10.1136/bmj.d4002
11 575 41. Yang B, Mustafa RA, Bossuyt PM, et al. GRADE guidelines: 31.
12 576 Assessing the certainty across a body of evidence for comparative
13 577 test accuracy. *J Clin Epidemiol* 2021;136:146-56. doi:
14 578 10.1016/j.jclinepi.2021.04.001
15 579 42. Zeller JM, Johnson AM, Hoffman A, et al. Mindfulness training to
16 580 improve nurse clinical performance: A pilot study. *West J Nurs Res*
17 581 2021;43(3):250-60. doi: 10.1177/0193945920964938
18
19
20
21
22
23
24
25
26 582

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	Location where item is reported
ADMINISTRATIVE INFORMATION			
Title:			LINE
Identification	1a	Identify the report as a protocol of a systematic review	38
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	/
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	70
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	4
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	409
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	/
Support:			
Sources	5a	Indicate sources of financial or other support for the review	/
Sponsor	5b	Provide name for the review funder and/or sponsor	/
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	/
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	41
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	46
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	145
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	201
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits such that it could be	212

		repeated	
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	242
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	248
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently in duplicate), any processes for obtaining and confirming data from investigators	271
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	290
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	304
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	325
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	348
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I ² , Kendall's τ)	351
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	356
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	364
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	367
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	379

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (site when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.