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Review

Engagement Strategies to Impro ve Adherence and Retention in Web-Based Mindfulness Prog rams: Systematic Review

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Abstr act

Backgr ound: Web-based mindfulness programs may be benef icial in impro ving the well-being outcomes of those living with

chronic illnesses. Adherence to programs is a key indicator in impro ving outcomes; however, with the digitization of programs,

it is necessary to enhance engagement and encourage people to return to digital health platforms. More information is needed on

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how engagement strate gies have been used in web-based mindfulness programs to encourage adherence.

Objecti ve: The aim of this study is to develop a list of engagement strate gies for web-based mindfulness programs and evaluate

the impact of engagement strate gies on adherence.

Methods: A narrati ve systematic review was conducted across the MEDLINE Complete, CINAHL Complete, APA PsycINFO,

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and Embase databases and followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis)

guidelines. Articles were screened using the population, interv ention, comparator , and outcome frame work. Adults aged >18

years with chronic health conditions were included in the study . Mindfulness interv entions, including those in combination with

mindfulness-based cogniti ve therap y, delivered on the web through the internet or smartphone technology were included.

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Interv entions lasted at least 2 weeks. Studies with a randomized controlled trial design or a pilot randomized controlled trial

design were included. Engagement strate gies, including web-based program features and facilitator -led strate gies, adherence,

and retention, were included.

Results: A total of 1265 articles were screened, of which 19 were relevant and were included in the review. On average, 70.98%

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(2258/3181) of the study participants were women with a mean age of 46 (SD 13) years. Most commonly , mindfulness programs

were delivered to people living with mental health conditions (8/19, 42%). Of the 19 studies, 8 (42%) used only program features

to encourage adherence, 5 (26%) used facilitator -led strate gies, and 6 (32%) used a combination of the two. Encouraging program

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adherence was the most common engagement strate gy used, which was used in 77% (10/13) of the facilitator -led studies and

57% (8/14) of the program feature studies. Nearly two-thirds (63%) of the studies provided a definition of adherence, which

varied between 50% and 100% completion across studies. The overall mean participant compliance to the mindfulness programs

was 56% (SD 15%). Most studies (10/19, 53%) had a long-term follow-up, with the most common follow-up period being 12

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weeks after interv ention (3/10, 30%). After the interv ention, the mean retention was 78% (SD 15%).

Conclusions: Engagement strate gies in web-based mindfulness programs comprise reminders to use the program. Other features

may be suitable for encouraging adherence to interv entions, and a facilitator -led component may result in higher retention. There

is variance in the way adherence is measured, and interv ention lengths and follow-up periods are inconsistent. More thorough

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reporting and a standardized frame work for measuring adherence are needed to more accurately assess adherence and engagement

strate gies.

KEYW ORDS

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KEYW ORDS

chronic disease; chronic illness; digital health; digital technology; internet mindfulness; mindfulness based stress reduction;

patient dropouts; mobile phone

Introduction

Backgr ound

Mindfulness is the act of bringing awareness to the present

moment in a nonjudgmental and accepting way [1]. Mindfulness

programs are increasing in popularity as nonpharmacological

alternati ves to manage both physiological and psychological

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outcomes related to health conditions [2]. Psychological benef its are evident in individuals across a variety of conditions, including cancer [3] and mental illness [4], and physical health outcomes have been observ ed through impro ved blood pressure control [5] and impro ved glycemic control in people living with diabetes [6].

Evidence shows that mindfulness skills can be impro ved through greater engagement with meditation, home practice, face-to-f ace

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contact with a facilitator , and a higher number of sessions per week [7]. High adherence to both face-to-f ace and web-based mindfulness programs results in signif icant impro vements in well-being outcome measures [8,9].

Mindfulness programs are increasingly being adapted to web-based platforms, providing opportunities for more people to participate compared with conventional face-to-f ace sessions [10]. Typically , adherence to web-based interv entions is low,

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both with program adherence and study attrition [11]. Program adherence is poorly defined but needs to be standardized across studies; however, it is commonly conceptualized by the number of log-ins or number of sessions or modules completed in a program [12].

Adherence to web-based programs in previous reports has varied between 39.5% and 92% [9] compared with adherence to face-to-f ace settings, where the rates ranged between 26% and

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100% [13] (based on definitions of 100% program completion). Mindfulness programs are often 8 weeks long in duration [9], with higher adherence having an impact on impro ved participant outcomes [14]. There is a need to explore whether engagement strate gies can impro ve adherence to unmoderated web-based interv entions. High attrition in telehealth interv entions is common and can undermine the potential impact of programs [15]. Adherence to mindfulness-based interv entions is often

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poorly defined and inconsistent across studies [16]. Promoting long-term adherence and engagement with web-based interv entions may maximize the potential outcomes [17]. Engagement refers to the frequenc y and duration of use of the interv entions, such as logging in and out of programs [18]. Strate gies to support engagement are used to encourage and draw people back to the interv entions [18]. Engagement can be enhanced by the design and features of web-based interv entions,

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including the use of gamification, breaking content into manageable blocks, and using a variety of formats to deliver content such as video and visuals [19]. Other considerations for impro ving engagement include guided interaction from trainedpersonnel [18], asynchronous emails [20], or web-based features such as reminders [18]. Beha vior change techniques are engagement strate gies incorporated into interv entions to promote sustainable changes in behavior [21]. Beha vior change

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techniques, such as notifications and semiautomated tracking, have previously been adopted in app-based interv entions and have shown a positi ve impact on impro ving engagement [22]. In mindfulness programs, engagement involves regular meditation and daily awareness exercises coupled with intention motivation and commitment to practice [23]. Techniques such as self-reflection are incorporated into mindfulness programs and have been shown to positi vely impact symptoms in people

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with anxiety and stress [24]. More recent techniques such as machine learning [25] may also be used to tailor interv entions to user-specif ic needs, thereby maximizing the clinical outcomes of users.

The influence of engagement strate gies on program adherence has not been compared across studies; however, it is an important consideration when designing and implementing web-based interv entions. In this review, we explored the engagement strate gies applied in web-based mindfulness

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programs and evaluated whether these strate gies had an impact on program adherence and retention.

Resear ch Question

The following research question was used in the study: how can engagement strate gies be incorporated into web-based mindfulness programs to impro ve adherence and retention?

Objecti ves

The objecti ves of this study are (1) to develop a list of engagement strate gies for web-based mindfulness programs and (2) to evaluate the impact of engagement strate gies on adherence.

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adherence.

Methods

Sear ch Process

This systematic review was guided by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) frame work [26]. The following databases were searched for terms related to mindfulness, web-based programs, and engagement strate gies: MEDLINE Complete, CINAHL Complete, APA PsycINFO, and Embase. The literature search focused on identifying papers published between January 2015 and March 2020. A 5-year period was chosen to capture the

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most recent web-based interv entions. See Table S1 in

Multimedia Appendix 1for an example of the search strate gy

applied to the MEDLINE database. The reference lists of

relevant articles and systematic reviews were searched for

additional articles.

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RenderX Eligibility Criteria

To guide the eligibility and screening process, the PICO

(population, interv ention, comparator , and outcome) frame work

[27] was used:

Population

Adults aged ≥18 years with a diagnosed chronic health condition

or self-reported anxiety or depression were included in the study .

Interv ention

Mindfulness interv entions delivered on the web through the

internet or smartphone technology were included. Mindfulness

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programs were defined as those focusing specif ically on mindfulness-based practice, including programs using a combination of mindfulness and cogniti ve behavioral therap y (mindfulness-based cogniti ve therap y).

To allow for engagement strate gies and adherence to be analyzed, the interv entions had to be at least 2 weeks in duration. There is limited research to describe how long interv entions should be to warrant the inclusion of engagement strate gies.

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Previously , engagement was measured by reflecting on the previous 2 weeks [23]. Therefore, we determined that interv entions had to be at least two weeks in duration to be included in the review.

Comparator and Context

Studies were required to have a comparison group with a randomized controlled trial (RCT) or a pilot RCT design. Mindfulness programs developed by research groups for specif ic populations or commercially available mindfulness programs were tested in controlled trial settings.

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were tested in controlled trial settings.

Outcomes

Program adherence, study retention rate (%), and strate gies such as web-based program features and facilitator -led features were included.

Screening

Retrie ved articles were uploaded and managed by Endnote X9 (Clari vate Analytics). Duplicates were remo ved, and titles and abstracts were screened by 1 author (NH). Full-te xt articles were uploaded to Covidence to allow cross-checking between authors

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[28]. Full texts were reviewed independently by 2 authors, and any disagreements were resolv ed through discussion.

Data Extraction

A data extraction tool was developed in Microsoft Excel to standardize the extraction. Data were extracted by 1 author (NH), and 10% were cross-check ed by the second author (PL).

Study Characteristics

Study data including author , year of publication, country , design, number of participants, interv ention type, interv ention duration,

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follow-up measurements, prior mindfulness experience,

recruitment method, financial compensation, commercial app

name, primary outcome, and primary findings were extracted.Participant Characteristics

Gender , age, race, ethnicity , type of chronic illness or condition,

and patient and caregiver status were extracted.

Adherence

Studies were included in the review when they reported

per-protocol and intention-to-treat analyses. Because of variance

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in reporting the interv ention, adherence was assessed in 3 different ways depending on the data available:

1.As a percentage of compliance with the interv ention protocol. For example, some authors defined adherence as 80% program completion, and in this review, we recorded the percentage of the sample that was adherent with 80% program completion.

2.In groups defined by the study authors. For example, in an 8-week program, some authors reported the percentage of

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people who were adherent with 0- 3 sessions, 4- 6 sessions, and 7-8 sessions. In this review, we recorded the percentage of the sample that was adherent with the highest group of completion, for example, 7-8 sessions.

3.Summarized findings of the frequenc y and duration of use.

Retention

Retention rates were reported for the interv ention group at postinterv ention measurements and subsequent follow-up points.

Engagement Strategies

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Engagement Strategies

Engagement strate gies were categorized into following 3 groups:

1.Program features, including chat rooms, discussion boards, diaries and reflecti ve processes, automated reminders, social support, goal setting, mood tracking, customization of content, demonstrations of meditation practice, and immediate feedback on meditation practice;

2.Facilitator -led strate gies, including reminders from the research team to continue practice, contact with the research

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team to discuss practice or monitoring, and response to

well-being scores throughout the interv ention; and

3.A combination of program features and facilitator -led

strate gies.

Data Analysis

Study characteristics, participant characteristics, adherence, and

retention rates were analyzed using descripti ve statistics.

Data analysis consists of the following:

1.Exploring adherence: how adherence was defined, the

impact of adherence on outcomes, impact of financial

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compensation on adherence, and impact of interv ention length on adherence.

2.Describing retention at postinterv ention measurements and the last data collection point.

3.Describing engagement strate gies (program features, facilitator -led strate gies, or a combination): engagement strate gies were categorized and summarized using frequenc y statistics.

4.Assessing the impact of engagement strate gies on adherence: the relationship between engagement strate gies

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and adherence was analyzed by comparing the type of

 engagement strate gy (program features, facilitator -led

strate gies, or a combination) with the percentage of people

who reached program adherence or the percentage of people

who adhered with the highest group of sessions (eg, those

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who completed 7-8 sessions in an 8-week program, as defined by the study authors).

•Assessing the impact of engagement strate gies on retention: the relationship between engagement strate gies and retention was measured by comparing the type of engagement strate gy with the interv ention length, retention at the postinterv ention measurement and retention at the last follow-up points.

Results

Study Characteristics

A total of 1922 articles were retrie ved from the databases and

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reference lists. After remo ving duplicates, a total of 1265 articles were screened by title and abstract. Full texts were retrie ved for 126 articles, of which 19 were included in the review (Figure1). Most studies were conducted in the United States (9/19, 47%) [5,24,29-35], were RCTs (16/19, 84%) [5,14,24,29,31-33,35-43], web-based (11/19, 58%) [3,14,33-35,37-43], and focused specif ically on mindfulness or meditation (15/19, 79%) [3,5,14,29-32,34-36,39-43] (Table S2

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in Multimedia Appendix 1) [3,5,14,24,27,29-41,43]. More studies (10/19, 52%) excluded people with previous or recent mindfulness experiences [24,29-31,37,39,42,43] than those who allowed participants with prior mindfulness experience (6/19, 31%) [3,14,32,34,35,38,40,41]. Over half of the studies used a combination of web-based and face-to-f ace recruitment strate gies (10/19, 52%) [5,29,31,32,34,35,37,39,40,42]. Commercially available mindfulness apps, including Headspace

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(n=3) [30,32,36], Calm (n=1) [29], and Pacifica (n=1), were used by 5 (26%) studies [24]. A total of 3 (16%) studies provided monetary compensation for participation [29,30,33], and 3 (16%) provided access to paid mindfulness apps [30,32,36]. Interv ention duration ranged from 2 weeks to 12 months, with over half (10/19, 53%) of the studies having an interv ention duration of 8 weeks [29,30,32,33,36,37,39,40,42,43].

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[29,30,32,33,36,37,39,40,42,43].

Figur e 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) diagram of the search process.

 A total of 8 (47%) studies focused on psychological measures

as their primary outcome [29,31-34,37-39,42], and 3 (16%)

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used a physiological measure [5,14,41]. A total of 7 (37%) studies did not report the primary outcome [3,24,30,35,36,40,43]. Secondary outcomes were predominately psychological measures and program evaluations (8/19, 42%) [16,24,30,32,34,38,39,42]. Most (17/19, 90%) studies showed that mindfulness resulted in a signif icant impro vement in outcomes either psychological or physical [3,5,14,24,29-34,36,37,39-43] (Table S3 in Multimedia Appendix 1) [3,5,14,27,29-41,43].

Participant Characteristics

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Participant Characteristics

A total of 34,601 participants were included in the trials. The mean sample size was 165 (SD 134; range 21-500). On average, 71% of the participants were women (SD 18; range 46-100) and 46 years old (SD 13; range 21-76). A total of 8 (42%) studies reported the ethnicity of the participants [24,29-35,39], and 4 (26%) reported race [29,31-33]. On average, White people

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comprised 74% (SD 14%) of the sample and 90% (SD 10%)were non-Hispanic. Mindfulness programs were delivered to

people with a variety of chronic illnesses, with the most common

conditions related to mental health (8/19, 42%)

[24,29,31,33-36,38] and cancer (4/19, 21%) [3,30,32,37]. Most

(17/21, 81%) studies were delivered to people living with the

illness [3,5,14,24,29,31-41,43].

Engagement Strategies

A total of 8 (42%) studies used only program features to

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encourage adherence, 5 (26%) used only facilitator -led strate gies, and 6 (32%) used a combination of the two (Table 1).

Within the facilitator -led strate gies (n=13) [5,30,31,33-38,42,43], encouraging adherence was most commonly done using contact and reminders from facilitators to use the program (10/13, 77%) [30,31,33-36,38,42]. Contact with a facilitator for discussion of content or well-being scores was used to a lesser extent (4/13, 31%) [5,37,38,43]. In 7 (37%)

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studies, engagement with facilitators occurred weekly

[34-37,42,43].

Table 1. Types of engagement strate gies used across studies and their adherence rates.

Adherence with study protocol (%) Facilitator engagement Program engagement Study

39 ✓ ✓ Chandler et al [5]

79 ✓ ✓ Compen et al [37]

66 ✓ ✓ Kladnitski et al [38]

56 ✓ ✓ Kubo et al [30]

57 ✓ ✓ Stjernsw ard and Hansson [27]

NRa ✓ ✓ Thompson et al [33]

50N/Ab ✓ Gotink et al [14]

72 N/A ✓ Hearn and Finlay [39]

58 N/A ✓ Henriksson et al [40]

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58 N/A ✓ Henriksson et al [40]

NR N/A ✓ Huberty et al [29]

NR N/A ✓ Mober g et al [24]

NR N/A ✓ Rosen et al [32]

NR N/A ✓ Russell et al [3]

53 N/A ✓ Younge et al [41]

27 ✓ N/A Bostock et al [36]

NR ✓ N/A Lindsay et al [31]

NR ✓ N/A Tavallaei et al [43]

NR ✓ N/A Wahbeh et al [35]

NR ✓ N/A Wahbeh [34]

aNR: not recorded.

bN/A: not applicable.

Within program feature strate gies (n=14)

[3,5,14,24,29,30,32,33,37-42], participants in 57% (8/14) studies

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recei ved automated reminders [3,5,14,29,30,32,40,41]. Half of the program reminders were recei ved at least once a week [3,14,32,41], and the remaining were sent on an ad hoc basis [29,30] or participants were able to personalize whether theyrecei ved notifications or not [5,30]. Other program features used to encourage adherence included the ability to personalize mindfulness course content (4/14, 29%) [5,25,26,28], home work activities (3/14, 21%) [33,37,38], self-reflections (2/14, 14%)

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[37,42], social contact (3/14, 21%) [5,24,33], personalization

of app appearance (2/14, 14%) [5,24], lesson summaries (1/14,

 7%) [38], progress tracking of mindfulness practice (1/14,

7%)[24], immediate feedback on practice (1/14, 7%) [5],

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demonstration videos (1/14, 7%) [39], goal setting (1/14, 7%) [24], tracking psychological outcomes (1/14, 7%) [24], and tracking physical health (1/14, 7%) [24] (Table S4 in Multimedia Appendix 1) [3,5,14,24,29-35,37-41,43].

Contact initiated by facilitators or program reminders was most commonly delivered by email (9/14, 64%) [3,14,33,36-38,40-42] or telephone (7/14, 50%) [30,31,33-35,38,43].

Adher ence

Nearly two-thirds (12/19, 63%) of the studies provided a

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definition of program adherence [3,5,14,30,33,36-42]. When defined as the percentage of program completion, the definitions of adherence varied between 50% and 100% program completion across studies. When adherence was grouped, the highest group of completion varied from 50% to 100% among the studies. A total of 6 (32%) studies did not provide a measurement for adherence and analyzed program use descripti vely [24,29,31,32,34,35]. Moreo ver, 1 (5%) study did

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not report adherence or program use [43]. The percentage of people who complied with the authors’ definitions of adherence ranged from 27% to 79%, with a mean compliance of 56% (SD 15%).

The Impact of Engagement Strategies on Adher ence

Among studies that used only program features (n=8) [3,14,24,29,32,39-41], 4 recorded adherence between 50% and 72% (mean 58%, SD 8%) [14,39-41] (Table S3 in Multimedia Appendix 1). Among studies that used only facilitator -led

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strate gies (n=5) [31,34-36,43], only 1 reported adherence of 27% [36]. Among studies that used a combination of program features and facilitator -led strate gies (n=6) [5,30,33,37,38,42], 7 recorded adherence between 39% and 79% (mean 59%, SD 13) [5,30,37,38,42].

When examining studies that used program features, of the studies that used 1 strate gy (n=6) [3,14,39-42], 5 measured adherence rates between 50% and 72% (mean 58%, SD 8%).

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Of the studies that used 2 strate gies (n=8) [29,30,32,33,37,38], 3 measured adherence between 56% and 79% (mean 67%, SD 9%). A total of 5 studies did not include any engagement strate gies within their program [15,34-36,43], and 2 [5,24] used ≥5 strate gies; adherence was only recorded in 2 of these studies, and they were below 40%. Studies that involved only program reminders as engagement strate gies (n=4, 3 studies recorded adherence) [3,14,40,41] had an average adherence rate of 54%

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(SD 3%) compared with the average adherence rate of 48% (SD 8%) of those studies that used reminders and other strate gies (n=4, only 2 recorded adherence) [5,29,30,32], and the average adherence rate of 69% of those studies that did not use program reminders but only used other strate gies (n=6, 4 recorded adherence) [24,33,37-39,42].

How Adher ence Affected Outcomes

A total of 10 (53%) studies analyzed the relationship between outcome variables and adherence [14,24,30,32,34,36,38-40,42].

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Of them, 4 studies found that people who had higher adherence to mindfulness programs had a signif icantly higher impro vementin outcomes [30,36,40,42]; 1 study found that people with higher scores for depression at baseline were less likely to be adherent or complete mindfulness programs [39]; 1 found that people with higher blood pressure readings were more likely to be compliant [14]; and 1 showed that higher quality of life scores at baseline were signif icantly associated with impro ved

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adherence [32]. A total of 3 studies found no relationship between baseline scores and adherence or adherence and outcome variables [24,34,38].

Financial Compensation and Program Adher ence

Of the 6 studies that provided any type of compensation, 2 measured adherence with a mean of 42% (SD 15%; range 27-56) [30,36]. Among the studies that did not offer financial compensation, the majority (8/13, 62%) measured adherence with a mean of 60% (SD 11%; range 39-79) [5,14,37-42].

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Inter vention Length and Program Adher ence

The impact of the interv ention length on adherence was analyzed. Of the 5 studies with an interv ention <8 weeks, none recorded adherence. Those with an 8-week interv ention recorded an average of 58% (SD 16%) adherence (6/10, 60% of the studies measured adherence) [30,36,37,39,40,42]; those with interv entions >8 weeks recorded an average of 52% (SD 9%) adherence (4/4, 100% of the studies measured adherence) [5,14,38,41].

Retention

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[5,14,38,41].

Retention

Most (10/19, 53%) studies conducted pre-post analysis with additional follow-up points [14,24,29,32-34,36,38,39,42]. Follow-up periods ranged from 4 to 36 weeks after interv ention, and the most frequent follow-up time was 12 weeks after the interv ention (3/10, 30%) [38,39,42]. After interv ention, most (14/19, 74%) studies had over 70% retention (mean 78%, SD 15%; range 35%-100%) [3,5,29-31,33-39,41,43]. At the last follow-up point, 4 studies had retention above 70%

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[14,33,36,38].

The Impact of Engagement Strategies on Retention

Studies that applied only facilitator -led strate gies, on average, were 6 weeks in duration (SD 2; range 2-8) and had a retention rate of 93% (SD 10; range 73-100) compared with studies with a combination of program features and facilitator -led strate gies with a mean duration of 16 weeks (SD 10; range 8-52) and a retention rate of 75% (SD 5%; range 69-84) and those with only

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program features with a mean duration of 8 weeks (SD 2; range 4-12) and retention rate of 67% (SD 15%; range 30-79).

Of the studies that used facilitator -led strate gies only, 40% (2/5) had follow-up periods after postinterv ention follow-up [34,36]. On average, follow-up was 7 (range 6-8) weeks and retention was 76% (SD 15%; range 69-82). Of the 6, 5 (50%) studies using a combination of program features and facilitator -led strate gies had long-term follow-up, which, on average, was 11

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weeks (SD 0.9; range 10-12), with a retention rate of 71% (SD 15; range 49-83) [33,38,42]. Of the 8, 5 (63%) studies using program features only also had a long-term follow-up period of, on average, 13 (range 4-36) weeks, with retention rates of 53% (SD 18; range 20-74) [14,24,29,32,39].

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RenderX Studies that used only program reminders as engagement strate gies (n=4) [3,14,40,41] had mean retention rates of 71% after interv ention (n=3) [3,40,41] and retention of 74% at the last follow-up point (n=1) [14]. Studies that used reminders and other strate gies (n=4) [5,29,30,32] had a mean retention of 78% after interv ention (n=3) [5,29,30] and 57% at the last follow-up point (n=2) [29,32]. Studies that did not use program reminders

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but only used other strate gies (n=8) [24,33,37-39,42] had a mean retention of 67% after interv ention (n=6) [24,33,37-39,42] and 58% at the last follow-up point (n=5) [24,38,39,42].

Discussion

Principal Findings

In this review, we described the engagement strate gies applied to web-based mindfulness programs and their impact on adherence rates. The use of program features only was associated with program adherence but not with maintaining

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study retention. Engagement strate gies were largely reminders to use the program and, to a lesser extent, the ability to customize program content, interact with features, or engage with content on a deeper level through reflections, home work activities, and discussions of content with facilitators. There was little difference between the type of engagement strate gy used and adherence to programs or retention rates.

The need to accurately report study and program attrition to

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better understand the associations between program adherence and health outcomes has been established [11,12]. Our review found variability across studies in adherence measurements and inconsistencies in reporting adherence. Some studies measured adherence as completing a specif ic percentage of the program [3,14,30,37,39,41]. Other studies described adherence by grouping the number of sessions completed [5,33,36,38,40,42] or by describing use [24,29,31,32,34,35]. Although findings

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suggest that program adherence is similar between interv entions using program features only and those using a combination of program features and facilitator -led strate gies, these results should be interpreted with caution because of the variability in reporting. The variability in measuring adherence is consistent in the e-therap y literature [44] and limits the ability to assess the relationships between adherence to and engagement with

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web-based interv entions and user outcomes. Future studies should consider reporting adherence as a percentage of program completion for easier comparisons across studies.

Similarly , the ability to measure the impact of engagement strate gies on study attrition is limited. The findings suggest that studies using only facilitator -led strate gies were favorable for maintaining study retention [31,34-36,43]. On average, at the postinterv ention measurement, studies with only facilitator -led

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strate gies had a retention rate of 93% (SD 10%) compared with the rate of those using only program features of 67% (SD 15%). Similar findings were observ ed during the follow-up period (76%, SD 7% vs 53%, SD 18%a). However, there is limited evidence as to whether the presence of the facilitator was the reason for this variability or whether other factors such as interv ention length, follow-up length, or demographic characteristics of participants contrib uted to attrition. For

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example, 1 study that used only program features to impro veengagement had low retention after interv ention (35%) and at
the 8-week follow-up (20%) [24]. No information was provided
regarding the reason for these high attrition rates, making it
difficult to determine the cause of these findings. The use of a
facilitator or therapist to guide web-based psychological
programs has been debated [45,46]. Studies of cogniti ve
behavioral therap y interv entions found that the presence of a

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therapist as a facilitator impro ved symptoms of depression compared with interv entions with no facilitator [46]. However, impro vements in anxiety symptoms were similar across studies [46], and no information was provided about whether the presence of a facilitator affected adherence. Impro vements in patient outcomes may also be explained by the presence of comorbidities, including physical and mental illnesses, on which mindfulness may have a positi ve impact [47]. Therefore,

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participation in a mindfulness program targeting 1 disease may have additional benef its for other comorbid conditions. Furthermore, studies that used only facilitator -led strate gies experienced, on average, a higher retention rate, which is similar to previous reviews that have described that self-directed interv entions often require low levels of support from facilitators [16]. The use of facilitators to encourage adherence, or therapists

to deliver content, needs to be weighed against the sustainability goals, cost of the program and length of the interv ention during trials, and potential scaling after implementation.

Most studies in this review showed that web-based mindfulness resulted in impro vements in either psychological or physiological outcome measures [3,5,14,24,29-34,36,37,39-43].

Two key findings from this review further highlighted the relationship between study retention and baseline functioning

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of participants, where those with poorer psychological well-being at baseline were more likely to drop out [39], and those with higher adherence were more likely to experience greater impro vements in outcomes [30,36,40,42]. This is similar to previous findings where higher levels of worry and rumination at baseline resulted in diseng agement from mindfulness-based interv entions [23]. Stricter measurements of adherence are required in future studies to fully understand the role of

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adherence in the success of interv entions.

Program features applied throughout studies to enhance engagement varied according to the type and number of features available to users. Furthermore, the number and type of features included had similar impacts on program adherence and study retention, suggesting that there may not be one superior feature to be included in programs. Features such as diaries, reminders, and social connectedness are commonly used in interv entions

as behavior change techniques [21], and web-based features have been shown to be successful in impro ving user outcomes in other e-interv entions [48]. Within mindfulness, more specif ic reporting is needed to assess how often users engage with each type of feature to determine the relationship among engagement strate gies, adherence, and outcomes.

Limitations

Across studies, there was a large variance in interv entions and in reporting adherence. These factors made it difficult to draw

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any firm conclusions from the data.

 The sample of the included studies was predominately White

and female, which limits the generalizability of these findings

to other population groups.

This review aims to describe the influence of engagement

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strate gies on adherence and retention among people living with chronic illnesses or conditions. Other studies measuring adherence to mindfulness in the general population may have provided additional information on the impact of engagement strate gies. However, there is a need to evaluate engagement and adherence to web-based interv entions, specif ically in people living with chronic illness. People with chronic illness may be more likely to experience depression and anxiety symptoms

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than those without a chronic illness [49]. Lower mental well-being can affect the use of and engagement with web-based interv entions.Furthermore, the primary outcome of the review was to assess adherence, retention, and engagement strate gies rather than to draw conclusions about the effectiveness of interv entions on patient outcomes. As a result, the risk of bias assessment was less relevant.

Conclusions

Engagement strate gies in web-based mindfulness programs

largely comprise reminders to use the program. The impact of other features such as personalization, self-reflection activities, and lesson summaries on adherence requires further investig ation. There is variance in the way adherence is measured, and interv ention lengths and follow-up periods are inconsistent. More thorough reporting and a standardized frame work for measuring adherence are needed to more accurately assess adherence and engagement strate gies.

Conflicts of Inter est

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Conflicts of Inter est

None declared.

Multimedia Appendix 1

Study demographics, examples of search strate gy, and adherence, retention, and engagement strate gies and outcomes.

[DOCX File , 53 KB-Multimedia Appendix 1]

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Abbreviations

RCT : randomized controlled trial

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RenderX Edited by R Kukafka; submitted 29.04.21; peer-reviewed by H Wahbeh, H Hask elber g; comments to author 18.06.21; revised version

received 09.08.21; accepted 12.09.21; published 12.01.22

Please cite as:

Winter N, Russell L, Ugalde A, White V, Livingston P

Enga gement Strategies to Impr ove Adher ence and Retention in Web-Based Mindfulness Programs: Systematic Review

J Med Internet Res 2022;24(1):e30026

URL: https://www .jmir.org/2022/1/e30026

doi: 10.2196/30026

PMID:

Chunk 114

doi: 10.2196/30026

PMID:

Chunk 115

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