

SIGNING UP IS NOT YET MINDFULNESS PRACTICE: A SYSTEMATIC REVIEW OF ADHERENCE TO eHEALTH AND mHEALTH MINDFULNESS-BASED PROGRAMS IN THE PRE-PANDEMIC PERIOD

SIMONA LIPTÁKOVÁ¹, MIROSLAV SVĚTLÁK^{2,3}, ROMAN HYTYCH¹, JURAJ MATIS⁴,
ALENA SLEZAČKOVÁ^{2,4}, RASTISLAV ŠUMEC^{2,5}

¹*Faculty of Social Studies, Masaryk University, Brno,*

²*Department of Psychology and Psychosomatics, Faculty of Medicine, Masaryk University, Brno*

³*Department of Psychiatry, University Hospital Brno and Faculty of Medicine, Masaryk University, Brno*

⁴*Department of Psychology, Faculty of Arts, Masaryk University, Brno*

⁵*First Department of Neurology, Faculty of Medicine, Masaryk University and St. Anne's University Hospital, Brno*

ABSTRACT

Information and communication technology are promising channels in delivering the mindfulness-based intervention. A common problem in these interventions is the lack of study of treatment adherence. The current article summarizes the state of measuring and reporting adherence, the rate of adherence, and possible predictors of adherence in the form of a systematic review following the PRISMA statement. A database search of PubMed, Web of Science, Medline, Scopus, and PsychINFO identified 3104 potentially relevant articles published up to the end of December 2019. The review focuses only on the SARS-CoV-2 pre-pandemic time because the accelerated development of the eHealth Mindfulness-based interventions and a vast amount of newly published interventions in the following years was expected. A total of 69 studies met all the eligibility criteria. Out of these studies, 61% reported some measure of adherence and 36% reported the adherence rate. The adherence rate in clinical populations ranged from 41% to

92%; in non-clinical populations, it ranged from 1% to 85%. Predictors of adherence were investigated in 48% of the studies; however, the majority of assessed variables had mixed findings about predicting adherence. There was a huge variety in the definitions and measurements of adherence. A standardized system of measuring and reporting adherence and further investigation of its predictors is needed.

key words:

mindfulness,
adherence,
online technology,
eHealth,
mHealth

klíčová slova:

mindfulness,
adherence,
online technologie,
eHealth,
mHealth

1 INTRODUCTION

In the last two decades, information and communication technology have been rapidly incorporated into traditional healthcare practices in the form of eHealth and mHealth approaches in the area of mental and physical health (Andersson, 2018). According to Eysenbach (2001, para. 3), eHealth refers to “health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way

Submitted: 25. 4. 2021; M. S., Department of Psychology and Psychosomatics, Faculty of Medicine, Masaryk University, Kamenice 126/3, 625 00 Brno; e-mail: msvetlak@med.muni.cz

This research was supported by the Ministry of Health of the CR / Ministry of Health Research Programme 2020–2026, project no. NU22-09-00056 and Masaryk University / Specific research – support for student projects project no. (MUNI/A/1126/2021).

We thank all the authors of reviewed studies for their research efforts in developing knowledge in this area.

of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology.” Later, the term was broadened to include mHealth, adding mobile phones and applications (apps) to the definition (Naslund et al., 2015).

There is increasing evidence that eHealth and mHealth programs and interventions are effective, for instance in smoking cessation (Vogel et al., 2019), insomnia reduction (Werner-Seidler et al., 2018), reduced chronic pain (Buhrman et al., 2016), alleviation of generalized anxiety disorder symptoms (Richards et al., 2015), increased management of behavior of adults with type 2 diabetes (Dack et al., 2019), stress reduction (Asplund et al., 2018), and depressive symptom management in older adults (Harerimana et al., 2019).

A recent meta-analysis (Carlbring et al., 2018) comparing internet-based cognitive behavior therapy (ICBT) with face-to-face cognitive behavior therapy (CBT) in various psychiatric and somatic conditions revealed a pooled effect size at post-treatment of Hedges $g=.05$ which clearly suggests equivalent overall effects. The important link is a finding showing evidence that ICBT can be as effective as other treatment formats while being more cost-effective (Donker et al., 2015). In the context of increasing pressure on healthcare budgets across the world, approaches are sought that are effective, with minimal economic costs and maximum selected population impact (Donker et al., 2015).

In this context, there is a massive expectation from eHealth mainly because of the media hype about it. eHealth seems to offer a solution for everything, but unfortunately, the paradox is that little has been scientifically substantiated. We are still at the beginning of answering the questions for whom, with what kind of suffering, in what period of life and disease, and at what readiness to change unhealthy behavior and regulate emotions eHealth is the best tool. We have increasing evidence that eHealth solutions are helpful. However, it must be noted that they are only one of many other tools in the repertoire of the experienced clinician or clinical psychologist. eHealth is not the tool for everybody, and health care professionals need to be careful when they indicate it.

Mindfulness-based programs

While most of the programs mentioned above are based on CBT, recent studies show that mindfulness-based programs (MBPs), most often based on or derived from mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1982) and mindfulness-based cognitive therapy (MBCT; Segal et al., 2002), the MBPs most used in clinical practice (Didonna, 2009), also represent suitable, well-structured, and effective approaches convertible to eHealth and mHealth programs.

From the first article published by Kabat-Zinn (1982) about the positive effect of MBSR on pain reduction and symptoms of negative mood in a group of patients with chronic pain, the effectiveness of mindfulness-based interventions on improving mental and physical health has been repeatedly documented in healthy people (Keng et al., 2011; Tomlinson et al., 2018) and in people with various psychiatric or somatic conditions (Goldberg et al., 2018; Rahimi-Ardabili et al., 2018).

The eHealth and mHealth format of mindfulness-based programs (eMBPs) have been documented to be effective in supporting mental health and reducing psychopathology symptoms in patients with cancer (Kubo et al., 2019; Zernicke et al., 2014), in healthy subjects (Cavanagh et al., 2018; Querstret et al., 2018), and in patients with depression (Lappalainen et al., 2015), anxiety (Krusche et al., 2013), tinnitus (Hesser et al., 2012), chronic pain (Dowd et al., 2015), and fibromyalgia (Davis & Zautra,

2013). A recent meta-analysis and systematic reviews proved that eMBPs have a significant impact on depression, anxiety, well-being, mindfulness, and stress (Cavanagh et al., 2018; Fish et al., 2016; Spijkerman et al., 2016).

By excluding face-to-face contact with an experienced mindfulness teacher, lowering costs, and enhancing accessibility and flexibility, eMBPs have the potential to deliver the benefits of mindfulness meditation programs to large groups of previously inaccessible participants. It is clear that these interventions can be popular, as commercial mindfulness websites and mobile apps (e.g. Headspace, Calm, Buddhify) are rapidly gaining public interest (Fish et al., 2016). Online programs (1) are easily accessible; (2) are anonymous; (3) are available to people during the course of their daily life; (4) do not necessarily require the involvement of a therapist educated in mindfulness; (5) are less expensive; and (6) save time (Andersson & Cuijpers, 2009; Andersson & Titov, 2014; Spijkerman et al., 2016). Almost half of the people in one study would prefer an online format of mindfulness meditation intervention to a face-to-face format (Wahbeh et al., 2014). The preference for online delivery is reflected in the increasing number of mindfulness-based mobile apps; a search identified 560 available apps (Mani et al., 2015).

1.2 Adherence

Even though eMBPs are repeatedly referred to as effective and beneficial for many reasons, effectiveness is only part of the story and it can be influenced by many factors. One common methodological problem is that programs are effective for people who stay in them (Van Dam et al., 2018) but what of those who drop out? It is evident that health outcomes cannot be accurately assessed if they are measured predominantly by resource utilization indicators and efficacy of interventions (WHO, 2003). In this context, one of the fundamental characteristics and methodical challenges in the evaluation of eHealth and mHealth apps is thus the phenomenon of participants stopping usage and/or being lost to follow-up, termed “the law of attrition” by Eysenbach (2005). Eysenbach argues that nonusage data should be of great interest to researchers, as research describing patterns and predictors for attrition and non-adherence offer information about treatment itself as well as data on system usability. According to his proposal, attrition can be split into two different processes: dropout attrition, or the phenomenon of losing participants to follow-up, and nonusage attrition, or the proportion of participant who do not drop out (e.g., they still fill in questionnaires), but who are no longer following the program. In other words, they are non-adherent. Adherence is defined as the extent to which an individual follows a treatment regimen as outlined by the treatment program. The term is related to compliance and is often used interchangeably (APA Dictionary of Psychology, n.d.). Adherence is the single most important modifiable factor influencing treatment outcome (WHO, 2003). Adherence to long-term therapy for chronic somatic or mental illnesses in developed countries averages 50% (WHO, 2003).

1.3 Investigation of adherence

No single measurement strategy has been deemed optimal, and there is no “gold standard” for measuring adherence behavior. Multi-method approaches combining feasible self-reporting (e.g. standardized, patient-administered questionnaires; Morisky et al., 1986), assessment of adherence behaviors (e.g. a medication event monitoring system that records the time and date when a medication container was opened; Cramer & Mattson, 1991), and biochemical measurements in blood or urine are the best for describing how patients take their medications. Reasonable objective measures are the current state-of-the-art in measurement of adherence behavior (WHO, 2003).

In the context of eHealth and mHealth interventions, adherence is the extent to which individuals experience the content of the program, expressed in website usage, number of logins, number of modules/sessions completed, time meditated, exercises/quizzes completed, diary entries, phone calls, etc. (Christensen et al., 2009). Another similar term is completion rate, which can be understood as a positive opposite of dropout rate or attrition, implying the proportion of individuals successfully completing an intervention (Baer, 2003).

Three general approaches are used to investigate the possible predictors of adherence, which are described by Christensen et al. (2009) as (1) statistical analysis to establish associations between adherence and different factors, (2) post-test questionnaires to obtain retrospective analyses of participant's perception of the intervention, usability measures, and possible obstacles to completing the treatment, and (3) experimental manipulation of variables believed to be causal in increasing adherence. The first strategy is probably the most frequent, as it does not require ad hoc preparation. Among the most common factors to study are characteristics of respondents (personality and demographic measures), which have been shown to have small but significant predictive value for adherence (Christensen et al., 2009; Kelders et al., 2013). In trials on clinical populations specifically, disease-specific effects can be assessed as possible predictors, with a high level of emotional distress leading to early dropout (Davis & Addis, 1999). The most promising predictors so far are unique variables associated with online delivery, such as special characteristics of the treatment program (duration, peer/therapist interaction, reminders, content, mode of delivery, type of media used, etc.) (Kelders et al., 2012).

Despite its significance, the adherence measure is often missing generally and specifically from eMBP studies. While attrition has become almost a stable report, adherence is often either underreported, omitted, or not studied at all. Many authors have expressed the necessity to investigate adherence and its possible predictors to further develop the field of mindfulness interventions administered online (see Fish et al., 2016; Jayewardene et al., 2017; Spijkerman et al., 2016). Donkin and her team (2011), who conducted a systematic review of the impact of adherence on the effectiveness of e-therapies, put together a list of methods for measuring adherence to e-therapy, including program logins, module completion, time spent online, completion of a predefined activity, posts made, pages viewed, replies to emails, forum visits, use of online tools, self-reported completion of offline activities, and print requests made. Understanding and describing the patterns and predictors for attrition represent a fundamental condition for developing effective eHealth mindfulness interventions with high population impact.

1.4 Summary

While systematic reviews documenting the significant impact of eMBPs on positive mental and somatic health outcomes have been done (Cavanagh et al., 2018; Fish et al., 2016; Spijkerman et al., 2016), a similar review on adherence to these programs is still missing. The aim of this paper is to systematically review (1) if the adherence to eMBPs is measured, (2) by which methods, (3) the prevalence of attrition and adherence, and (4) the adherence predictors.

This should serve as a starting point for maximizing effectiveness and adherence and minimizing attrition rates in the construction and development of future online eMBP programs for patients with any medical condition affected by mindfulness.

2 METHOD

This review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2009).

2.1 Eligibility criteria

This systematic review is limited to studies of eMBPs with the aim of studying adherence. Relatively broad inclusion criteria were constructed to allow for a synoptic overview of the subject rather than a partial analysis.

The criteria for study inclusion were as follows: (1) the study intervention must be based on mindfulness principles, (2) the mindfulness intervention must be delivered through technology with no more than one face-to-face session, (3) the research intended to assess the effect of the intervention, and (4) the paper must be written in English. Exclusion criteria were: (1) failure to meet inclusion criteria and (2) study had a descriptive rather than exploratory character. In addition, only peer-reviewed published articles were included.

2.2 Search strategy

A comprehensive search of relevant literature was conducted up to December 31, 2019. Five databases (PubMed, Web of Science, Medline, Scopus, and PsychINFO) were searched for relevant keywords. Three major keyword themes were used: (1) “mindfulness” (2) “technology” and (3) “adherence/attrition.” For each construct, several relevant or synonymous keywords were used to account for variability in expression and to ensure broad coverage of the subject (see Appendix 1 for the full search strings). Following this search strategy, 3104 studies were identified (see Figure 1 for the full flow diagram of article selection).

2.3 Data extraction

The study selection was made in four steps. Three researchers (SL, MS, JM) participated in the whole process to ensure the validity of the procedure. First, as multiple databases were used to conduct the search, duplicates were removed through End-Note (www.endnote.com). Second, titles were screened for eligibility, and studies on clearly different subjects were omitted. Third, abstracts were screened for eligibility, and studies that did not meet the inclusion criteria were omitted. Fourth, the full texts of the studies were assessed for the final selection of studies eligible for this review. In cases where the suitability of a study came into question during one of the steps, it was included in the next step. Any disagreements between the researchers were discussed, and studies were included or omitted only if agreement was reached on all sides.

Necessary data were extracted manually. Only information included in published available papers were included. In some studies, supporting documents available for download on the journal or database website were used to obtain supporting data. There was no contact with study authors. Information such as time commitment, adherence rate, and attrition percentage were calculated manually if possible, from available data if not listed explicitly in the study articles. Any missing or unclear data were marked as such.

2.4 Assessment of quality

The quality of the included studies was assessed to ensure that the studies supporting treatment efficacy were sound. Five criteria for empirically supported psychotherapies outlined by Chambless and Hollon (1998) were applied: (1) appropriate study design with comparison condition, (2) adequate sample size (defined as a minimum of

n ≥ 25 participants per group), (3) specified target population and inclusion criteria, (4) utilization of reliable/valid outcome measures (defined as applying instruments that have demonstrated reliability and validity in previous research), and (5) appropriate data analysis (defined as addressing missing data/using appropriate intention-to-treat analyses).

2.5 Analysis

Meta-analysis was not considered appropriate for the study objectives. This approach was used because the investigation of eMBPs in clinical and non-clinical populations is still in its early stages (predominantly in stage 1; Dimidjian & Segal, 2015) according to the National Institutes of Health Stage Model (Onken et al., 2014), as nearly half of the programs in this review included intervention generation, refinement, modification, adaptation, and pilot testing, whereas efficacy results are reported only in a preliminary manner. Thus, there is a small number of RCT studies per outcome and generally high heterogeneity across all included studies—study characteristics (design, intervention type, delivery modes, measured outcomes, and assessment timepoints) varied substantially, and homogeneity in effects cannot be expected with standard meta-analytical methods.

The findings are summarized using a narrative approach, and we have focused on a detailed description of high-quality studies in the results and conclusions.

2.5.1 Coding of study characteristics

The following study characteristics were coded. For a summary of respective characteristics, see Table 1 on <https://upp.med.muni.cz/en/supplements/2022>.

2.5.2 Authors and date

For compendious reporting, study authors were recorded with the study publication date in the form of an in-text citation. Respective studies are further addressed in this way.

2.5.3 Intervention

Mode of delivery (web, mobile app, or podcast) was recorded with information about facilitator interaction or absence thereof and the way the facilitator was included in the intervention. This presence could be in the form of an introductory face-to-face meeting, asynchronous or synchronous guidance, email or telephone support, group support, or feedback. Any reward for study participation or study completion was included in this section.

2.5.4 Participants

Population characteristics and sample size were recorded. The sample size is split in intervention group or groups, which are then defined. Control group size is reported in the case of randomized controlled trials (report style adapted from Christensen et al., 2009).

2.5.5 Program

Distinctive characteristics of the program used in each study were recorded. The information includes the duration of the program, the type of intervention the trial was based on, required time commitment, and whether reminders were present and in what way they were utilized.

2.5.6 Follow-through

Information about study adherence and attrition was retrieved. Adherence was reported in the percentage of participants following the treatment as prescribed. If the study did not disclose these statistics, it was reported as such, and additional information about usage was provided if accessible. Attrition was reported in the percentage of participants failing to complete measurements after randomization was done. If possible, predictors of participant dropout or adherence were mentioned and recorded.

3 RESULTS

3.1 Study selection

A PRISMA Flow diagram (see Figure 1) demonstrates the process of a study eligibility review. An initial database search identified 3104 studies which was narrowed down to 1728 after duplicates were removed. After a title screen, 1289 studies were excluded, clearly on a subject irrelevant to this review. Further, 18 studies were excluded after a full-text assessment. Of these, three did not meet the “mindfulness-based” criterion, ten failed to meet “technology-delivered with no more than one face-to-face session” criterion, two were not written in English, and two were not peer-reviewed. This led to a total of 69 studies being included in the final systematic review.

3.2 Study characteristics

The 69 interventions that were included in the systematic review are described, with all the characteristics, in Table 1. Overall, 24 interventions targeted improving mental health after mental or somatic clinical conditions. General mental health improvement in the non-clinical population was targeted the most often, in 43 interventions. Finally, two interventions targeted lifestyle behavior improvement. Study publication dates range from the beginning of 2013 to the end of December 2020.

3.2.1 Intervention and participants

In terms of the mode of delivery, 50 study interventions were primarily web-based, 15 were delivered through a mobile phone app, one used a combination of web-based and mobile phone apps (Puolakanaho et al., 2019), one was delivered via email (Halamová et al., 2018), one via videoconferencing (Khazailei et al., 2019), and one was delivered through a podcast medium (Toole & Craighead, 2016).

There were 49 interventions without any means of facilitation, and the rest had some kind of synchronous or asynchronous support method. Nine included an introductory session on explaining mindfulness principles or technology used in the intervention, or both, and 11 had a facilitator supporting the whole intervention.

In 22 interventions, there was a reward for study participation. Participant count ranged from 15 in feasibility trials and pilot studies (19% of studies) to 2081 in randomized controlled trials (81%). Populations included a variety of clinical conditions and countries (Europe, North America, and Asia).

3.2.2 Program

Program length ranged from 1 week (Toole & Craighead, 2016) to 12 weeks (Hoffmann et al., 2018; Younge et al., 2015). Most trials used a specific MBP (39%), ACT and trials combining various programs were both represented in 20% of studies, 27% of trials utilized an MBSR program, and 9% of trials based the intervention on MBCT. Time commitment fluctuated from 100 minutes (Howells et al., 2016) to 27 hours (Bruggeman Everts et al., 2015), with 59% of studies having unclear information

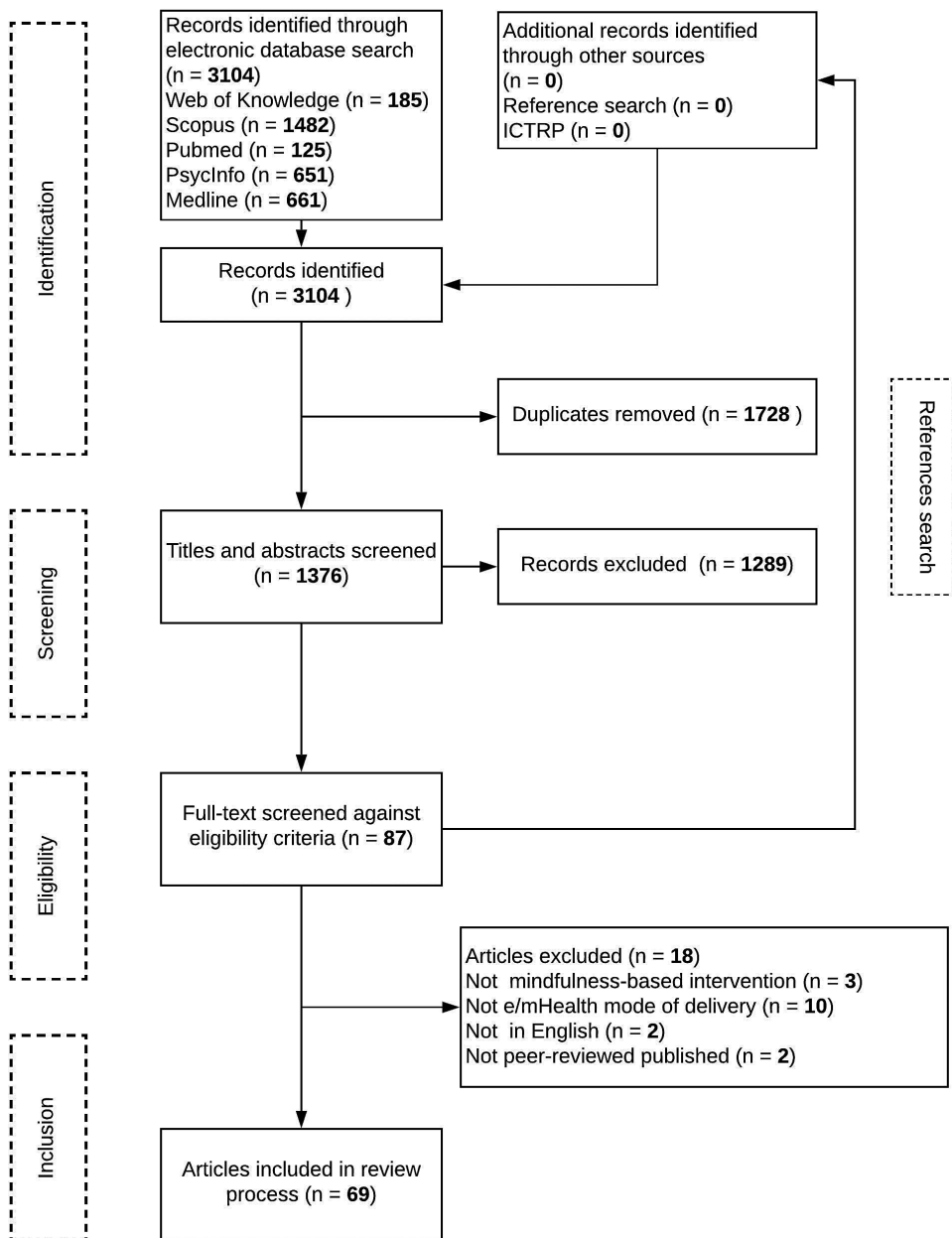


Figure 1 PRISMA flow diagram of mindfulness-based technology-delivered studies

about the total time commitment. The frequency, duration, and characteristics of informal practice were unclear in most of the studies. Reminders to practice were used in most studies (59%).

3.2.3 Methodological quality

A full summary of the methodological quality of the included studies based on the five criteria defined by Chambless and Hollon (1998) can be seen in Table 2 on <https://upp.med.muni.cz/en/supplements/2022>. From all the included studies, 37 (54%) met all five research design criteria. More specifically, 52 (75%) studies utilized appropriate control conditions, 57 (83%) had an adequate sample size and clearly identified inclusion criteria, 65 (94%) studies used valid and reliable measurement instruments, and 62 (90%) used appropriate data analysis.

4 MAIN OUTCOMES

4.1 Adherence

Out of 69 studies, 23% (16 studies) did not report any statistics of adherence at all. In total, 61% of studies reported some measure of adherence. Adherence rate was reported on 36% of studies. There were 27% of studies that did not report the percentage of participants who adhered to treatment as prescribed but offered a related statistic about program usage (usage time, number of logins, activity log completion, number of diary entries, reading reminder emails, messages or phone calls to facilitator) or engagement (number of sessions completed, practice time, informal practice time, frequency of practice, course completion time). The adherence rate in clinical populations ranged from 41% (Scott et al., 2018) to 92% (Cox et al., 2018); in non-clinical populations from 1% (Antonson et al., 2018) to 85% (Levin et al., 2013).

4.2 Attrition

Information about dropout attrition was included in 90% of studies. The attrition rate in clinical populations ranged from 2% (Trompetter et al., 2014) to 47% (Dimidjian et al., 2014); in non-clinical populations from 8% (Levin et al., 2013) to 88% (Mak et al., 2017).

4.3 Predictors of adherence

Of all studies, 33 (48%) investigated possible predictors of adherence or completion of the program.

4.3.1 Demographic/personal predictors

Age (Bostock et al., 2018; Krusche et al., 2018), and higher age notably (Kvillemo et al., 2016; Mattila et al. 2016; Montero-Marin et al., 2018);, was found to be a predictor of treatment adherence and completion in five (7.2%) studies, but the results of the study by Krusche et al. (2013) do not support this predictor.

Gender (female in particular) was mentioned in three (4.4%) studies (Bruggeman Everts et al., 2015; Mattila et al., 2016; Trompetter et al., 2014); Kvillemo et al. (2016) found no significant difference in gender between completers and non-completers. In accordance with this trend, the data presented by Puolakanaho et al. (2018) documented that dropouts were mostly male.

Higher education (tertiary education specifically) was found to be a predictor of treatment adherence and completion in three (4.4%) studies (Bruggeman Everts et al., 2015; Galante et al., 2016; Stjernswärd & Hansson, 2018); it was not a predictor in one study (Kvillemo et al., 2016).

Unemployment was mentioned as a significant positive predictor in three (4.4%) studies (Galante et al., 2016; Montero-Marin et al., 2018; Scott et al., 2018); Galante et al. (2016) found the same true for participants working part-time; and three (4.4%)

other studies failed to find this predictor significant (Bostock et al., 2018; Bruggeman Everts et al., 2015; Kvillemo et al., 2016).

Other personal predictors that were found to be significant in relationship to adherence were using sleeping medication (Bruggeman Everts et al., 2015), having previous experience with mindfulness, yoga, or other mind-body techniques (Bruggeman Everts et al., 2015; Krusche et al., 2018; Mak et al., 2017; Montero-Marin et al., 2018), knowing about the study from personal contacts (Galante et al., 2016), owning a smartphone prior to the study (Mattila et al., 2016), and not being in a stable relationship (Montero-Marin et al., 2018).

In total, 17 (24.6%) studies found no association with any demographic measures in terms of study adherence and/or treatment completion in baseline variables (Cavanagh et al., 2013; Cavanagh et al., 2018; Davis et al., 2013; Eriksson et al., 2018; Forbes et al., 2018; Gu et al., 2018; Krusche et al., 2013; Kvillemo et al., 2016; Morledge et al., 2013; Murray et al., 2015; Nguyen-Feng et al., 2017; Nissen et al., 2020; Shore et al., 2018; Trompetter et al., 2014; Querstret et al., 2017; Querstret et al., 2018; Wahbeh et al., 2016).

4.3.2 Psychological predictors

A positive relationship with adherence was found in Forbes et al. (2018), where conscientiousness and baseline mindfulness were found to be significant predictors, but neuroticism was not associated with it in any way. Galante et al. (2016) also found that lower stress levels from baseline predicted study retention.

A link to non-adherence was found to be tied to depression (Bruggeman Everts et al., 2015), as well as lower baseline mental well-being, energy, and treatment expectancy (Mak et al., 2017).

In total, 12 (17.4%) studies did not find any association between psychological predictors and adherence and/or treatment completion (Antonson et al., 2018; Cavanagh et al., 2013; Cavanagh et al., 2018; Davis et al., 2015; Krusche et al., 2013; Morledge et al., 2013; Murray et al., 2015; Nguyen-Feng et al., 2017; Trompetter et al., 2014; Querstret et al., 2017; Querstret et al., 2018; Wahbeh et al., 2016).

4.4 Intervention characteristics and mode of delivery predictors

Five studies (7.2%) assessed predictors about the intervention or the mode of delivery. Allexandre et al. (2016) found that group practice enhanced adherence. The results of the study by Cox et al. (2018) indicate that delivery through telephone calls had better adherence and retention than a self-directed mobile mindfulness program. Diary users were also found to have a higher course completion rate (Galante et al., 2016), as were participants who used the app more actively (Mattila et al., 2016). Krusche et al. (2013) did not find any significant differences amongst participants in relation to the course completion time.

5 DISCUSSION

This systematic review critically evaluated the current literature on eMBPs with the goal of assessing the state of measuring and reporting adherence to these programs, the levels of adherence to the intervention, and the possible predictors of adherence. The findings of this systematic review could contribute to a deeper understanding of the feasibility and effectiveness of eMBPs.

5.1 Main findings

5.1.1 *The state of measuring and reporting adherence*

After the initial search of databases, a total of 3104 studies found was reduced to the 69 studies encompassed in this review. Out of the 69 studies included, 61% reported some statistics of adherence. Of those, 36% reported explicitly the percentage of participants who adhered to treatment as prescribed or offered a relative statistic from which the adherence rate was calculated, defined as target participation in the program and measured participation in the program, and 27% utilized a descriptive statistic about program usage (usage time, number of logins, activity log completion, number of diary entries, reading reminder emails, messages or phone calls to facilitator) or engagement (number of sessions completed, practice time, informal practice time, frequency of practice, course completion time) without the definition of what was considered as adherent or non-adherent participation.

This finding is consistent with the systematic review by Donkin and his team (2011), who examined overall adherence in e-therapies. The number of studies reporting adherence was lower in their study (only 48% of 33 studies), and there was considerable variation in the reporting of adherence and its consequent analysis. The number of logins was the most prevalent measure of adherence, followed by the number of completed modules. The logins appeared to be the measure of adherence most consistently related to outcomes in physical health programs, while module completion was found to be most related to outcomes in psychological health interventions. It is often unclear why certain measures of adherence were chosen over others, as a precise definition was missing from the assessed studies.

There was also a high fluctuation in the terms used, such as completion (Bostock et al., 2018; Scott et al., 2018), engagement (Cavanagh et al., 2013), program usage (Kelson et al., 2017; Krieger et al., 2016; Levin et al., 2016; Mattila et al., 2016), compliance (Lengacher et al., 2018), amount of exercise (Stjernswärd & Hansson, 2017), and attendance (Thompson et al., 2015). Such variation is likely to lead to mixed findings. In order to prevent a reporting bias and consequent inaccurate portrayal of adherence to the intervention, predefined criteria of what is considered adherent and non-adherent participation and an explanation for how it is measured need to be put in place.

5.2 Rate of adherence

The adherence rate ranged from 41% to 92% in clinical populations and spread even more widely in non-clinical populations, from 1% to 85%. Such large variance is likely caused by great heterogeneity in the investigation of adherence. This finding is consistent with the average adherence of 50% found in web-based interventions (Kelders et al., 2012). As such, the findings clearly accentuate the need to concentrate more on adherence-related characteristics in these programs. When compared to the average adherence rate of face-to-face interventions, which ranges from 60% to 97% (Baer, 2003), the clearly lower rate suggests that it is difficult for many people to regularly participate in a mindfulness program administered online. Although the format of digital delivery is very appealing in terms of cost reduction and increased access, given the low rates of adherence, it is important to consider factors that can predict the successful utilization of such interventions. Perhaps studies with high adherence reflect characteristics of the program or the intervention itself in that if they were to be applied more broadly, they would be able to counter for the non-adherence. Measuring and reporting adherence is important to avoid methodological bias as well. Put

simply, the omission of adherence may partly explain the overwhelmingly positive results of published studies: someone who has not benefited may have skipped some of the exercises but still filled out the post-questionnaires. Therefore, studying adherence could be one of the main focuses of feasibility studies right after studying the effectivity of an intervention per se.

Attrition was mentioned in 90% of studies, ranging from 2% to 47% in clinical populations and from 8% to 88% in non-clinical populations. Such widespread variation in attrition rates is not surprising, as similar results have been obtained before (Russell et al., 2018). The statistics were reported consistently in the form of attrition rates in all the studies that included it. As it is now known that participants who drop out can provide information that is as useful as those who complete the study, it has become a stable part of reporting results of the intervention. Given that the physical and psychological outcomes of the intervention have been found to be negatively influenced by low adherence (Donkin et al., 2011), adherence deserves to be given the same attention in measuring and reporting as attrition now does. However, it is necessary to clearly distinguish between these two measures, as although they are supposedly similar, they map distinct information about participation.

5.3 Predictors of adherence

Out of all studies, only 48% included an investigation of possible predictors of adherence in their analysis. Significant demographic predictors of increased adherence included age, female gender, higher education, unemployment or part-time employment, using sleeping medication, previous experience with techniques similar to mindfulness, knowledge about the study from personal contacts, owning a smartphone prior to the study, and not being in a stable relationship.

A closer look at the factors that predicted a higher level of adherence yielded interesting findings. The three predictors that were mentioned and not refuted by other studies were age, gender, and education. On average, they were considered significant in only 7.2% of the studies. For age, previously both younger (Christensen et al., 2009) and older age (Kvillemo et al., 2016; Mattila et al., 2016; Montero-Marín et al., 2018) have been shown to predict whether a participant will be adherent to the intervention. This seemingly discrepant finding may be explained by how age was operationalized in the included studies, meaning in what ranges the age groups were defined. Therefore, the relationship between age and adherence may simply follow a normal distribution curve, with both younger adults and much older participants being more likely to adhere.

Female gender was one of the clearest predictors related to adherence. This is consistent with findings from other online health interventions (Beatty & Binnion, 2016; Wangberg et al., 2008) and broader research on health behaviors indicating that women are more likely to engage in such interventions than men (Berrigan et al., 2003). For men, higher adherence was found in face-to-face psychotherapy (Strauss et al., 2010), which suggests gender preference for different formats of psychological therapy.

Higher education specifically turned out to be positively associated with adherence in all studies that mentioned it, which provides further support for similar findings (Kelders et al., 2013). As it has been suggested that higher education predicts higher intervention uptake in the first place, this comes as no surprise (Waller & Gilbody, 2008). However, it can be rather unstable as a sole predictor of adherence, as it was found to be insignificant in other systematic review on this topic (Beatty & Binnion, 2016).

Needless to say, 24.6% of studies found no relationship at all between demographic variables and adherence. These sometimes-contradictory findings support the notion that while demographic factors are among the most common to be studied in relation to adherence, they have just a small predictive value for adherence (Christensen et al., 2009; Kelders et al., 2013). The same holds true for psychological predictors, where only 5.8% of the reviewed studies found any predictive value and each characteristic was mentioned uniquely, but 17.4% of the studies failed to recognize any significant relationship. Among some mentioned were conscientiousness, baselined mindfulness, and lower stress levels, which were positively associated with adherence; depression, lower baseline mental well-being, energy, and treatment expectancy indicated an opposite relationship. All these characteristics were mentioned uniquely. While demographic and psychological factors might not have strong predicting power themselves, they have proven useful when controlled in subsequent levels of analysis (Forbes et al., 2018).

The last category of predictors, which was believed to be the most promising one in previous research (Kelders et al., 2012), is intervention characteristics and the mode of delivery predictors. Strikingly, only 7.2% of the studies assessed factors related to the intervention itself. Group practice, telephone call delivery, and a diary feature have been mentioned as significant predictors; however, each of these factors have been mentioned only once. While many studies included features previously proven to enhance engagement, such as reminders (Webb et al., 2010), or some kind of social support, either from peers or a therapist (White, 2001), none of the studies mentioned them in their analysis of possible predictors.

As most of the studies concentrated on the effectivity of the interventions themselves, the evaluation of predictors was not the main goal. Still, when determining where such studies are feasible, it is necessary to include an assessment of adherence. Given that only 42% of the studies included in this review assessed factors related to adherence in some way, the results are somewhat inconclusive and offer low support for any of the predictors mentioned. While demographic variables that have been shown to have the lowest predictive values were studied most often, factors that have been shown to be the most influential in previous research, such as the ones related to the intervention and the mode of delivery, received almost no attention in analyses.

5.4 Methodology

The field of eMBP still has some limitations, mainly in terms of methodological quality. Approximately half of the studies (54%) met the full criteria for appropriate research design as defined by Chambless and Hollon (1998). Some of the studies relied on small sample sizes, limiting their ability to detect a statistically significant effect. However, some feasibility studies were included in the review, which might have influenced the result of this criterion. The strongest asset was choosing valid and reliable measurement instruments, which was generally standard amongst the selected studies, except for only two. It is also important to note that the interventions assessed in this review varied in many intervention-related characteristics. Most of them were primarily web-based; one study assessed the mode of delivery as a potential influence. Neither facilitator support, rewards for study participation, type of program, or even program length, which ranged from 1 week to 12 weeks, were assessed. The length of the intervention itself could account for variations in adherence, yet this was not investigated in any of the included studies. More research is required to determine the impact of these predictors on adherence to eMBP. A great deal of heterogeneity of study methodologies and definitions was also noted; the emerging field of eMBP

would benefit from more consistency and uniformity in predefined terms. Despite its many positive benefits, mindfulness itself has received a lot of criticism due to its somewhat broad definition and methodological problems (see Hanley et al., 2016; van Dam et al., 2018). Therefore, it is advisable to set and maintain high standards in mindfulness research.

5.5 Limitations of the study

The coding eMBP included in this study was based on the descriptions in the published literature. Although there was a deliberate effort to find all the information needed for systemization in this review, the coding was limited to the description of the interventions on paper. The description of variables may have differed in the respective studies, which may have led to some confusion in interpretation. It is possible that some analyses relevant for this review were carried out by the authors of the studies, but it was not possible to include these analyses in their published article. Perhaps further contact with study authors would provide more information. In any case, initiatives to standardize and improve the description of web-based interventions like the consort statement for eHealth (van Gemert-Pijnen et al., 2011) and guidelines for executing and reporting internet intervention research (Proudfoot et al., 2011) are still very necessary and will hopefully enable better comparisons of eHealth technologies. Another interrelated limitation is the publication bias, which may have influenced the selection of studies for this review in the first place.

As this review does not include a meta-analysis, the overall effects such as study power or potential mediators have not been calculated. Therefore, the obtained results were compared more in the descriptive range. Rather than quantitative summarization of the data, this review is more of a qualitative synthesis of information. A statistical analysis of predictors and their relationship to adherence might reveal more underlying relationships.

5.6 Implications for future research

While this review does not provide strong support for specific factors influencing the resulting adherence to eMBP, it presents a detailed overview of the state of measuring and reporting it, revealing a large opportunity for possible improvement. Considering the results of this study, it seems reasonable to first decide on a clear definition of adherence and what is considered adherent or non-adherent participation, and second to plan for adherence when designing eMBP. In order to do so, a clear definition and standardized measuring needs to be agreed on in this kind of intervention with the aim of ensuring good methodology and preventing potential biases. To thoroughly understand the concept of adherence, qualitative analysis needs to be supplemented with qualitative data of reasons for adherence.

Two hypothetical adherence predictors have not been studied yet, although we could expect their effect. The first one is the readiness to change derived from the transtheoretical model (e.g., Prochaska et al., 2020). We must expect that adherence to the intervention is highly dependent on the participant's readiness to change their behaviour and attitudes. The different parts of the intervention for different stages of changes are the expected future of eHealth in the context of machine learning and "smart" algorithms.

The second one is the therapeutic alliance, such as the common factor in psychotherapy, which is supposed to be an essential factor in its outcomes (Mulder et al., 2017). In the eHealth area, the therapeutic alliance is not a dyadic but a triadic relationship among the users, the e-mental health program, and the program supporter

(Cavanagh & Millings, 2013). Some data in the literature indicate that a therapeutic alliance with the e-mental health program can be stated (Ormrod et al., 2010). Although we do not yet know how much the therapeutic alliance matters in e-mental health program effectivity and research and discussion are still in their early stages (Cavanagh & Millings, 2013), this factor should be studied. The eHealth interventions should also be designed to be able to activate, develop and maintain the triadic therapeutic alliance.

6 CONCLUSION

It seems that mindfulness programs have been adapted to eMBP in an ad-hoc manner and might benefit from considering possible influences on adherence specific to this kind of intervention. As this review showed rather inconclusive results about possible predictors of adherence, a finding only supported by mixed results from previous research, there is clearly a need for a more thorough investigation. As demographic and psychological variables have not yet been shown to provide sufficient explanation for non-adherence, the research might benefit from looking more into the intervention characteristics specific to the technology-based mode of delivery and the design of the programs itself.

REFERENCES

- Adherence (n.d.) In *APA Dictionary of Psychology*. Retrieved July 8, 2020 from <https://dictionary.apa.org/adherence>
- Ahtinen, A., Mattila, E., Välikynen, P., Kaipainen, K., Vanhala, T., Ermes, M., Sairanen, E., Myllymäki, T., & Lappalainen, R. (2013). Mobile mental wellness training for stress management: feasibility and design implications based on a one-month field study. *JMIR mHealth and uHealth*, 1(2), e11. <https://doi.org/10.2196/mhealth.2596>
- Allexandre, D., Bernstein, A. M., Hunter, J., Roizen, M. F., Morledge, T. J., & Walker, E. (2016). A web-based mindfulness stress management program in a corporate call center. *Journal of Occupational and Environmental Medicine*, 58(3), 254-264. <https://doi.org/10.1097/JOM.0000000000000680>
- Andersson, G. (2018). Internet interventions: Past, present and future. *Internet Interventions*, 12, 181-188. <https://doi.org/10.1016/j.invent.2018.03.008>
- Andersson, G., & Cuijpers, P. (2009). Internet-based and other computerized psychological treatments for adult depression: A meta-analysis. *Cognitive Behaviour Therapy*, 38(4), 196-205. <https://doi.org/10.1080/16506070903318960>
- Andersson, G., & Titov, N. (2014). Advantages and limitations of Internet-based interventions for common mental disorders. *World Psychiatry*, 13(1), 4-11. <https://doi.org/10.1002/wps.20083>
- Antonson, C., Thorsen, F., Sundquist, J., & Sundquist, K. (2018). Upper secondary school students' compliance with two Internet-based self-help programmes: A randomised controlled trial. *European Child*, 27(2), 191-200. <https://doi.org/10.1007/s00787-017-1035-6>
- Asplund, R. P., Jäderlind, A., Björk, I. H., Ljótsson, B., Carlbring, P., & Andersson, G. (2019). Experiences of internet-delivered and work-focused cognitive behavioral therapy for stress: A qualitative study. *Internet Interventions*, 18, 100282. <https://doi.org/10.1016/j.invent.2019.100282>
- Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical Psychology-Science and Practice*, 10(2), 125-143. <https://doi.org/10.1093/clipsy/bpg015>
- Bailey, N., Nguyen, J., Bialylew, E., Corin, S., Gilbertson, T., & Chambers, R. (2018). Effect on well-being from an online mindfulness intervention: "Mindful in May". *Mindfulness*, 9(5), 1637. <https://doi.org/10.1007/s12671-018-0910-7>
- Beatty, L., & Binnion, C. (2016). A systematic review of predictors of, and reasons for, adherence to online psychological interventions. *International Journal of Behavioral Medicine*, 23(6), 776-794. <https://doi.org/10.1007/s12529-016-9556-9>
- Berrigan, D., Dodd, K., Troiano, R. P., Krebs-Smith, S. M., & Barbash, R. B. (2003). Patterns of health behavior in U.S. adults. *Preventive Medicine*, 36(5), 615-623. [https://doi.org/10.1016/S0091-7435\(02\)00067-1](https://doi.org/10.1016/S0091-7435(02)00067-1)
- Borjalilu, S., Mazaheri, M. A., & Talebpour, A. (2019). Effectiveness of mindfulness-based stress management in the mental health of Iranian University Students: A comparison of blended therapy, face-to-face sessions, and

- mHealth app (Aramgar). *Iranian Journal of Psychiatry and Behavioral Sciences*. In Press. <https://doi.org/10.5812/ijpbs.84726>.
- Bostock, S., Crosswell, A. D., Prather, A. A., & Steptoe, A. (2018). Mindfulness on-the-go: Effects of a mindfulness meditation app on work stress and well-being. *Journal of Occupational Health Psychology*. <https://doi.org/10.1037/ocp0000118>
- Bruggeman Everts, F. Z., van der Lee, M. L., & de Jager Meezenbroek, E. (2015). Web-based individual mindfulness-based cognitive therapy for cancer-related fatigue – A pilot study. *Internet Interventions*, 2(2), 200-213. <https://doi.org/10.1016/j.invent.2015.03.004>
- Buhrman, M., Gordh, T., & Andersson, G. (2016). *Internet interventions for chronic pain including headache: A systematic review*. *Internet Interventions*, 4, 17-34. <https://doi.org/10.1016/j.invent.2015.12.001>
- Carlbring, P., Andersson, G., Cuijpers, P., Riper, H., & Hedman-Lagerlöf, E. (2018). Internet-based vs. face-to-face cognitive behavior therapy for psychiatric and somatic disorders: An updated systematic review and meta-analysis. *Cognitive Behaviour Therapy*, 47(1), 1-18. <https://doi.org/10.1080/16506073.2017.1401115>
- Cavalera, C., Rovaris, M., Mendozzi, L., Pugnetti, L., Garegnani, M., Castelnovo, G., Molinari, E. & Pagnini, F. (2018). Online meditation training for people with multiple sclerosis: a randomized controlled trial. *Multiple Sclerosis Journal*, 25(4), 610-617. <https://doi.org/10.1177/1352458518761187>
- Cavanagh, K., Churchard, A., O'Hanlon, P., Mundy, T., Votolato, P., Jones, F., Gu, J., & Strauss, C. (2018). A randomised controlled trial of a brief online mindfulness-based intervention in a non-clinical population: Replication and extension. *Mindfulness*, 9(4), 1191-1205. <https://doi.org/10.1007/s12671-017-0856-1>
- Cavanagh, K., & Millings, A. (2013). (Inter)personal computing: The role of the therapeutic relationship in E-mental health. *Journal of Contemporary Psychotherapy*, 43(4), 197-206. <https://doi.org/10.1007/s10879-013-9242-z>
- Cavanagh, K., Strauss, C., Cicconi, F., Griffiths, N., Wyper, A., & Jones, F. (2013). A randomised controlled trial of a brief online mindfulness-based intervention. *Behaviour Research and Therapy*, 51(9), 573-578. <https://doi.org/10.1016/j.brat.2013.06.003>
- Chambless, D. L., & Hollon, S. D. (1998). Defining empirically supported therapies. *Journal of Consulting and Clinical Psychology*, 66(1), 7-18. <https://doi.org/10.1037/0022-006X.66.1.7>
- Cox, C. E., Jones, D. M., Reagan, W., Key, M. D., Hough, C. L., Ungar, A., Reagan, W., Key, M. D., Gremore, T., Olsen, M. K., Sanders, L., Greeson, J. M., & Porter, L. S. (2018). Effects of mindfulness training programmes delivered by a self-directed mobile app and by telephone compared with an education programme for survivors of critical illness: A pilot randomised clinical trial. *Thorax*. <https://doi.org/10.1136/thoraxjnl-2017-211264>
- Cramer, J. A., & Mattson, R. H. (1991). Monitoring compliance with antiepileptic drug therapy. In: J. A. Cramer, & B. Spilker (Eds.), *Patient compliance in medical practice and clinical trials* (pp. 123-138). Raven Press.
- Dack, C., Ross, J., Stevenson, F., Pal, K., Gubert, E., Michie, S., Yardley, L., Barnard, M., May, C., Farmer, A., Wood, B., & Murray, E. (2019). A digital self-management intervention for adults with type 2 diabetes: Combining theory, data and participatory design to develop HeLP-Diabetes. *Internet Interventions*, 17, [100241]. <https://doi.org/10.1016/j.invent.2019.100241>
- Davis, M. J., & Addis, M. E. (1999). Predictors of attrition from behavioral medicine treatments. *Annals of Behavioral Medicine*, 21(4), 339-349. <https://doi.org/10.1007/BF02895967>
- Davis, M. C., & Zautra, A. J. (2013). An online mindfulness intervention targeting socioemotional regulation in fibromyalgia: Results of a randomized controlled trial. *Annals of Behavioral Medicine*, 46(3), 273-284. <https://doi.org/10.1007/s12160-013-9513-7>
- Didonna, F. (2009). *Clinical handbook of mindfulness*. Springer.
- Dimidjian, S., Beck, A., Felder, J. N., Boggs, J. M., Gallop, R., & Segal, Z. V. (2014). Web-based mindfulness-based cognitive therapy for reducing residual depressive symptoms: An open trial and quasi-experimental comparison to propensity score matched controls. *Behaviour Research and Therapy*, 63, 83-89. <https://doi.org/10.1016/j.brat.2014.09.004>
- Dimidjian, S., & Segal, Z. V. (2015). Prospects for a clinical science of mindfulness-based intervention. *American Psychologist*, 70(7), 593-620. <https://doi.org/10.1037/a0039589>
- Donker, T., Blankers, M., Hedman, E., Ljótsson, B., Petrie, K., & Christensen, H. (2015). Economic evaluations of Internet interventions for mental health: A systematic review. *Psychological Medicine*, 45(16), 3357-3376. <https://doi.org/10.1017/S0033291715001427>
- Donkin, L., Christensen, H., Naismith, S. L., Neal, B., Hickie, I. B., & Glozier, N. (2011). A systematic review of the impact of adherence on the effectiveness of e-Therapies. *Journal of Medical Internet Research*, 13(3). <https://doi.org/10.2196/jmir.1772>

- Dowd, H., Hogan, M. J., McGuire, B. E., Davis, M. C., Sarma, K. M., Fish, R. A., & Zautra, A. J. (2015). Comparison of an online mindfulness-based cognitive therapy intervention with online pain management psychoeducation: A randomized controlled study. *The Clinical Journal of Pain*, 31(6), 517-527. <https://doi.org/10.1097/AJP.0000000000000201>
- Eriksson, T., Germundsjö, L., Åström, E., & Rönnlund, M. (2018). Mindful self-compassion training reduces stress and burnout symptoms among practicing psychologists: A randomized controlled trial of a brief web-based intervention. *Frontiers in Psychology*, 9. <https://doi.org/10.3389/fpsyg.2018.02340>
- Eysenbach, G. (2001). What is eHealth? *Journal of Medical Internet Research*, 3(2), e20. <https://doi.org/10.2196/jmir.3.2.e20>
- Eysenbach, G. (2005). The law of attrition. *Journal of Medical Internet Research*, 7(1), e11. <https://doi.org/10.2196/jmir.7.1.e11>
- Fish, J., Brimson, J., & Lynch, S. (2016). Mindfulness interventions delivered by technology without facilitator involvement: What research exists and what are the clinical outcomes? *Mindfulness*, 7(5), 1011-1023. <https://doi.org/10.1007/s12671-016-0548-2>
- Forbes, L., Gutierrez, D., & Johnson, S. K. (2018). Investigating adherence to an online introductory mindfulness program. *Mindfulness*, 9(1), 271-282. <https://doi.org/10.1007/s12671-017-0772-4>
- Fuller-Tyszkiewicz, M., Richardson, B., Lewis, V., Linardon, J., Mills, J., Juknaitis, K., Lewis, Ch., Coulson, K., O'Donnell, R., Arulkadacham, L., Ware, A., & Krug, I. (2019). A randomized trial exploring mindfulness and gratitude exercises as eHealth-based micro-interventions for improving body satisfaction. *Computers in Human Behavior*, 95, 58-65. <https://doi.org/10.1016/j.chb.2019.01.028>
- Galante, J., Bekkers, M.-J., Mitchell, C., & Gallacher, J. (2016). Loving-kindness meditation effects on well-being and altruism: A mixed-methods online RCT. *Applied Psychology: Health*, 8(3), 322-350. <https://doi.org/10.1111/aphw.12074>
- Goldberg, S. B., Tucker, R. P., Greene, P. A., Davidson, R. J., Wampold, B. E., Kearney, D. J., & Simpson, T. L. (2018). Mindfulness-based interventions for psychiatric disorders: A systematic review and meta-analysis. *Clinical Psychology Review*, 59, 52-60. <https://doi.org/10.1016/j.cpr.2017.10.011>
- Gu, J., Cavanagh, K., & Strauss, C. (2017). Investigating the specific effects of an online mindfulness-based self-help intervention on stress and underlying mechanisms. *Mindfulness*, 9(4), 1245-1257. <https://doi.org/10.1007/s12671-017-0867-y>
- Halamova, J., Kanovsky, M., Jurková, V., & Kupeli, N. (2018). Effect of a short-term online version of a mindfulness-based intervention on self-criticism and self-compassion in a nonclinical sample. *Studia Psychologica*, 60, 259-273. <https://doi.org/10.21909/sp.2018.04.766>
- Hanley, A. W., Abell, N., Osborn, D. S., Roehrig, A. D., & Canto, A. I. (2016). Mind the gaps: Are conclusions about mindfulness entirely conclusive? *Journal of Counseling & Development*, 94(1), 103-113. <https://doi.org/10.1002/jcad.12066>
- Harerimana, B., Forchuk, C., & O'Regan, T. (2019). The use of technology for mental healthcare delivery among older adults with depressive symptoms: A systematic literature review. *International Journal of Mental Health Nursing*. <https://doi.org/10.1111/inm.12571>
- Hearn, J. H., Cotter, I., & Finlay, K. A. (2018). Efficacy of internet-delivered mindfulness for improving depression in caregivers of people with spinal cord injuries and chronic neuropathic pain: A randomized controlled feasibility trial. *Archives of Physical Medicine and Rehabilitation*. <https://doi.org/10.1016/j.apmr.2018.08.182>
- Heckenberg, R. A., Hale, M. W., Kent, S., & Wright, B. J. (2018). An online mindfulness-based program is effective in improving affect, over-commitment, optimism and mucosal immunity. *Physiology & Behavior*. <https://doi.org/10.1016/j.physbeh.2018.11.001>
- Hesser, H., Gustafsson, T., Lundén, C., Henriksson, O., Fattahi, K., Johnsson, E., Zetterqvist Westin, V., Carlbring, P., Mäki-Torkko, E., Kaldo, V., & Andersson, G. (2012). A randomized controlled trial of internet-delivered cognitive behavior therapy and acceptance and commitment therapy in the treatment of tinnitus. *Journal of Consulting and Clinical Psychology*, 80(4), 649-661. <https://doi.org/10.1037/a0027021>
- Hoffmann, D., Rask, C. U., Hedman-Lagerlöf, E., Ljótsson, B., & Frosthalm, L. (2018). Development and feasibility testing of internet-delivered acceptance and commitment therapy for severe health anxiety: Pilot study. *Journal of Medical Internet Research*, 5(2), e28. <https://doi.org/10.2196/mental.9198>
- Howells, A., Ivtzan, I., & Eiroa-Orosa, F. (2016). Putting the 'app' in happiness: A randomised controlled trial of a smartphone-based mindfulness intervention to enhance wellbeing. *Journal of Happiness Studies*, 17(1), 163-185. <https://doi.org/10.1007/s10902-014-9589-1>
- Huberty, J., Green, J., Glissmann, C., Larkey, L., Puzia, M., & Lee, C. (2019). Efficacy of the mindfulness meditation mobile app

- "calm" to reduce stress among college students: Randomized controlled trial. *JMIR mHealth and uHealth*, 7(6), e14273. <https://doi.org/10.2196/14273>
- Hunter, J. E., Jenkins, C. L., Grim, V., Leung, S., Charen, K. H., Hamilton, D. R., Allen, E. G. & Sherman, S. L. (2019). Feasibility of an app-based mindfulness intervention among women with an FMR1 premutation experiencing maternal stress. *Research in Developmental Disabilities*, 89, 76-82. <https://doi.org/10.1016/j.ridd.2019.03.008>
- Champion, L., Economides, M., & Chandler, C. (2018). The efficacy of a brief app-based mindfulness intervention on psychosocial outcomes in healthy adults: A pilot randomised controlled trial. *PLOS ONE*, 13(12), e0209482. <https://doi.org/10.1371/journal.pone.0209482>
- Christensen H., Griffiths K. M., & Farrer L. (2009). Adherence in internet interventions for anxiety and depression. *Journal of Medical Internet Research*, 11(2), e13. <https://doi.org/10.2196/jmir.1194>
- Jayewardene, W. P., Lohrmann, D. K., Erbe, R. G., & Torabi, M. R. (2017). Effects of preventive online mindfulness interventions on stress and mindfulness: A meta-analysis of randomized controlled trials. *Preventive Medicine Reports*, 5, 150-159. <https://doi.org/10.1016/j.pmedr.2016.11.013>
- Järvelä-Reijonen, E., Karhunen, L., Sairanen, E., Muotka, J., Lindroos, S., Laitinen, J., Puttonen, S., Peuhkuri, K., Hallikainen, M., Pihlajamäki, J., Korpela, R., Ermes, M., Lappalainen, R., & Kolehmainen, M. (2018). The effects of acceptance and commitment therapy on eating behavior and diet delivered through face-to-face contact and a mobile app: a randomized controlled trial. *International Journal of Behavioral Nutrition and Physical Activity*, 15(1). <https://doi.org/10.1186/s12966-018-0654-8>
- Joyce, S., Shand, F., Lal, T. J., Mott, B., Bryant, R. A., & Harvey, S. B. (2019). Resilience@Work mindfulness program: Results from a cluster randomized controlled trial with first responders. *Journal of Medical Internet Research*, 21(2), e12894. <https://doi.org/10.2196/12894>
- Kabat-Zinn, J. (1982). An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General Hospital Psychiatry*, 4(1), 33-47. [https://doi.org/10.1016/0163-8343\(82\)90026-3](https://doi.org/10.1016/0163-8343(82)90026-3)
- Kelders, S. M., Bohlmeijer, E. T., & Van Gemert-Pijnen, J. E. (2013). Participants, usage, and use patterns of a web-based intervention for the prevention of depression within a randomized controlled trial. *Journal of Medical Internet Research*, 15(8), e172. <https://doi.org/10.2196/jmir.2258>
- Kelders, S. M., Kok, R. N., Ossebaard, H. C., & Van Gemert-Pijnen, J. E. (2012). Persuasive system design does matter: a systematic review of adherence to web-based interventions. *Journal of Medical Internet Research*, 14(6), e152. <https://doi.org/10.2196/jmir.2104>
- Kelson, J. N., Lam, M. K., Keep, M., & Campbell, A. J. (2017). Development and evaluation of an online acceptance and commitment therapy program for anxiety: Phase I iterative design. *Journal of Technology in Human Services*, 35(2), 135-151. <https://doi.org/10.1080/15228835.2017.1309311>
- Keng, S.-L., Smoski, M. J., & Robins, C. J. (2011). Effects of mindfulness on psychological health: A review of empirical studies. *Clinical Psychology Review*, 31(6), 1041-1056. <https://doi.org/10.1016/j.cpr.2011.04.006>
- Khazaeili, M., Zargham Hajebi, M., Mohamadkhani, P., & Mirzahoseini, H. (2019). The effectiveness of mindfulness-based intervention on anxiety, depression and burden of caregivers of multiple sclerosis patients through web conferencing. *Journal of Practice in Clinical Psychology*, 7(1), 21-32. <https://doi.org/10.32598/jpcp.7.1.21>
- Krieger, T., Martig, D. S., van den Brink, E., & Berger, T. (2016). Working on self-compassion online: A proof of concept and feasibility study. *Internet Interventions*, 6, 64-70. <https://doi.org/10.1016/j.invent.2016.10.001>
- Krusche, A., Dymond, M., Murphy, S. E., & Crane, C. (2018). Mindfulness for pregnancy: A randomised controlled study of online mindfulness during pregnancy. *Midwifery*, 65, 51-57. <https://doi.org/10.1016/j.midw.2018.07.005>
- Krusche, A., Williams, J. M. G., & Cyhlarova, E. (2013). Mindfulness online: An evaluation of the feasibility of a web-based mindfulness course for stress, anxiety and depression. *Bmj Open*, 3(11). <https://doi.org/10.1136/bmjopen-2013-003498>
- Kubo, A., Kurtovich, E., McGinnis, M., Aghaee, S., Altschuler, A., Quesenberry, C., Kolevska T., & Avins, A. L. (2019). A Randomized Controlled Trial of mHealth mindfulness intervention for cancer patients and informal cancer caregivers: A feasibility study within an integrated health care delivery system. *Integrative Cancer Therapies*, 18, 26(5), 295-296. <https://doi.org/10.1177/1534735419850634>
- Kvillemo, P., Brandberg, Y., & Bränström, R. (2016). Feasibility and outcomes of an internet-based mindfulness training program: A pilot Randomized Controlled Trial. *Jmir Men-*

- tal Health*, 3(3), e33. <https://doi.org/10.2196/mental.5457>
- Lappalainen, P., Langrial, S., Oinas-Kukkonen, H., Tolvanen, A., & Lappalainen, R. (2015). Web-based acceptance and commitment therapy for depressive symptoms with minimal support: A randomized controlled trial. *Behavior Modification*, 39(6), 805-834. <https://doi.org/10.1177/0145445515598142>
- Lappalainen, P., Langrial, S., Oinas-Kukkonen, H., Muotka, J., & Lappalainen, R. (2019). ACT for sleep - Internet-delivered self-help ACT for sub-clinical and clinical insomnia: A randomized controlled trial. *Journal of Contextual Behavioral Science*, 12, 119-127. <https://doi.org/10.1016/j.jcbs.2019.04.001>
- Lengacher, C. A., Reich, R. R., Ramesar, S., Alinat, C. B., Moscoso, M., Cousin, L., Marino, V. R., Elias, M. N., Paterson, C. L., Pleasant, M. L., Rodriguez, C. S., Wang, H. L., Kip, K. E., Meng, H., & Park, J. Y. (2018). Feasibility of the mobile mindfulness-based stress reduction for breast cancer (mMBSR(BC)) program for symptom improvement among breast cancer survivors. *Psycho-Oncology*, 27(2), 524-531. <https://doi.org/10.1002/pon.4491>
- Levin, M. E., Haeger, J. A., Pierce, B. G., & Twohig, M. P. (2016). Web-based acceptance and commitment therapy for mental health problems in college students. *Behavior Modification*, 41(1), 141-162. <https://doi.org/10.1177/0145445516659645>
- Levin, M. E., Pistorello, J., Seeley, J. R., & Hayes, S. C. (2013). Feasibility of a prototype web-based acceptance and commitment therapy prevention program for college students. *Journal of American College Health*, 62(1), 20-30. <https://doi.org/10.1080/07448481.2013.843533>
- Lilly, M., Calhoun, R., Painter, I., Beaton, R., Stangenes, S., Revere, D., Baseman, J., & Meischke, H. (2019). Destress 9-1-1- an online mindfulness-based intervention in reducing stress among emergency medical dispatchers: a randomised controlled trial. *Occupational and Environmental Medicine*, 76(10), 705-711. <https://doi.org/10.1136/oemed-2018-105598>
- Lyzwinski, L. N., Caffery, L., Bambling, M., Edirippulige, S., Stangenes, S., Revere, D., et al. (2019). The mindfulness app trial for weight, weight-related behaviors, and stress in university students: Randomized controlled trial. *Jmir Mhealth and Uhealth*, 7(4), 705-711. <https://doi.org/10.2196/12210>
- Mak, W. W., Chio, F. H., Chan, A. T., Wu, E. K., & Lui, W. W. (2017). The efficacy of internet-based mindfulness training and cognitive-behavioral training with telephone support in the enhancement of mental health among college students and young working adults: Randomized controlled trial. *Journal of Medical Internet Research*, 19(3). <https://doi.org/10.2196/jmir.6737>
- Mani, M., Kavanagh, D. J., Hides, L., & Stoyanov, S. R. (2015). Review and evaluation of mindfulness-based iPhone apps. *JMIR mHealth and uHealth*, 3(3), e82. <https://doi.org/10.2196/mhealth.4328>
- Mattila, E., Lappalainen, R., Valkkynen, P., Sairanen, E., Lappalainen, P., Karhunen, L., Peuhkuri, K., Korpela, R., Kolehmainen, M., & Ermes, M. (2016). Usage and dose response of a mobile acceptance and commitment therapy app: Secondary analysis of the intervention arm of a randomized controlled trial. *Jmir Mhealth and Uhealth*, 4(3). <https://doi.org/10.2196/mhealth.5241>
- Messer, D., Horan, J. J., Larkey, L. K., & Shanholtz, K. E. (2019). Effects of internet training in mindfulness meditation on variables related to cancer recovery. *Mindfulness*. <https://doi.org/10.1007/s12671-019-01182-y>
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA Statement. *Annals of Internal Medicine*, 151(4), 264-269. <https://doi.org/10.7326/0003-4819-151-4-200908180-00135>
- Montero-Marin, J., García-Campayo, J., Gaete, J., Araya, R., Demarzo, M., Manzanera, R., & Alvarez de Mon, M. (2018). Impact of a blended web-based mindfulness programme for general practitioners: A pilot study. *Mindfulness*, 9(1), 129-139. <https://doi.org/10.1007/s12671-017-0752-8>
- Morisky, D. E., Green, L. W., Levine, D. M., Neal, B., Hickie, I. B., & Glozier, N. (1986). Concurrent and predictive validity of a self-reported measure of medication adherence. *Medical Care*, 24(1), 67-74. <https://doi.org/10.1097/00005650-198601000-00007>
- Morledge, T. J., Alexandre, D., Fox, E., Fu, A. Z., Higashi, M. K., Kruzikas, D. T., Pham, S. V., & Reese, P. R. (2013). Feasibility of an online mindfulness program for stress management—A randomized, controlled trial. *Annals of Behavioral Medicine*, 46(2), 137-148. <https://doi.org/10.1007/s12160-013-9490-x>
- Mulder, R., Murray, G., & Rucklidge, J. (2017). Common versus specific factors in psychotherapy: Opening the black box. *The Lancet Psychiatry*, 4(12), 953-962. [https://doi.org/10.1016/S2215-0366\(17\)30100-1](https://doi.org/10.1016/S2215-0366(17)30100-1)
- Murray, G., Leitan, N. D., Berk, M., Thomas, N., Michalak, E., Berk, L., Johnson, S. L., Jones, S., Perich, T., Allen, N. B., & Kyrios, M. (2015). Online mindfulness-based intervention for late-stage bipolar disorder: Pilot

- evidence for feasibility and effectiveness. *Journal of Affective Disorders*, 178, 46-51. <https://doi.org/10.1016/j.jad.2015.02.024>
- Naslund, J. A., Marsch, L. A., McHugo, G. J., & Bartels, S. J. (2015). Emerging mHealth and eHealth interventions for serious mental illness: a review of the literature. *Journal of Mental Health*, 24(5), 321-332. <https://doi.org/10.3109/09638237.2015.1019054>
- Nguyen-Feng, V. N., Greer, C. S., & Frazier, P. (2017). Using online interventions to deliver college student mental health resources: Evidence from randomized clinical trials. *Psychological Services*, 14(4), 481-489. <https://doi.org/10.1037/ser0000154>
- Nissen, E. R., O'Connor, M., Kald, V., Højris, I., Borre, M., Zachariae, R., & Mehlsen, M. (2019). Internet-delivered mindfulness-based cognitive therapy for anxiety and depression in cancer survivors: A randomized controlled trial. *Psycho-Oncology*, 29(1), 68-75. <https://doi.org/10.1002/pon.5237>
- Onken, L. S., Carroll, K. M., Shoham, V., Cuthbert, B. N., & Riddle, M. (2014). Reenvisioning clinical science: Unifying the discipline to improve the public health. *Clinical Psychological Science*, 2(1), 22-34. <https://doi.org/10.1177/2167702613497932>
- Ormrod, J. A., Kennedy, L., Scott, J., & Cavanagh, K. (2010). Computerised cognitive behavioural therapy in an adult mental health service: A pilot study of outcomes and alliance. *Cognitive Behaviour Therapy*, 39(3), 188-192. <https://doi.org/10.1080/16506071003675614>
- Pbert, L., Druker, S., Crawford, S., Frisard, C., Trivedi, M., Osganian, S., & Brewer, J. (2019). Feasibility of a smartphone app with mindfulness training for adolescent smoking cessation: Craving to Quit (C2Q)-Teen. *Mindfulness*, 11. <https://doi.org/10.1007/s12671-019-01273-w>
- Petersen, J. M., Krafft, J., Twohig, M. P., & Levin, M. E. (2019). Evaluating the open and engaged components of acceptance and commitment therapy in an online self-guided website: Results from a pilot trial. *Behavior Modification*, 29(1), 68-75. <https://doi.org/10.1177/0145445519878668>
- Potharst, E. S., Boekhorst, M., Cuijlt, I., van Broekhoven, K., Jacobs, A., Spek, V., Nyklíček, I., Bögels, S. M., & Pop, V. (2019). A randomized control trial evaluating an online mindful parenting training for mothers with elevated parental stress. *Frontiers in Psychology*, 10, 1550. <https://doi.org/10.3389/fpsyg.2019.01550>
- Prochaska, J. O., Norcross, J. C., & Saul, S. F. (2020). Generating psychotherapy breakthroughs: Transtheoretical strategies from population health psychology. *American Psychologist*, 75(7), 996-1010. <https://doi.org/10.1037/amp0000568>
- Proudfoot, J., Klein, B., Barak, A., Carlbring, P., Cuijpers, P., Lange, A., Ritterband, L., & Andersson, G. (2011). Establishing guidelines for executing and reporting internet intervention research. *Cognitive Behaviour Therapy*, 40(2), 82-97. <https://doi.org/10.1080/16506073.2011.573807>
- Puolakanaho, A., Lappalainen, R., Lappalainen, P., Muotka, J. S., Hirvonen, R., Eklund, K. M., Ahonen, T. P. S., & Kiuru, N. (2018). Reducing stress and enhancing academic buoyancy among adolescents using a brief web-based program based on acceptance and commitment therapy: A randomized controlled trial. *Journal of Youth and Adolescence*. <https://doi.org/10.1007/s10964-018-0973-8>
- Rahimi-Ardabili, H., Reynolds, R., Vartanian, L. R., McLeod, L. V. D., & Zwar, N. (2017). A systematic review of the efficacy of interventions that aim to increase self-compassion on nutrition habits, eating behaviours, body weight and body image. *Mindfulness*, 9(2), 388-400. <https://doi.org/10.1007/s12671-017-0804-0>
- Richards, D., Richardson, T., Timulak, L., & McElvaney, J. (2015). The efficacy of online delivered treatment for generalized anxiety disorder: A systematic review and meta-analysis. *Internet Interventions*, 2(3), 272-282. <https://doi.org/10.1016/j.invent.2015.07.003>
- Russell, L., Ugalde, A., Milne, D., Austin, D., & Livingston, P. M. (2018). Digital characteristics and dissemination indicators to optimize delivery of internet-supported mindfulness-based interventions for people with a chronic condition: Systematic review. *Jmir Mental Health*, 5(3). <https://doi.org/10.2196/mental.9645>
- Querstret, D., Cropley, M., & Fife-Schaw, C. (2017). Internet-based instructor-led mindfulness for work-related rumination, fatigue, and sleep: Assessing facets of mindfulness as mechanisms of change. A randomized waitlist control trial. *Journal of Occupational Health Psychology*, 22(2), 153-169. <https://doi.org/10.1037/ocp0000028>
- Querstret, D., Cropley, M., & Fife-Schaw, C. (2018). The effects of an online mindfulness intervention on perceived stress, depression and anxiety in a non-clinical sample: A randomised waitlist control trial. *Mindfulness*, 9(6), 1825-1836. <https://doi.org/10.1007/s12671-018-0925-0>
- Sairanen, E., Lappalainen, R., Lappalainen, P., Kaipainen, K., Carlstedt, F., Anclair, M., & Hiltunen, A. (2019). Effectiveness of a web-based acceptance and commitment therapy intervention for wellbeing of parents whose

- children have chronic conditions: A randomized controlled trial. *Journal of Contextual Behavioral Science*, 13, 94-102. <https://doi.org/10.1016/j.jcbs.2019.07.004>
- Scott, W., Chilcot, J., Guildford, B., Daly-Eichenhardt, A., & McCracken, L. M. (2018). Feasibility randomized-controlled trial of online acceptance and commitment therapy for patients with complex chronic pain in the United Kingdom. *European Journal of Pain*, 22(8), 1473-1484. <https://doi.org/10.1002/ejp.1236>
- Segal, Z. V., Williams, J. M. G., & Teasdale, J. D. (2002). *Mindfulness-based cognitive therapy for depression: A new approach to preventing relapse*. Guilford Press.
- Shore, R., Strauss, C., Cavanagh, K., Hayward, M., & Ellett, L. (2018). A randomised controlled trial of a brief online mindfulness-based intervention on paranoia in a non-clinical sample: Results from a pilot trial. *Mindfulness*, 9(1), 294-302. <https://doi.org/10.1007/s12671-017-0774-2>
- Simister, H. D., Tkachuk, G. A., Shay, B. L., Vincent, N., Pear, J. J., & Skrabek, R. Q. (2018). Randomized controlled trial of online acceptance and commitment therapy for fibromyalgia. *The Journal of Pain*, 19(7), 741-753. <https://doi.org/10.1016/j.jpain.2018.02.004>
- Spijkerman, M. P. J., Pots, W. T. M., & Bohlmeijer, E. T. (2016). Effectiveness of online mindfulness-based interventions in improving mental health: A review and meta-analysis of randomised controlled trials. *Clinical Psychology Review*, 45, 102-114. <https://doi.org/10.1016/j.cpr.2016.03.009>
- Stjernswärd, S., & Hansson, L. (2017). Effectiveness and usability of a web-based mindfulness intervention for families living with mental illness. *Mindfulness*, 8(3), 751-764. <https://doi.org/10.1007/s12671-016-0653-2>
- Stjernswärd, S., & Hansson, L. (2018). Effectiveness and usability of a web-based mindfulness intervention for caregivers of people with mental or somatic illness. *A randomized controlled trial. Internet Interventions*, 12, 46-56. <https://doi.org/10.1016/j.invent.2018.03.004>
- Thompson, N. J., Patel, A. H., Selwa, L. M., Stoll, S. C., Begley, C. E., Johnson, E. K., & Fraser, R. T. (2015). Expanding the efficacy of Project UPLIFT: Distance delivery of mindfulness-based depression prevention to people with epilepsy. *Journal of Consulting and Clinical Psychology*, 83(2), 304-313. <https://doi.org/10.1037/a0038404>
- Tomlinson, E. R., Yousaf, O., Vittersø, A. D., & Jones, L. (2018). Dispositional mindfulness and psychological health: A systematic review. *Mindfulness*, 9(1), 23-43. <https://doi.org/10.1007/s12671-017-0762-6>
- Toole, A. M., & Craighead, L. W. (2016). Brief self-compassion meditation training for body image distress in young adult women. *Body Image*, 19, 104-112. <https://doi.org/10.1016/j.bodyim.2016.09.001>
- Trompetter, H. R., Bohlmeijer, E. T., Veehof, M. M., & Schreurs, K. M. G. (2014). Internet-based guided self-help intervention for chronic pain based on acceptance and commitment therapy: A randomized controlled trial. *Journal of Behavioral Medicine*, 38(1), 66-80. <https://doi.org/10.1007/s10865-014-9579-0>
- Van Dam, N. T., van Vugt, M. K., Vago, D. R., Schmalzl, L., Saron, C. D., Olenzki, A., Meissner, T., Lazar, S. W., Kerr, C. E., Gorchov, J., Fox, K. C. R., Field, B. A., Britton, W. B., Brefczynski-Lewis, J. A., & Meyer, D. E. (2018). Mind the hype: A critical evaluation and prescriptive agenda for research on mindfulness and meditation. *Perspectives on Psychological Science*, 13(1), 36-61. <https://doi.org/10.1177/1745691617709589>
- Van Gemert-Pijnen, J. E. W. C., Nijland, N., van Limburg, M., Ossebaard, H. C., Kelders, S. M., Eysenbach, G., & Seydel, E. R. (2011). A holistic framework to improve the uptake and impact of eHealth technologies. *Journal of Medical Internet Research*, 13(4). <https://doi.org/10.2196/jmir.1672>
- Vogel, E. A., Belohlavek, A., Prochaska, J. J., & Ramo, D. E. (2019). Development and acceptability testing of a Facebook smoking cessation intervention for sexual and gender minority young adults. *Internet Interventions*, 15, 87-92. <https://doi.org/10.1016/j.invent.2019.01.002>
- Wahbeh, H., & Oken, B. S. (2016). Internet mindfulness meditation intervention for the general public: Pilot randomized controlled trial. *Jmir Mental Health*, 3(3), e37. <https://doi.org/10.2196/mental.5900>
- Wahbeh, H., Svalina, M. N., & Oken, B. S. (2014). Group, One-on-One, or internet? Preferences for mindfulness meditation delivery format and their predictors. *Open Medicine Journal*, 1, 66-74. <https://doi.org/10.2174/1874220301401010066>
- Wahbeh, H., Goodrich, E., & Oken, B. S. (2016). Internet-based mindfulness meditation for cognition and mood in older adults: A pilot study. *Alternative Therapies in Health and Medicine*, 22(2), 44-53. <https://doi.org/10.2174/1874220301401010066>
- Waller, R., & Gilbody, S. (2008). Barriers to the uptake of computerized cognitive behavioural therapy: a systematic review of the quantitative and qualitative evidence. *Psychological Medicine*, 39(05), 705. <https://doi.org/10.1017/s0033291708004224>
- Wangberg, S. C., Bergmo, T. S., & Johnsen, J.

- A. (2008). Adherence in internet-based interventions. *Patient Preference and Adherence*, 2, 57-65.
- Webb, T. L., Joseph, J., Yardley, L., & Michie, S. (2010). Using the internet to promote health behavior change: A systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. *Journal of Medical Internet Research*, 12(1). <https://doi.org/10.2196/jmir.1376>
- Werner-Seidler, A., Johnston, L., & Christensen, H. (2018). Digitally-delivered cognitive-behavioural therapy for youth insomnia: A systematic review. *Internet interventions*, 11, 71-78. <https://doi.org/10.1016/j.invent.2018.01.007>
- White, M. (2001). Receiving social support online: implications for health education. *Health Education Research*, 16(6), 693-707. <https://doi.org/10.1093/her/16.6.693>
- World Health Organization (2003). *Adherence to long-term therapies: evidence for action* / [edited by Eduardo Sabaté]. World Health Organization. <https://www.who.int/iris/handle/10665/42682>
- Younge, J. O., Michels, M., Roos-Hesselink, J. W., Wery, M. F., Gotink, R. A., Hunink, M. G. M., & Roos-Hesselink, J. W. (2015). Web-based mindfulness intervention in heart disease: A randomized controlled trial. *Plos One*, 10(12). <https://doi.org/10.1371/journal.pone.0143843>
- Zernicke, K. A., Campbell, T. S., Specia, M., Carlson, L. E., McCabe-Ruff, K., & Flowers, S. (2014). A randomized wait-list controlled trial of feasibility and efficacy of an online mindfulness-based cancer recovery program: The eTherapy for cancer applying mindfulness trial. *Psychosomatic Medicine*, 76(4), 257-267. <https://doi.org/10.1097/PSY.0000000000000053>
- technology* OR “e-learning” OR “e-health” OR ehealth OR “e-mental”
 #3 adherence OR attrition OR compliance OR drop-out OR follow-up OR longevity OR participation OR engagement OR effectiveness
 #4 rct OR random*
 #5 English, Journal

SOUHRN

Přihlásit se do programu ještě není Mindfulness praxe: systematická review zkoumající adherenci k eHealth a mHealth programům založeným na Mindfulness v době před začátkem SARS-CoV-2 pandemie

Informační a komunikační technologie představují nové a slibné kanály, jak lze k uživatelům doručit intervence založené na Mindfulness přístupu. Běžným problémem v této oblasti aplikovaného výzkumu je nedostatek evidence o adherenci ke zmíněným programům. Aktuální článek ve formě systematické review podle PRISMA protokolu shrnuje informace o tom, jaká je adherence k intervencím ve studiích zabývajících se eHealth Mindfulness programy, jak je adherence měřena a co jsou její možné prediktory. V databázích PubMed, Web of Science, Medline, Scopus a PsychINFO bylo do konce roku 2019 identifikováno 3104 potenciálně relevantních článků. Vzhledem k očekávanému nárůstu implementace eHealth programů na podporu duševního zdraví pro zdravou i klinickou populaci v důsledku pandemie SARS-CoV-2, se stávající review zabývala jen studii před začátkem pandemie. 69 z nich splnilo všechna vstupní kritéria pro systematickou review. 61 % studií ve svých výsledcích prezentovalo různé parametry adherence, 36 % pak prezentovalo základní tzv. adherence rate. Míra adherence v klinických populacích se pohybovala od 41 % do 92 %; v neklinických populacích se pohybovala od 1 % do 85 %. Prediktory adherence byly zkoumány ve 48 % studií, většina hodnocených proměnných však přinesla značně heterogenní výsledky. Velká heterogenita byla pozorována také v samotné definici adherence a ve způsobech a nástrojích jejího měření. Aktuální systematická review jednoznačně dokládá potřebu standardizovaného systému měření adherence a dalšího výzkumu v oblasti jejich prediktůrů.

APPENDIX 1

Appendix A – Example of electronic search strategy

Search strategy: PsychINFO (EBSCO)

#1 mindful* OR “mental health” OR acceptance* OR meditation* OR awareness* OR “MBSR” OR “MBCT” OR “Dialectical Behavior Therapy”

#2 online* OR web* OR internet* OR computer* OR app* OR mobile* OR smartphone* OR