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REVIEW ARTICLE

The use of mHealth apps to improve hospital nurses' mental
health and well- being: A systematic review

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Chunk 2

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Chunk 3

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Email: cindimoore@hotmail.comAbstract

Chunk 4

Email: cindimoore@hotmail.comAbstract

Background: Nursing well- being has become a heightened focus since the COVID- 19 pandemic. Nurses are leaving the profession early in their careers or retiring sooner than expected. Those who remain in the workforce report higher levels of burnout, anxiety, depression, and exhaustion. There is concern that there may be a shortage of at least half a million nurses by 2030.

Chunk 5

at least half a million nurses by 2030.

Aims: This systematic review aimed to investigate the evidence of using a mental health promotion mHealth app to improve the mental health of hospital nurses.

Methods: A systematic search was conducted in CINAHL Plus with Full Text, MEDLINE with Full Text, Professional Development Collection, Psychology and Behavioral Sciences Collection, Sociological Collection, PsycInfo, Embase, and PubMed with

Chunk 6

search dates of January 2012–November 15, 2022. The mHealth intervention needed to be asynchronously delivered through a smartphone with hospital nurse participants to be included in this review.

Results: Of the 157 articles screened for this review, six were included. Primary outcome variables were anxiety, burnout, coping, depression, self-efficacy, stress, well-being, and work engagement. Intervention types included mindfulness-based

Chunk 7

interventions (MBIs), cognitive behavioral therapy (CBT), stress inoculation therapy (SIT), psychoeducation, and stress management. Anxiety, depression, well-being, and burnout improved with MBIs; depression improved with CBT; and anxiety and active coping improved with SIT.

Linking evidence to action: This review demonstrated promising findings in using mHealth apps to improve the mental health of hospital nurses. However, more ran -

domized controlled trials with larger sample sizes may reveal which type of mHealth app and how much exposure to the intervention is more effective in improving specific mental health symptoms. Longitudinal follow-up is also recommended to study sustainability of the mental health improvements.

KEYWORDS

anxiety, burnout, mental health, mHealth app, mindfulness-based intervention, nurses, review, smartphone, stress, well-being

smartphone, stress, well-being

| 111

THE USE OF mHealth APPS TO IMPROVE HOSPITAL NURSES' MENTAL HEALTH AND WELL-BEING

INTRODUCTION

Nurses are reporting more negative mental health symptoms than ever before, especially those who care for patients in the hospital setting. Post-pandemic studies found that 68% of nurses reported high levels of stress, 59% reported exhaustion, 45% reported anxiety, 38% felt burnout, and over 50% reported thoughts of leaving.

Chunk 10

ing their job in the next 6 months (American Nurses Association [ANA], 2022). These findings have negative implications not only for the personal well- being of nurses but also for the stability of the nursing workforce and the ability to deliver quality healthcare to our communities in the near future. Zhang et al. (2017) estimate that by 2030, the United States will have a nursing workforce shortfall of over half a million nurses. Supporting the mental health of hospital

Chunk 11

nurses is one way to help build a healthy nursing workforce that can meet future healthcare demands.

Nurses who feel supported by their organization by taking part in mental health promotion programs are more likely to succeed in achieving better health (Melnyk et al., 2021). There are numerous randomized controlled trials (RCTs) that have demonstrated sustained positive health effects in healthcare workers from inter -

Chunk 12

ventions designed to improve mental health, well- being, resilience, lifestyle habits, and physical activity (Mistretta et al., 2018 ; Spinelli et al., 2019 ; Stratton et al., 2017). Many interventions like these have been carried out in settings that require attendance to a web- based activity or in- person seminar, lasting over an hour or more, with regular follow- up activity (Melnik et al., 2021). Nurses often find it dif -

Chunk 13

difficult to attend a class or participate in scheduled events, whether because of personal obligations, work schedules, or lengthy work commute (Ross et al., 2019). Access to mental health promotion programs can be facilitated by delivering the intervention through a smartphone, commonly referred to as a mobile health (mHealth) app (Lewis et al., 2014).

The World Health Organization defines an mHealth app as any health promotion program that is delivered using mobile phone

Chunk 14

technology (Hassen, 2020). Since the onset of the COVID- 19 pandemic, the market growth of mental health mHealth apps has more than doubled and is expected to continue to grow at a rate of about 20% year after year until 2030 (Grand View Research [GVR], 2023). Apps for depression, anxiety, meditation, and stress dominate the market shares of mental health apps, and stress management (SM) is predicted to have the most rapid expan -

Chunk 15

sion in the coming years (GVR, 2023). There is growing evidence that the recent technological advancements in mHealth apps are consistently producing positive outcomes at a clinical level and will continue to improve to meet the health needs of the users (Olsen, 2021). However, researchers are unable to show consistent effectiveness of the apps on sustained improvement in common mental health disorders, such as depression and anxiety in

Chunk 16

diverse populations (Goldberg et al., 2022 ; Lu et al., 2022 ; Tsai et al., 2022). This systematic review aimed to investigate the evidence that using a mental health promotion mHealth app could improve the mental health of hospital nurses, compared to nurses who received a single session, a different mHealth intervention, or nothing at all. Specifically, intervention approaches used in each mHealth app, occupational and mental health outcomes measures

Chunk 17

within and between groups, and sustainability of the outcomes were assessed.

METHODS

This systematic review followed recommendations by the Centre for Reviews and Dissemination guidance for undertaking reviews in health care (Centre for Review and Dissemination, 2008) and is registered in the International Prospective Register of Systematic Reviews (PROSPERO; CRD42023384846).

Search strategy

Keyword searches were completed using the following databases:

Chunk 18

CINAHL Plus with Full Text, MEDLINE with Full Text, Professional Development Collection, Psychology and Behavioral Sciences Collection, Sociological Collection; PsycInfo; Embase; and PubMed. We used a lower date boundary of January 2012, when smartphones were being developed, and limiters of “all adult” and “adulthood.” MeSH terms and Boolean operations were used to develop a comprehensive, nested search list (Table 1). Relevant ar -

ticle reference lists were hand- searched, but no new articles were found. One author (CM) performed this search and exported all available articles. Two authors (CM and SK) reviewed titles and abstracts to assess for eligibility for the review. The last search was performed on November 15, 2022 to ensure new literature was not overlooked.

TABLE 1 Search terms.

(nurse* OR nurses OR nursing OR “nursing student*” OR “nurse, registered” OR “registered nurse*” OR “nursing personnel” OR

Chunk 20

“new grad*” OR “newly graduated nurse*” OR “nursing staff”)

AND

(mindfulness OR meditation OR “mindfulness meditation*” OR CBT

or “cognitive behavioral therapy*” or “cognitive behavioral”

OR “stress management*” OR “well being” OR “well- being*” OR

resilience OR coping OR “guided imagery*” OR “mindfulness-

based intervention*” OR “mind-body therapy*” OR “self- care”

OR “self care*” OR “self- help”)

AND

(“mhealth app*” OR “ehealth app*” OR “mobile phone*” OR “cell

Chunk 21

phone*" OR "m- health" or "e- health" OR smartphone* OR
"mobile phone*" OR "app, mobile" OR "application, mobile" OR
"digital health" OR phone* OR "mobile health")

AND

("compassion fatigue*" OR burnout OR "career burnout" OR "work
burnout" OR "emotional distress" OR "emotional stress" OR "job
stress*" OR "occupational stress*" OR "job stress*" OR "mental
strain" OR "mental fatigue" OR "work stress*" OR "work- related
stress*" OR "workplace stress*")

NOT

Patient

stress*" OR "workplace stress*")

NOT

Patient

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112 |

THE USE OF mHealth APPS TO IMPROVE HOSPITAL NURSES' MENTAL HEALTH AND
WELL-BEING

Eligibility criteria

WELL-BEING

Eligibility criteria

Three inclusion criteria were used: (1) direct patient care hospital nurses, nurse practitioners (NPs), and nursing or NP students; (2) intervention must be delivered solely by smartphone; and (3) intervention can be accessed asynchronously. Six exclusion criteria were used: (1) any technology-based intervention that did not use a smartphone; (2) any intervention that offered supplemental

FIGURE 1 Flowchart of study identification/PRISMA guidelines (Page et al., 2021).Studies identified from :

Database s(n= 195)Studies removed before
screenin g:

Duplicate record sremoved
(n=38)

Studies screene d
(n=157)Studies excluded**
(n=127)

Studies sought for retrieva l
(n=30)

Studies assessed for eligibili ty
and full text read
(n=30)Studies excluded :(n = 24)

No Research (n= 1)

Abstract Only (n=1)

Protocol Only (n=4)

Editorial Only (n = 2)

Wrong Population (n = 7)

Chunk 25

Editorial Only (n = 2)

Wrong Population (n = 7)

Wrong Intervention (n = 4)

Wrong Study Design (n = 2)

No Data Reported (n = 1)

Sample Size ≤ 30 (n = 2)

Studies included in review

(n=6)Identification of studie svia databases and registersIdentification Screening Included

TABLE 2 JBI critical appraisal checklist tool for RCT studies.

Was true

randomization

used for

assignment of

participants to

treatment groups?Was allocation

to treatment

groups

concealed?Were treatment

groups similar

Chunk 26

groups

concealed? Were treatment

groups similar

at the baseline? Were participants

blind to

treatment

assignment? Were those

delivering

treatment

blind to

treatment

assignment? Were outcomes

assessors blind

to treatment

assignment? Were treatment

groups treated

identically

other than the

intervention of

interest? Was follow up

complete and

if not, were

differences

between groups

in terms of

their follow- up

adequately

described and

analyzed?Were participants

analyzed in

Chunk 27

analyzed? Were participants
analyzed in
the groups
to which
they were
randomized? Were outcomes
measured
in the same
way for
treatment
groups? Were outcomes
measured
in a reliable
way? Was appropriate
statistical
analysis used? Was the trial design
appropriate,
and any
deviations from
the standard
RCT design
accounted for in
the conduct and
analysis of the
trial?

Villani 2013 U U U U U U U U U U Y Y Y

Hwang Y U N Y N A U N Y N Y Y Y Y

Imamura Y N U N N N N Y Y Y Y Y Y

Chunk 28

Imamura Y N U N N N N Y Y Y Y Y Y

Sasaki Y N U N N N N Y Y Y Y Y Y

Note : Green indicates was met. Yellow indicates unclear. Red indicates not met.

Abbreviations: JBI, Joanna Briggs Institute; N, No; NA, not applicable; U, unclear; Y, Yes.

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| 113

THE USE OF mHealth APPS TO IMPROVE HOSPITAL NURSES' MENTAL HEALTH AND
WELL-BEING

coaching, even if the primary intervention was delivered by smart -

phone; (3) any in-person class delivery of the intervention; (4) any intervention that required access to a computer; (5) any intervention that required synchronous participation in a group setting; and (6) any study that included any other healthcare workers.

Operational definitions of excluded terms were: (1) Smartphone is any mobile phone that is capable of executing a software application; (2) Technology-based intervention is any program that is primary

Chunk 31

ily designed to be delivered by signing into a website from a desktop or laptop computer; (3) Supplemental coaching is any written or verbal interaction with another person whose role is to provide counseling or advice to a participant in the study; and (4) In-person class is any program that requires attendance at a specified time, usually in a group setting.

Study selection

All relevant articles were exported into Zotero© and then into

Covidence©. Duplicate articles were automatically removed. Two authors (CM and SK) applied eligibility criteria to independently select articles for inclusion in screening and full-text review and discussed and resolved any disagreements.

Data extraction and quality evaluation

An extraction template was developed to collect the following: (1) study title, date, and first author; (2) country; (3) conceptual model; (4) study setting and population description; (5) aim of the study;

(6) study design; (7) demographic variables; (8) intervention description, dose, and time span; (9) mhealth app name; and (10) outcome variables and measures. Quality was assessed using Joanna Briggs Institute (JBI) critical appraisal tools for RCTs and cohort studies (Moola et al., 2020 ; Tufanaru et al., 2020). Extraction and quality assessment were performed independently by two authors (CM and SK) and any disagreements were discussed until an agreement was reached.

Data analysis

reached.

Data analysis

Pooled statistical analysis was not possible because outcome variables in the included studies were measured using different scales, and sample sizes amongst the majority of the studies were small, either by design or attrition. Reported significance, based on an alpha of 0.05, was descriptively compared.

RESULTS

Search results

The initial search resulted in 195 articles, of which 38 were dupli -

cates. Initial screening resulted in 127 articles being excluded. Of the remaining 30 articles, only nine met eligibility criteria (Figure 1). Full- text review demonstrated that three of the nine studies (Hommelsson, 2022 ; Jakel et al., 2016 ; Villani et al., 2012) either did not report data or did not have a large enough sample size (≥ 30) to produce data suitable for statistical analysis (Gliner et al., 2017 , p. 153). These were removed from the study selection, leaving six

studies for the review.

Study quality

The results of the JBI RCT and cohort critical appraisals are in

Tables 2 and 3 . Of the four RCTs, one met three of the 13 criteria

(Villani et al., 2013), and three met seven of the 13 criteria (Hwang &

Jo, 2019 ; Imamura et al., 2021 ; Sasaki et al., 2021). Of the two non-

RCTs, one met five of the 11 criteria (Knill et al., 2021) and one met

four of the 11 criteria (Foley & Lanzillotta- Rangeley, 2021). Because

TABLE 2 JBI critical appraisal checklist tool for RCT studies.

Was true

randomization

used for

assignment of

participants to

treatment groups?Was allocation

to treatment

groups

concealed?Were treatment

groups similar

at the baseline?Were participants

blind to

treatment

assignment?Were those

delivering

treatment

blind to

treatment

assignment?Were outcomes

assessors blind

to treatment

assignment?Were treatment

groups treated

identically

other than the
intervention of

Chunk 38

identically
other than the
intervention of
interest? Was follow up
complete and
if not, were
differences
between groups
in terms of
their follow- up
adequately
described and
analyzed? Were participants
analyzed in
the groups
to which
they were
randomized? Were outcomes
measured
in the same
way for
treatment
groups? Were outcomes
measured
in a reliable

way?Was appropriate

statistical

analysis used?Was the trial design

appropriate,

and any

deviations from

the standard

and any
 deviations from
 the standard
 RCT design
 accounted for in
 the conduct and
 analysis of the
 trial?

Villani 2013 U U U U U U U U U U Y Y Y

Hwang Y U N Y NA U N Y N Y Y Y Y

Imamura Y N U N N N N Y Y Y Y Y Y

Sasaki Y N U N N N N Y Y Y Y Y Y

Note : Green indicates was met. Yellow indicates unclear. Red indicates not met.

Abbreviations: JBI, Joanna Briggs Institute; N, No; NA, not applicable; U, unclear; Y, Yes.

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114 |

THE USE OF mHealth APPS TO IMPROVE HOSPITAL NURSES' MENTAL HEALTH AND
WELL-BEING

these two studies had only one experimental group and no control

Chunk 41

group (Foley & Lanzillotta- Rangeley, 2021 ; Knill et al., 2021), two of the 11 criteria related to comparing the experimental group with the control group were not applicable.

Characteristics of selected studies

Six studies were selected for inclusion in this review (Foley & Lanzillotta- Rangeley, 2021 ; Hwang & Jo, 2019 ; Imamura et al., 2021 ; Knill et al., 2021 ; Sasaki et al., 2021 ; Villani et al., 2013). Three were

RCTs, one was a secondary analysis of one of the selected RCTs, one was pre- experimental, and one was an evidence- based- practice quality improvement project (Table 4). All participants were hospital clinical nurses, with sample sizes ranging from 30 to 949. Of the studies that reported gender and level of education, 86% of participants were female, 23.2% had an associate degree or diploma, 70.8% had a bachelor's degree, and 6% had a graduate degree or

were in a graduate degree program.

Findings

All six studies had significant findings using an alpha of 0.05 in their statistical analysis. One study showed improvement in well-being and burnout in nurses and NPs at 30, 60, and 90 days when the groups were pooled (Knill et al., 2021), and one showed improvement in stress and self-efficacy within the experimental group at 4 weeks (Hwang & Jo, 2019). However, both of these studies note

Chunk 44

that the participants had normal baseline scores of well-being, burn-out (Knill et al., 2021), anxiety, and depression (Hwang & Jo, 2019) at the start of the study, potentially decreasing the effects of the interventions. Imamura et al. (2021) showed a decrease in depression at 3 months in the intervention group that used CBT modules in a fixed order over a 6-week period, but only for those whose baseline depression was ≤ 10 on the Depression Anxiety Stress Scale- 21, and

these changes were not significant at 7 months. Sasaki et al. (2021) reported an increase in work engagement in the intervention group that used a fixed order of CBT modules, but changes were not significant at 7 months. Foley and Lanzillotta- Rangeley (2021) demonstrated a decrease in depression, anxiety, and stress. Lastly, one study had improvement in anxiety and coping at 4 weeks (Villani et al., 2013).

Attrition was problematic for two of the six studies. Foley and

Lanzillotta- Rangeley (2021) reported a completion rate of 40%. Knill et al. (2021) reported attrition in both groups, resulting in a completion rate of 58% by the nurse group and 42% by the NP group.

A common feature of mHealth apps is the ability to analyze user engagement and ongoing use of the app by tracking the number of modules accessed, number of minutes a program is used, and how often the app is accessed (Fleming et al., 2018). Three of the

Chunk 47

studies in this review reported the mHealth app usage metrics in their studies. Foley and Lanzillotta-Rangeley (2021) showed that TABLE 3 JBI critical appraisal checklist tool for cohort studies.

Were the two groups similar and recruited from the same population? Were the exposures measured similarly to assign people to both exposed and unexposed groups? Was the exposure measured in a valid and reliable way? Were confounding factors

identified?Were strategies

Chunk 48

confounding

factors

identified? Were strategies

to deal with

confounding

factors stated? Were the groups/

participants free

of the outcome

at the start of

the study (or at

the moment of

exposure)? Were the

outcomes

measured in

a valid and

reliable way? Was the follow

up time reported

and sufficient to

be long enough

for outcomes to

occur? Was follow up

complete, and

if not, were the

reasons to loss

to follow up

described and
explored?Were
strategies
to address
incomplete

Chunk 49

strategies

to address

incomplete

follow up

utilized?Was

appropriate

statistical

analysis

used?

Foley NA NA Y U NA U Y Y U U Y

Knill NA NA Y Y N U Y Y N U Y

Note : Green indicates was met. Yellow indicates unclear. Red indicates not met.

Abbreviations: JBI, Joanna Briggs Institute; N, No; NA, not applicable; U, unclear; Y, Yes.

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| 115

THE USE OF mHealth APPS TO IMPROVE HOSPITAL NURSES' MENTAL HEALTH AND
WELL-BEING

the nurse anesthesia students completed an average of 6.5 ses -

Chunk 51

sions out of the 10, averaging 51.2 min of meditation over the 10-day period. Knill et al. (2021) reported that the oncology nurses and NPs meditated for a combined 16,010 min; app usage by nurses dropped from 58% at day 30 to 39% at day 90, and NP app usage dropped from 72% at day 30 to 46% at day 90. The nurses reported group use of the app while at work, so only one user was tracked, which made the individual usage rate appear lower. The most used

program by all the participants combined was sleep hygiene (Knill et al., 2021). Imamura et al. (2021) and Sasaki et al. (2021) reported a module completion rate of >83% for all six modules of programs A and B, and a survey completion rate of >90% for programs A and B and the control group at 3 and 7 months. Villani et al. (2013) reported 100% completion for all eight videos. Hwang and Jo (2019) did not report app usage history.

Primary interventions (aim 1)

Primary interventions (aim 1)

Two studies used the mindfulness- based intervention (MBI) app, Headspace™ (Foley & Lanzillotta- Rangeley, 2021 ; Knill et al., 2021). Headspace™ was developed in 2012 by a Buddhist monk, Andy Puddicombe. Features of Headspace™ include guided meditations, breathing exercises, and psychoeducation to improve stress and anxiety. Over 2100 businesses have partnered with Headspace™ to offer free access to their employees, and

Chunk 54

over 70 million people have downloaded the app (Headspace, n.d.; Curry, 2023). Headspace™ has been shown to reduce stress and increase mindfulness and well-being in research studies (Economides et al., 2018 ; Flett et al., 2018 ; Howells et al., 2014). Headspace™ has a Mobile Application Rating Score of 4.6 out of 5, making it one of the best-rated apps available (Wang et al., 2021). Headspace™ offers a 10 day program at no charge (Headspace, n.d.). Hwang

and Jo (2019) used an un- named proprietary stress- management app to deliver modules for meditation, breathing, yoga, healing music, physical fitness, and diet education. Imamura et al. (2021) and Sasaki et al. (2021) used a proprietary CBT app, ABC SM, to deliver educational modules in varying combinations on behavior - activation, problem solving, CBT techniques, coping, assertive - ness, job crafting, and self- compassion. Villani et al. (2013) used

Mobile- stress inoculation therapy (SIT), using muscle relaxation exercises, autogenic training, and calming video scenes prior to delivering video with stress- inducing images.

Instrumentation, occupational, and mental health outcomes (aim 2)

Few studies used the same measurement tools to evaluate the effects of the mHealth app interventions (Table 5). Occupational health outcomes included work engagement, perceived stress, job

stress, emotional labor, and burnout. Mental health outcomes included anxiety, depression, self-efficacy, well-being, and coping. Sustainability of outcomes (aim 3)

Of the six studies reviewed, four measured outcomes within the boundaries of the intervention length (Table 4). Imamura et al. (2021) and Sasaki et al. (2021) were the only studies to evaluate outcomes after the intervention ended, at 3 and 7 months. They

demonstrated a decrease in depression and an increase in work engagement, respectively, at 3 months, but no significant effect was observed at 7 months.

DISCUSSION

The purpose of this review was to evaluate existing evidence of the effects of mHealth interventions in the hospital inpatient nurse population. Improvement in stress, anxiety, depression, well-being, and burnout was seen with the MBIs, which is in agreement with prior

research showing that MBIs improve stress, depression, and anxiety in the nursing population (Green & Kinchen, 2021). A meta- analysis of 23 studies by Stratton et al. (2017) reported that MBIs delivered by tablet, computer, or smartphone improved overall well- being (depression, stress, and anxiety), with the largest effect size seen in decreasing stress.

Use of a CBT SM app for 6 weeks in this review decreased depression, but only in those whose baseline depression was ≤ 10 (mild)

on the Depression Anxiety Stress Scale- 21. This finding agrees with a meta- analysis of mHealth apps used to treat depression, which found that those with mild to moderate depression showed significant improvement in symptoms compared to those with major depression (Firth et al., 2017).

Regarding the length of mHealth app interventions in this review, five of the six studies lasted 6 weeks or less, and one lasted 12 weeks. Two systematic reviews found that CBT- based mHealth

Chunk 61

apps might have some effect on depression or anxiety if the length of intervention is at least 6 weeks, but the varying quality of the existing evidence limits solid predictive analytics (Hrynyschyn & Dockweiler, 2021 ; Lu et al., 2022).

SIT decreased anxiety and improved coping. There is a dearth of literature discussing the use of SIT to reduce anxiety in nurses; however, two studies have used SIT for nurses to decrease stress.

Both studies reported no significant effects of SIT on stress (Khatoni et al., 2020 ; Suryanto & Alfian, 2020). A 2016 systematic review examining the effects of SIT on post- traumatic stress disorder (PTSD) found that SIT improved PTSD symptoms initially, but this waned over a 3- month period (Lee et al., 2016).

Effect sustainability of a SM mHealth app reported in two of the included studies demonstrated a loss of positive effects be -

tween the 3- and 7- month follow- up surveys (Imamura et al., 2021 ; Sasaki 2021). In a meta- review of meta- analyses of mHealth apps for mental health, Lecomte et al. (2020) found lasting benefits from 6 to 11 weeks post- intervention for anxiety and 7 to 11 weeks post- intervention for depression. The included RCTs studied mHealth app outcomes on anxiety and depression in various populations,

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116 |

THE USE OF mHealth APPS TO IMPROVE HOSPITAL NURSES' MENTAL HEALTH AND
WELL-BEING

TABLE 4 Study characteristics.

First author and

TABLE 4 Study characteristics.

First author and	
year	Study conceptual model
Study design	Study setting
Population	
description	Sample size
pre/post mHealth app description	mHealth intervention
instructions	
Villani 2013	Karasek's Job Strain
Model	RCT
Medical oncology wards	
in Milan, Italy	Oncology nurses
F—30; M—0	30/30
Mobile SIT 2	15- minute videos twice
weekly for 4 weeks	
Foley 2021	Lazarus Theory of
Stress, Coping, and	
Adaptation	Pre- experimental
(one- group	
design)	University DNP

Chunk 66

(one- group

design)University DNP

anesthesia program

(SRNAs)DNP Anesthesia

students

F—n/a; M—n/a53/33 Mindfulness- based

Intervention1 module daily for 10 days

Hwang 2019 None RCT College hospitals in

metropolitan Seoul,

KoreaHospital nurses

F—53; M—360/56 Proprietary stress

management app using

music, yoga, and metal

healthcare educationsTwice weekly for at least

10 minutes a day for

4 weeks

Knill 2021 None Evidence- based

practice quality

improvement

Chunk 67

practice quality

improvement

projectInpatient BMT units in a

Midwest hospitalBMT nurses

and nurse

practitioners

F—n/a; M—n/a67/37 Mindfulness- based

Intervention10 minutes daily, 7 days/week

for 12 weeks

Imamura 2021 Cognitive behavioral

therapyRCT Large general hospital

in Hanoi, VietnamHospital nurses

F—806; M—143949/873 Proprietary cognitive

behavioral therapy stress

management programsProgram A—1 module weekly

for 6 weeks, in any order;

Program B—1 module

Chunk 68

for 6 weeks, in any order;

Program B—1 module

weekly for 6 weeks in

prescribed order

Sasaki 2021 Secondary analysis of

work engagement RCT Large general hospital

in Hanoi, Vietnam Hospital nurses

F – 806; M – 143949/873 Proprietary cognitive

behavioral therapy stress

management programs Program A – 1 module weekly

for 6 weeks, in any order;

Program B—1 module

weekly for 6 weeks in

prescribed order

Chunk 69

weekly for 6 weeks in

prescribed order

Abbreviations: BMT, bone marrow transplant; DNP, Doctor of Nursing Practice; F, female; M, male; SIT, stress inoculation therapy; RCT, randomized controlled trial.

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| 117

THE USE OF mHealth APPS TO IMPROVE HOSPITAL NURSES' MENTAL HEALTH AND
WELL-BEING

including healthcare workers, college students, people with chronic

illness, and veterans (Lecomte et al., 2020).

While the app usage rates in Knill et al. (2021) may appear low, they are higher than the range of usage rates of similar mHealth apps used by the public, which range from less than 1% to 28% of people either completing app programs or using the app on a regular basis (Fleming et al., 2018). Imamura et al. (2021) and Sasaki et al. (2021) reported that their high participation rate might have resulted from

reminder emails and texts sent to participants who were nearing the deadline for completion. Reminders and messaging can be helpful to increase engagement in app use; however, it can also be a source of irritation to the app user and contribute to disengagement if the frequency or content of the reminders increases the user's stress or anxiety (Szinay et al., 2020).

Limitations

Strengths of the studies in this review are the RCT designs of four

Chunk 73

studies, a 7- month follow- up in two studies, app usage rates in two studies, and module completion rates in three studies. However, sample sizes in all but two of the studies were less than 60 at the study end, either by design or by attrition. Two studies reported that many participants' baseline measures were in the normal range, which would lessen the overall effects of the interventions. All the post- intervention measures were self- reported, which could intro -

duce response bias. Study duration did not extend beyond 12 weeks for any of the included studies and follow-up in all but two of the studies did not extend beyond the study period. Therefore, the sustainability of the positive effects found with the mHealth app usage discussed in this review cannot be determined. Lastly, the studies used many different measures to evaluate outcomes, making pooled analysis of the data problematic.

analysis of the data problematic.

There are some limitations in our review. We only included studies that measured effects of mHealth apps on hospital nurses. This search restriction limits the ability to compare the effectiveness of mHealth apps used in other healthcare professionals (e.g., physicians, pharmacists). However, we also recognize that hospital nurses may face different stressors and demands than other healthcare workers and may interact with mHealth app interven -

tions differently. Another limitation is that we excluded studies that incorporated coaching, regular check-ins, or peer support as we were interested in the effectiveness of a self-guided mental health mHealth app that does not rely on other integrated interventions for success.

Linking evidence to action

- This review demonstrated promising findings in using mHealth apps to improve the mental health of hospital nurses.
- More RCTs with larger sample sizes may reveal which type of

mHealth app and how much exposure to the intervention is more effective in improving specific mental health symptoms.

- Longitudinal follow- up is also recommended to study sustainability of the mental health improvements.

First author	Baseline self- report measures	Measurement tools/scales	First follow- up measure	Last follow- up measure
Foley 2021	Anxiety Depression stress	DASS- 21—Depression, Anxiety, Stress scales	10 days	NA

Chunk 78

scales10 days NA

Villani 2013 Active coping

Denial

Job latitude, Psychological Job

demand, Social support at

work

Perceived stress

Anxiety, State; Anxiety, TraitCOPE—Brief Coping Orientation to

Problems Experienced

JCQ- Job Content Questionnaire

MSP—Mesure du Stress Psychologique

STAI—State Trait Anxiety IndexBefore and after each

5 min video, twice

weekly for total of 8

measurements over

4 weeksNA

Hwang 2019 Anxiety

Depression

Perceived stress

Well- being

Job stress

Emotional labor

Chunk 79

Well- being

Job stress

Emotional labor

Self- efficacyGAD- 7—Generalized Anxiety Disorder- 7q

PHQ- 9—Personal Health Questionnaire- 9q

PSS- Perceived Stress Scale

W H O - 5 - W e l l - B e i n g I n d e x - 5 q

Korean Occupational Stress Scale (KOSS)

Korean- Emotional Labor scale

Self- Efficacy Likert scale4 weeks NA

Imamura 2021 Anxiety

depressionDASS- 21—Depression, Anxiety, Stress

scales12 weeks 28 weeks

Knill 2021 Burnout

Well- beingBurnout—one question

Chunk 80

Well- beingBurnout—one question

WBI—Well- being Index4 weeks 12 weeks

Sasaki 2021 Work engagement UWES—90 Utrecht Work Engagement

Scale–9q12 weeks 28 weeks

Abbreviations: NA, not applicable.

Abbreviations: NA, not applicable.

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118 |

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WELL-BEING
CONCLUSION

WELL-BEING

CONCLUSION

From this systematic review, there are very little data available that indicate the dosage of mHealth mental health interventions required to appreciate a change in mental health and well-being outcome variables. Future research should focus on determining a minimum amount of intervention needed for substantial change to be noted. Rigorous longitudinal RCTs are needed to provide valuable evidence regarding both short- and long-term effects of

mHealth interventions with nurses who practice in hospital and healthcare settings.

CONFLICT OF INTEREST STATEMENT

None of the authors have conflicts of interest to disclose.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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| 119

THE USE OF mHealth APPS TO IMPROVE HOSPITAL NURSES' MENTAL HEALTH AND
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