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REVIEW

Enablers and Barriers of Online Mindfulness-Based Interventions for Informal Carers: A Mixed-Methods Systematic Review

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Abstract

Objectives Informal carers are an integral part of any health care system. However, provision of informal care is associated with caregiver burden and decreased wellbeing. Mindfulness programs can reduce caregiving burden and improve wellbeing among informal carers, but they face challenges when participating in face-to-face programs. Studies have explored the effects of online delivery of mindfulness programs for informal carers. However, the enablers and barriers for participation are not well understood. This review aimed to synthesise the evidence and provide a comprehensive understanding of the enablers and barriers to participation in online mindfulness programs among this population.

Methods A mixed-methods systematic review was conducted following the Joanna Briggs Institute mixed-methods systematic review approach and using eight databases. All empirical studies published in English and involving informal carers aged over 18 years were included. Critical appraisal was conducted using the Mixed Methods Appraisal Tool. Thematic analysis was conducted to integrate the data.

Results Nine studies were included: three quantitative, two qualitative, and four mixed methods. Three subthemes for enablers and barriers were developed. Three subthemes for enablers included self-motivation, positive experience of mindfulness, and program structure and delivery. Three subthemes for barriers included lack of self-motivation, external factors preventing participation, and program structure and delivery. The enablers and barriers were interrelated within and across the identified themes.

Conclusions A comprehensive synthesis of current evidence was provided for consideration when developing online mindfulness-based interventions for informal carers. Further investigation is recommended, particularly in relation to the enablers and barriers to engagement by informal carers.

Preregistration The review protocol was registered with PROSPERO (CRD42023409311).

Keywords Enablers · Barriers · Informal Carers · Mindfulness · Online Delivery

Informal carers are defined as individuals who provide care for family members, friends, or neighbours on a voluntary basis (Australian Institute of Health and Welfare, 2023). Informal carers fulfill an important role within the Australian health care system by enabling care recipients to continue living in their communities (Carers Australia, 2021). Approximately 10% of Australians are informal carers who provide care recipients with basic care, including activities of daily living, communication, and mobility (Australian Institute of Health and Welfare, 2023). Caregiving often predisposes carers to an increased risk of stress, burden, and depression (Kor et al., 2018) and decreased psychological wellbeing (Cunningham et al., 2019). Caregiving demands may also limit the ability of informal carers to engage in paid work or to participate in social and leisure activities (Australian Institute of Health and Welfare, 2023), which in turn can lead to feelings of isolation and ultimately reduced quality of life (Brown et al., 2017).

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Emerging evidence suggests that quality of life within the informal carer population can be improved by engaging with mindfulness activities (Contreras et al., 2022; Juberg et al., 2023; Simpson et al., 2023). Mindfulness-based interventions (MBI) have been defined as psychological interventions that combine the mind and body to decrease stress (Kor et al., 2018). Mindfulness-based interventions have been utilised within different populations of carers including those of people with dementia (Chacko et al., 2022) and identified as a valuable psychological intervention (Kor et al., 2018), yielding positive effects on health and wellbeing in this population, reducing mental health conditions (Appleton et al., 2020), depression, cancer, and cardiovascular disease (Parkinson et al., 2019).

MBI have traditionally been delivered in face-to-face modes (Kabat-Zinn, 1982; Segal et al., 2002), but are being increasingly delivered online via pre-recorded guidance (Bailey et al., 2018), or via online courses with synchronous mindfulness practice sessions (Bogosian et al., 2021; Cavalera et al., 2019; Krusche et al., 2012). There are also many asynchronous online mindfulness applications available, with Headspace and Calm being two popular examples (Flett et al., 2019). Online mindfulness programs rapidly increased in popularity during the COVID-19 pandemic due to social distancing and enforced lock-downs (Zhang et al., 2020). Often during the pandemic, informal carers chose to self-isolate to reduce the risk of transmission to their care recipient (Bailey et al., 2022), making online interventions ideal for them. It is well recognised that this pandemic had a detrimental impact on people's mental wellbeing (Santomauro et al., 2021; Torales et al., 2020), including that of informal carers (Allen et al., 2022; Hughes et al., 2021; Rippon et al., 2023). Online access to MBI is particularly suitable for informal carers due to the remote delivery which allows them to balance the competing demands of care duties, particularly if they need to be at home with the care recipient, negating the need to make alternative care giving plans (Bogosian et al., 2021; Price-Blackshear et al., 2020). Asynchronous online applications, in particular, enable participants to access the course at their convenience (Mrazek et al., 2019), maintain their privacy (Price-Blackshear et al., 2020), and select activities based on individual preferences (Huberty et al., 2019).

Several systematic reviews have identified that online MBI may improve the mental health outcomes of a range of populations including students, employees, and patients (Gal et al., 2021; Jayawardene et al., 2017; Sommers-Spijkerman et al., 2021; Witarto et al., 2022; Zhang et al., 2020). Despite the positive health outcomes of online MBI delivery reported in the literature, these studies have also identified poor adherence and high attrition among the participants (Linardon & Fuller-Tyszkiewicz, 2020; Torous et al., 2020; Yadav et al., 2022).

Whilst there is a paucity of systematic reviews exploring the barriers and enablers to MBI in informal carers, a recent systematic review among people with chronic conditions found adherence to the therapy can be enhanced with greater understanding of the program's benefits, and by providing individualised support during practice (Marks et al., 2022), whereas barriers identified within previous research included time commitment, poor computer skills, health issues, and less motivation (Marks et al., 2022). To the best of our knowledge, there is no review conducted which explores the barriers and enablers of online MBI for informal carers. A preliminary search of PROSPERO, MEDLINE, the Cochrane Database of Systematic Reviews, and Joanna Briggs Institute (JBI) Evidence Synthesis was conducted, whereby no current or in-progress systematic reviews on the topic were identified. Therefore, this systematic review aimed to identify and explore the barriers and enablers of online MBI for informal carers.

Method

Review Design

This review followed the JBI methodology for mixed-methods systematic reviews (MMSR) featuring as a guide to synthesise and integrate qualitative, quantitative, and mixed-methods studies (Lizarondo et al., 2020). The protocol for the systematic review was developed via collaboration between all authors and registered with the International Prospective Register of Systematic Reviews, on 1 April 2023 before data extraction commenced (CRD42023409311).

Search Strategy

A three-step search strategy was utilised in this review, in accordance with the JBI methodology (JBI, 2020). First, an initial limited search was undertaken using MEDLINE (Ovid) and PsycINFO (EBSCO) to identify the keywords and Mesh terms used. Second, the search was replicated using the finalised keywords and Mesh terms in the other databases including CINHAL Ultimate (EBSCO host), Web of Science, Cochrane Library, JBI, Scopus, and Embase (Elsevier). The search also included sources of unpublished studies and grey literature, such as ClinicalTrials.gov and BASE. The search strategy, including all identified keywords and index terms, was adapted for each included information source, whereby a second search was undertaken on 14 March 2023 prior to data analysis. A final search was undertaken on 01 January 2024 to identify any recent publications that were eligible for inclusion. The applied full search strategies are provided in Table S1 of the Supplementary Information. Lastly, a hand search was conducted to review the reference lists of selected

study for critical appraisal, and Google Scholar searched to identify any articles missed by the database search.

Eligibility Criteria

Quantitative, qualitative, and mixed-methods studies that included data relevant to the research question were considered for inclusion in the review. Mixed-methods studies that contained data from quantitative or qualitative components that could be extracted were also considered. Whilst grey literature comprising theses were included, we excluded letters to the editor, opinion pieces, systematic reviews, and editorials. The search strategy was guided by the PICo mnemonic: population, phenomena of interest, and context.

Population

This review considered studies that included informal carers aged 18 years and above. Studies that involved both informal carers and care recipients were included if findings related to informal carers could be extracted.

Phenomena of Interest

This review identified and explored the barriers and enablers that influence the delivery of online MBI, with the core component being the mindfulness-based activities. We included synchronous and asynchronous mindfulness-based stress reduction and mindfulness-based cognitive therapy, as well as any other intervention where mindfulness was the preliminary intervention. The review included studies with any data pertaining to barriers and enablers with no limits of period of intervention impacting informal carers in undertaking online MBI.

Context

This review considered literature describing the implementation of MBI within an online setting of any application. The duration of the intervention was not considered due to the scarcity of available literature in the area.

Study Selection

Following the search, all identified citations were uploaded into EndNote 20 for the removal of duplicates. The remaining studies were then exported to Covidence for title, abstract, and full-text screen (Covidence Systematic Review Software, 2023). Titles and abstracts were then screened by two independent reviewers from the study team for assessment against the inclusion criteria. The full text of selected citations was then assessed against the inclusion criteria by two independent reviewers from the study team for inclusion/exclusion. Disagreements between the reviewers at the full-text review stage accounted for 18% of the cases and were resolved through discussion with a third reviewer. The included articles were then exported back to Endnote. The results of the search and study selection are presented in a PRISMA flow diagram (Page et al., 2021) (Fig. 1).

Quality Appraisal

Critical appraisal of included studies was conducted using the Mixed Methods Appraisal Tool (MMAT), which was designed to appraise quantitative, qualitative, and mixed-methods studies (Hong et al., 2018). The MMAT comprises two screening questions to ensure selection of only empirical studies for appraisal. Each category has five criteria to rate with either "yes", "no", and "can't tell" (Hong et al., 2018). Two study team members were involved in appraising the methodological quality of the included studies. Similarly, any disagreement with the appraisal was resolved via discussion with the third study team member. Due to limited studies being available, no study was excluded based on its methodological quality (Table 1).

Data Extraction and Synthesis

Data from the included studies were extracted and are presented in Table 2. These data included study design, aim of the study, study population, characteristics of participants (age, sex, relationship to care recipient), sample size and online intervention (program duration, recommended daily practice, delivery type audio/video/webinar), data collection methods, data analysis, results, and attrition rate. Empirical data concerning the barriers and enablers for online mindfulness interventions were also extracted and are presented in Table 3.

Data synthesis was conducted using the convergent integrated approach which involved combining the "qualitised" data and qualitative data (Lizarondo et al., 2020). "Qualitised data" refer to quantitative results from experimental, observational, and quantitative components of mixed-methods studies that were transformed into textual descriptions or narrative interpretation in a way that answered the review questions by repeated detailed examination (Hong et al., 2017).

Thematic synthesis was used to categorise and pool together data of similar meaning in order to form subthemes (Harden & Thomas, 2008). Following this, codes were developed for each subtheme and deductively organised under the main themes for "Enablers to practicing online mindfulness" and "Barriers to practicing online mindfulness" (Table 3). To explore relationships between subthemes and main themes, a concept map was used to illustrate the relationships within and between the descriptive subthemes and main themes (Novak &

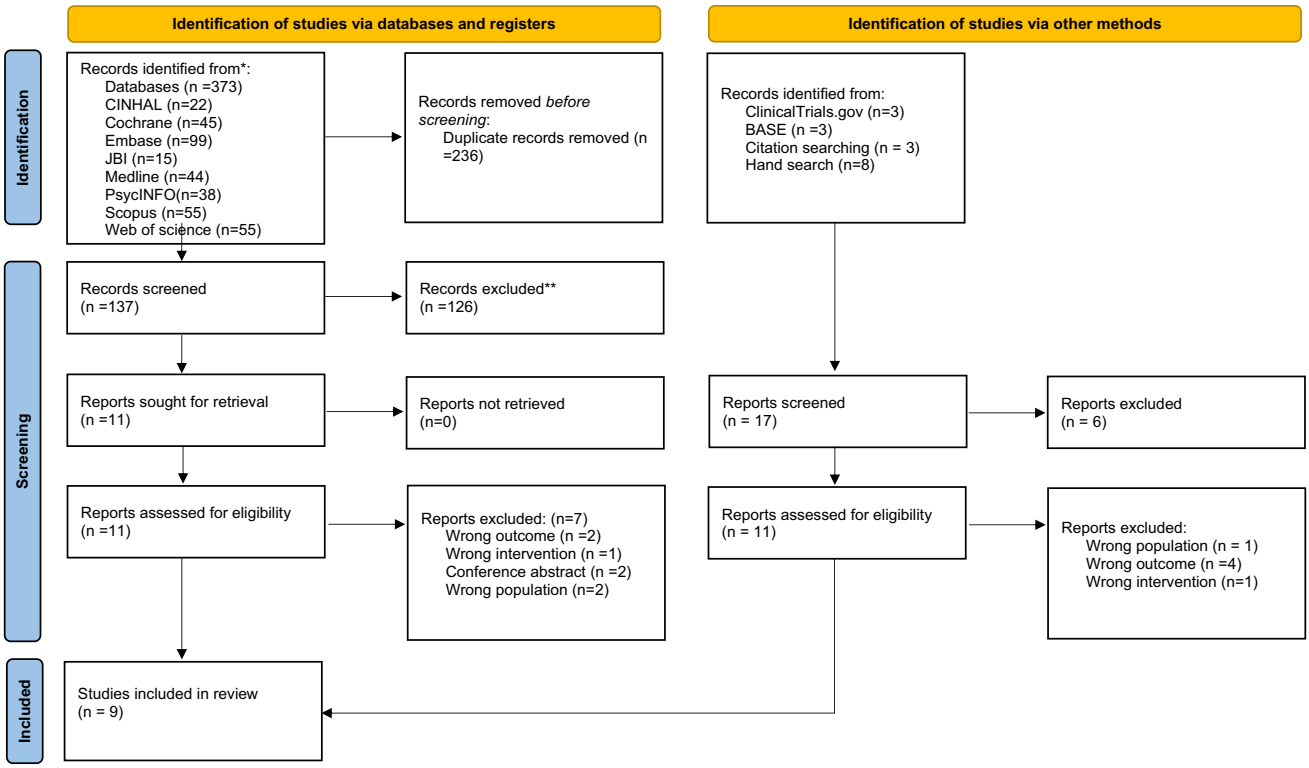

Fig. 1 PRISMA flow diagram of the screening process

Canas, 2008) (Fig. 2). Concept mapping is a graphical tool used to organise and represent knowledge hierarchically (Eppler, 2006; Novak & Canas, 2008). Considering the aim of this review, key concepts relating to each descriptive theme were identified and ranked from the most general and comprehensive concept presented at the top to the more specific and least general concepts presented at the bottom.

Results

Search Outcome

The search resulted in 373 retrieved records from the databases, of which 236 were duplicates. Following screening of titles and abstracts, 11 studies were assessed for eligibility as full text, resulting in 4 studies being included in the review. Three studies were retrieved from the citation search, with 8 studies identified by hand searching and 6 studies identified by grey literature, of which, 5 studies met the inclusion criteria. Accordingly, a total of 9 studies were included, as illustrated in Fig. 1.

Methodological Quality of Included Studies

Both qualitative studies (Llaneza et al., 2022; Stjernsward & Hansson, 2020) had coherence between qualitative data sources, collection analysis, and interpretation with appropriate research questions for qualitative research followed by adequate data collection methods. Findings were also adequately derived from the data and results were sufficiently interpreted from data. All 4 mixed-methods studies (Atreya et al., 2018; Dragomanovich et al., 2021; Lunsky et al., 2021; Stjernsward & Hansson, 2017) had issues with interpretation of integration of qualitative and quantitative components. One study had issues with qualitative interpretation of results, and a lack of consideration for confounding factors (Dragomanovich et al., 2021). Another study had issues with sample selection, addressing divergences of quantitative and qualitative results, and the rationale for using a mixed-methods design (Stjernsward & Hansson, 2017). The other study also had issues with the rationale for a mixed-methods design, integration of findings, and interpretation of qualitative and quantitative results (Lunsky et al., 2021). Three randomised controlled trials had issues with blinded outcome assessors (Lange, 2020; Stjernsward & Hansson, 2018; Zarei et al., 2022). The methodological quality of the included studies is reported in Table 1.

Table 1 Methodological quality assessment of included studies

Questions	Stjernsward & Hansson, 2020	Stjernsward & Hansson, 2017	Dragomanovich et al., 2021	Llaneza et al., 2022	Atreya et al., 2018	Lange, 2020	Lunsky et al., 2021	Zarei et al., 2022	Stjernsward & Hansson, 2018
S1. Are there clear research questions?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
S2. Do the collected data allow to address the research questions?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Qualitative									
1.1. Is the qualitative approach appropriate to answer the research question?	Yes	Yes	Yes	Yes	Yes		Yes		
1.2. Are the qualitative data collection methods adequate to address the research question?	Yes	Yes	Yes	Yes	Yes		Yes		
1.3. Are the findings adequately derived from the data?	Yes	Yes	Yes	Yes	Yes		Yes		
1.4. Is the interpretation of results sufficiently substantiated by data?	Yes	Yes	No	Yes	Yes		Yes		
1.5. Is there coherence between qualitative data sources, collection, analysis and interpretation?	Yes	Yes	Yes	Yes	Yes		Yes		
RCT									
2.1. Is randomization appropriately performed?						Yes		Yes	Yes
2.2. Are the groups comparable at baseline?						Yes		Yes	Yes
2.3. Are there complete outcome data?						Yes		Yes	Yes
2.4. Are outcome assessors blinded to the intervention provided?						No		No	No
2.5 Did the participants adhere to the assigned intervention?						Yes		Yes	Yes
Non-randomised									
3.1. Are the participants representative of the target population?			Yes		Yes		Yes		
3.2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?			Yes		Yes		Yes		
3.3. Are there complete outcome data?			Yes		Yes		Yes		

Table 1 (continued)

Questions	Stjernsward & Hansson, 2020	Stjernsward & Hansson, 2017	Dragomanovich et al., 2021	Llaneza et al., 2022	Atreya et al., 2018	Lange, 2020	Lunsky et al., 2021	Zarei et al., 2022	Stjernsward & Hansson, 2018
3.4. Are the confounders accounted for in the design and analysis?			No		Yes		Yes		
3.5. During the study period, is the intervention administered (or exposure occurred) as intended?			Yes		Yes		Yes		
Quantitative descriptive									
4.1. Is the sampling strategy relevant to address the research question?		Yes							
4.2. Is the sample representative of the target population?		Can't tell							
4.3. Are the measurements appropriate?		Yes							
4.4. Is the risk of nonresponse bias low?		No							
4.5. Is the statistical analysis appropriate to answer the research question?		Yes							
Mixed-methods									
5.1. Is there an adequate rationale for using a mixed-methods design to address the research question?		No	Yes		Yes		No		
5.2. Are the different components of the study effectively integrated to answer the research question?		Yes	Yes		Yes		Yes		
5.3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?		No	No		No		No		
5.4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?		Can't tell	Yes		Yes		No		
5.5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?		No	Yes		Yes		Yes		

Table 2 Summary of the population demographics, interventions, data collection, analysis, and findings of the included studies

Study, country, study design	Study aim	Participants (age, sex, relationship)	Online intervention	Data collection method	Data analysis	Findings	Comment
Stjernsward and Hansson (2020) Sweden Qualitative	To explore the users' experiences of a web-based mindfulness program, including motivation and challenges to use	10 informal carers of a person with mental illness or somatic illness. Mean age 57.6 years old, 9 females, 9 partners	8 weeks **web-based MBI** (2 × 10 min/day, 6 days)—audio/video files, instruction to daily mindfulness practices; a time log, and a private diary	Semi-structured phone interview after 10 weeks	Content analysis	Results confirmed the importance of supporting motivation and adherence to online MBI, with the potential for enhanced outcomes	Explored enablers and barriers of online MBI. Small sample size, homogeneity in demography
Llaneza et al. (2022) USA Qualitative	To determine barriers and facilitators of mHealth mindfulness therapy in caregivers of older adults with cognitive impairment	15 informal carers to cognitive impaired older adult age 65 and above. Mean age 61.86 years old, 14 females, 8 adult children	8 weeks **web-based MBI** (set practice goals based on participants needs, Mindfulness Coach app)	Semi-structured telephone interview (15–30 min, last data collection for the parent study was December 2020, data collection for this study was from Jan 2021 to April 2021)	Inductive-deductive analysis	Self-directed mHealth delivered mindfulness therapy may be a promising intervention for the carers	Explored enablers and barriers of online MBI. Small sample size, homogeneity in demography
Stjernsward and Hansson (2017) Sweden Mixed-methods	To explore the value and usability of a web-based MBI	15 relative/significant other of a person with mental health problems. Mean age 51 years old, 14 females, 5 parents, 5 partners	8 weeks **web-based MBI** (2 × 10 min, 6 days) Audio/video files, instructions for daily mindfulness exercises, a time log, and a private diary	Semi-structured phone interviews at 3 months follow-up. Post-intervention ($n = 78$) and 3-month follow-up usability survey data ($n = 57$)	Qualitative data were analysed with content analysis. Quantitative data analysis was undertaken with descriptive statistics	Program was acceptable, usable, and valued by the participants. 77% of participants recommended the program to others	Explored enablers and barriers of online MBI. Small sample size, homogeneity in demography
Atreya et al. (2018) USA Mixed-methods (Dyadic intervention, $n = 53$)	To assess feasibility, acceptability and preliminary efficacy of an online MBI among patients and caregivers	20 informal caregivers of colorectal cancer patients. Median age 51 years old, 8 males, 13 significant others	8 weeks **audio-based MBI** (15–20 min per day practice, 5 days per week) A MP3 player pre-loaded with 8 mindfulness practices, a study booklet containing a practice diary	Pre- and post-symptoms and wellbeing survey Pre- and post-intervention semi-structured focus group interview ($n = 6$)	Inductive content analysis for qualitative data. Quantitative data analysis was undertaken with paired *t*-tests pre- and post-intervention (4 and 8 weeks)	Program was of interest to, feasible, and acceptable for patients with metastatic gastrointestinal cancer and carers. Consistent with quantitative findings, 71% of participants reported benefit at post-intervention qualitative interviews. **20% attrition rate**	Identified enablers and barriers through recruitment, pre-study interview and adherence. Explored barriers to participation. Small sample size, homogeneity in demography

Table 2 (continued)

Study, country, study design	Study aim	Participants (age, sex, relationship)	Online intervention	Data collection method	Data analysis	Findings	Comment
Dragomanovich et al. (2021) USA Mixed-methods (Dyadic intervention, n-69)	To evaluate the feasibility, acceptability, and estimate efficacy of an 8-week web-based mindfulness program	23 informal carers of metastatic cancer patients. Age not given, 12 males, 15 spouse/partner	8 weeks **web-based MBI** One track per day, 5 days per week + an hour weekly webinar (15 min teaching, 20 min guided MBI, Q&A)	Pre- and post-symptoms and wellbeing survey, Single question survey for potential adverse effects Semi-structured telephone interview at week 8	Qualitative data analysed with thematic analysis Quantitative data was analysed via descriptive statistics for feasibility and acceptability data	Program was feasible and acceptable for patients with metastatic gastrointestinal cancer and carers. 88% of respondents reported a positive experience in post-intervention qualitative interviews. **29% attrition rate**	Identified enablers and barriers through recruitment, pre-study interview, and adherence. Explored barriers to participation. Small sample size, lack of a control arm, use of multiple comparisons, and low interactive webinar attendance
Lunsky et al. (2021) Canada Mixed-methods	To identify feasibility, adherence, acceptability of online MBI and explore the outcome of online MBI	39 parents of adolescents and adults of autistic. Mean age 52.68, 35 mothers	6 weeks **group-based web MBCT** (90 min Zoom session per week) 10–15 min audio practice recording	Outcome measured at baseline, post-intervention, and 3-month follow-up	Linear mixed-effect modelling was employed as the primary tool to examine the intervention effect	Interventions was feasible, acceptable, and led to improved clinical outcomes. **53% attrition rate**	Identified enablers and barriers through retention and open-ended questions at the end of the program
Zarei et al. (2022) Canada RCT	To evaluate the feasibility and effectiveness of an online MBCT among informal carers of people with dementia	26 informal carers of a person living with dementia. Mean age 60 years old, 23 females, 18 adult children	8 weeks **web-based MBI** via group conference (30–45 min/day, + 2 h/week video conference) "The Mindful Way Workbook" + practice log + snack pack of raisings	Pre-intervention interview, post-intervention satisfaction questionnaire at week 8, follow-up questionnaire 4 weeks after	Quantitative analysis was undertaken with *t*-test and *U* tests to identify changes pre- and post-intervention	Tele-MBCT is a feasible intervention and may improve psychological outcomes and adaptive coping in family carers of people with dementia. 88.8% were satisfied with the online delivery method. **8% attrition rate**	Identified enablers and barriers through recruitment and retention. Small sample size, homogeneity in demography

Table 2 (continued)

Study, country, study design	Study aim	Participants (age, sex, relationship)	Online intervention	Data collection method	Data analysis	Findings	Comment
Lange (2020) UK RCT	To investigate the feasibility and acceptability of an online MBI	15 informal carers (8 in intervention group) of stroke survivors. Mean age 62.13 years old, 5 males, all spouse/ partner	4 weeks **web-based MBI** (10–20 min/ daily, allowed 6 weeks to complete)	Survey at baseline (demographic information, Barthel Index), post-intervention (Internet Evaluation and Utility Questionnaire) and follow-up at 3 months (not reported in the study) One interview with withdrawn participant	Qualitative data analysed using content analysis. Quantitative data analysis was undertaken with descriptive statistics	Results suggest limited feasibility of extending the current methodology to a larger trial. Five participants completed online MBI and feedback indicated the MBI was acceptable to them. **62.5% and 14% attrition rate** respectively for intervention and control group	Identified enablers and barriers through recruitment and retention. Explored enablers and barriers. Small sample size
Stjernsward and Hansson (2018) Sweden RCT	To assess the effectiveness and usability of a web-based MBI for families living with mental or somatic illness	196 relative/significant other to a person with mental or somatic illnesses Mean age 52.5 years old, 47% parents	8 weeks **web-based** MBI (2×10 min, 6 days) Audio/video files, instructions for daily mindfulness exercises, a time log, and a private diary	Online questionnaires at baseline (T1), post-intervention (T2), and 3-month follow-up (T3)	General linear models were performed to evaluate between group comparisons of the intervention's impact on primary and secondary outcomes	Significant improvements were found in the primary outcome mindfulness, with mainly medium effect sizes in both the global sum scale and all subscales both post-intervention and at follow-up. **30%, 29% attrition rate at T2 and T3**	Identified enablers and barriers through free text answers in post-questionnaires

MBCT, mindfulness-based cognitive therapy; *RCT*, randomised controlled trial; *MBI*, mindfulness-based interventions

Table 3 Data extraction of the included studies related to enablers and barriers of practicing online MBI

Studies	Enablers	Barriers	Suggestion for the program[+]
Atreya et al. (2018)	Better support for the care recipient Desire to help with research Learn a new skill Help with sleep Promote relaxation Curiosity Asist to focus/train/organise thoughts Positive experience with meditation	Time constraint Life circumstances Technology issues Difficulty to understand the program structure Prefer an alternate strategy for coping	Build on favourite tracks Provide longer and shorter track options Select male or female voices
Dragomanovich et al. (2021)	Better support for the care recipient Improve coping skills Assist to stay in the present Help with sleep Curiosity Assist to focus/train/organise thoughts Learn a new skill Reduce anxiety	Time constraint Life circumstances Technology issues Prefer an alternate strategy for coping	
Lange (2020)	Flexible and accessible interventions Improve coping skills Opportunity for self-care Positive experience with meditation	Time constraints Personal characteristics Life circumstances Technology issues View program as a stressor	More mid-week practice reminders
Llaneza et al. (2022)	Flexible and accessible intervention Improve coping skills Use of mindfulness skills in daily life	Time constraints Life circumstances Personal characteristics	Allow personalised individual schedule Live support options Additional phone calls reminders
Lunsky et al. (2021)	Flexible and accessible interventions Improve coping skills Helpful to be with other carers in a group Closed Facebook group was useful	Time constraint Life circumstances Personal characteristics	Automatic reminders in calendar Posting of recordings of sessions More instructions to participate in an online forum
Stjernsward and Hansson (2020)	Flexible and accessible intervention Improve coping skills Desire to help with research Opportunity for self-care Positive experience with meditation Availability of the research team View mindfulness as a fashionable trend	Time constraints Personal characteristics Training generated negative feelings Life circumstances Environment not found suitable View program as a stressor Technology issues Understanding of the program's structure Unmet expectations Belong to the control group	Incorporate periods of silence during exercises Reduce repetition of instructions Provide option to pause and rewind audio files Increase the variety within the wordings Include more rationale to support mindfulness as a practice Add psychoeducational content to common feelings and experiences in carers Include additional short tutorial or email to be able to contact course leads
Stjernsward and Hansson (2018)	Flexible and accessible interventions Improve coping skills Opportunity for self-care	Time constraint Personal characteristics Training generated negative feelings Life circumstances View program as a stressor	More varied exercises and speaker voices Shorter daily training or longer test period Clearer instructions Easier navigation Internet-independent application Possibility to browse through the exercises.

Table 3 (continued)

Studies	Enablers	Barriers	Suggestion for the program[+]
Stjernsward and Hansson (2017)	Flexible and accessible intervention Improve coping skills Desire to help with research Opportunity for self-care Promote relaxation Reduce anxiety Availability of the research team Positive experience with meditation Better support for the care recipient Use of mindfulness skills in daily life Improve sleep Relieve physical pain	Time constraint Personal characteristics Training generated negative feelings Life circumstances Environment not suitable View program as a stressor	More varied exercises Partially "foreign" language (e.g. compassion training, certain figures of speech) Incorporate periods of silence during exercises A longer program Opportunity to discuss thoughts and feelings
Zarei et al. (2022)	Flexible and accessible intervention Improve coping skills Interventions addressed carers needs Helpful to be with other carers in a group	Time constraints Life circumstances	

[+]Reported when information available in the original studies

Study Characteristics

Study characteristics in the included studies are summarised in Table 2. Three studies were published between 2017 and 2019 (Atreya et al., 2018; Stjernsward & Hansson, 2017, 2018), with 6 studies published since 2020 (Dragomanovich et al., 2021; Lange, 2020; Llaneza et al., 2022; Lunsky et al., 2021; Stjernsward & Hansson, 2020; Zarei et al., 2022). The studies were conducted in Canada ($n=2$) (Lunsky et al., 2021; Zarei et al., 2022), the UK ($n=1$) (Lange, 2020), Sweden ($n=3$) (Stjernsward & Hansson, 2017, 2018, 2020), and the USA ($n=3$) (Atreya et al., 2018; Dragomanovich et al., 2021; Llaneza et al., 2022). The sample sizes of studies ranged from 10 to 196 informal carers, whereby 2 studies included informal carers and care recipients with a total number of 69 participants (Dragomanovich et al., 2021) and 53 (Atreya et al., 2018), respectively. Eight studies reported the mean age of participants, ranging between 50 and 65 years of age (Atreya, 2018; Lange, 2020; Llaneza et al., 2022; Lunsky et al., 2021; Stjernsward & Hansson, 2017, 2018, 2020; Zarei et al., 2022). Three studies included over 90% female participants (Llaneza et al., 2022; Stjernsward & Hansson, 2017, 2020), whereby participant relationship to the care recipient was reported in all studies, of which 4 studies involved a majority of spouse/partner relationship (Lange, 2020; Stjernsward & Hansson, 2017, 2018, 2020). Three of the nine included studies (Stjernsward & Hansson, 2017, 2018, 2020) had the same online MBI as they were part of one larger study. One study had an audio-based intervention (Atreya et al., 2018), whereas other studies had both audio/video and web interventions. One study did not report the daily practice requirement; however, it included 14 levels of mindfulness training (Llaneza et al., 2022). Length of practice times were between 10 and 20 min daily for the remaining studies. Apart from daily practice, 3 studies provided weekly webinars for online MBI (Dragomanovich et al., 2021; Lunsky et al., 2021; Zarei et al., 2022) and

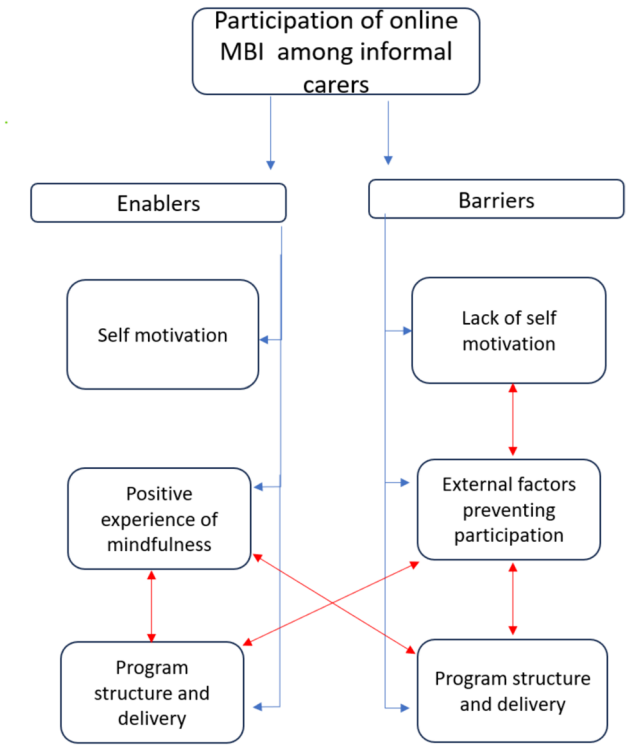

Fig. 2 Concept map illustrating relationships within and between the descriptive subthemes and main themes

6 studies had practice dairies (Atreya et al., 2018; Lange, 2020; Stjernsward & Hansson, 2017, 2018, 2020; Zarei et al., 2022). The duration of online interventions was 8 weeks for 6 studies (Atreya et al., 2018; Dragomanovich et al., 2021; Llaneza et al., 2022; Stjernsward & Hansson, 2017, 2018, 2020), 6 weeks for one study (Lunsky et al., 2021), and 4 weeks for another study (Lange, 2020).

Enablers of Online Mindfulness Practice

Three descriptive themes derived for enablers included (1) self-motivation, (2) positive experience of meditation, and (3) program structure and delivery.

Self-motivation

Self-motivation can be defined as a complex psychological process, involving how learners' subjective beliefs and perceptions impact on their choices, effort, and persistence in achieving their goals (Bakhtiar & Hadwin, 2022; Berliner & Calfee, 2004; Eccles & Wigfield, 2002). To provide better support for the care recipient was noted as a motivator to participate in online MBI in 3 studies (Atreya et al., 2018; Dragomanovich et al., 2021; Stjernsward & Hansson, 2017). To focus/train/organise thoughts was cited as an enabler to participate in 2 studies (Atreya et al., 2018; Dragomanovich et al., 2021). Some participants joined the program due to their curiosity, whilst others participated to learn a new skill (Atreya et al., 2018; Dragomanovich et al., 2021). In one study, participants viewed mindfulness as a fashionable trend (Stjernsward & Hansson, 2020), thus prompting their participation. Three studies described the participants' desire to participate in the intervention being driven, in part, by a desire to support in research in carer wellbeing (Atreya et al., 2018; Stjernsward & Hansson, 2017, 2020). Some participants noted that participating in a research study with a deadline was a positive influence to continue with the interventions (Stjernsward & Hansson, 2017).

Positive Experience of Mindfulness

Previous positive experience of meditation encouraged participants to ***undertake online MBI in*** 4 studies (Atreya et al., 2018; Lange, 2020; Stjernsward & Hansson, 2017, 2020). Participants from a study carried out to determine barriers and enablers of online mindfulness for informal carers of older adults with cognitive impairment reported that skills including breathing exercises, present moment awareness, and compassion helped them to reduce stress in their daily lives and thus encouraged adherence to online MBI programs (Llaneza et al., 2022). Some participants reported learning practical and meaningful skills from online MBI to empower them with better coping in the future (Lunsky et al., 2021). In addition, participants reported that having coping strategies available on their personal mobile device was helpful as they were able to access support right after a stressful period or at a regular scheduled time (Llaneza et al., 2022). In one study, participants experienced online MBI as a coping tool for stress, which in turn enhanced their wellbeing (Stjernsward & Hansson, 2017). They noted that they managed to reflect on a situation and not to be overwhelmed by strong emotions.

Participants also observed "thoughts come and go", recognising the consequences of their actions, and choosing to either act upon or let go of a situation in a strategic way (Stjernsward & Hansson, 2017). Similar findings were reported in another study, where participants were more aware of their feelings and re-centred themselves using mindfulness exercises (Dragomanovich et al., 2021). The study was conducted to evaluate the feasibility and acceptability and estimate the efficacy of an 8-week online MBI program among informal carers of metastatic cancer patients. Participants in one study experienced reduced physical pain resulting from long-term stress when practicing online MBI, which in turn enhanced their health and wellbeing (Stjernsward & Hansson, 2017). In the same study, participants reported reduced anxiety. This study was conducted to explore the value and usability of an 8-week online MBI for informal carers of a person with mental and somatic health problems.

Four out of nine study participants experienced improved sleep, enabling them to continue practices (Atreya et al., 2018; Dragomanovich et al., 2021; Stjernsward & Hansson, 2017, 2018), whilst giving them an opportunity to self-care (Lange, 2020; Stjernsward & Hansson, 2017, 2018, 2020). Some participants recognised the training as an opportunity to look after their own needs, considering this as a valid excuse to take time off from caring (Stjernsward & Hansson, 2020). Further, participants valued to be connected with others in similar situations (Lunsky et al., 2021; Zarei et al., 2022). Participants from a study carried out to evaluate the feasibility and effectiveness of online mindfulness among informal carer of people with dementia reported to continue using the program as it addressed their needs (Zarei et al., 2022).

Program Structure and Delivery

Seven out of nine studies reported flexible and accessible interventions as an enabler for participating in online MBI (Lange, 2020; Llaneza et al., 2022; Lunsky et al., 2021; Stjernsward & Hansson, 2017, 2018, 2020; Zarei et al., 2022). Interventions were available for the participants to access at their own convenience (Stjernsward & Hansson, 2017). Participants noted that accessibility from home was especially beneficial when home bound with care recipients. Participants from another study also noted that having the app in their personal device and being able to use it according

to their personal schedule, mood, and time preferences were motivators of using the intervention (Llaneza et al., 2022). Support from the research team members was reported as an enabler in 2 studies (Stjernsward & Hansson, 2017, 2020). Weekly email reminders with contact information for researchers for enquiries and technical support were motivators to continue the interventions (Stjernsward & Hansson, 2020). In one study, parents of adolescents and adults with autism noted a closed Facebook page as an enabler as it allowed them to access missed sessions and make connection with parents who have similar challenges (Lunsky et al., 2021).

Barriers to Mindfulness Practices

Three descriptive themes derived for barriers included (1) lack of self-motivation, (2) external factors preventing participation, and (3) program structure and delivery.

Lack of Self-motivation

Lack of self-motivation was identified as a significant barrier to mindfulness practice in 6 studies (Lange, 2020; Llaneza et al., 2022; Lunsky et al., 2021; Stjernsward & Hansson, 2017, 2018, 2020). Reasons for lack of motivation included low mood, inability to focus, lack of interest in using the app (Llaneza et al., 2022), procrastination (Lange, 2020; Stjernsward & Hansson, 2017, 2020), forgetfulness, difficulty in establishing new habits (Stjernsward & Hansson, 2017, 2020), and a lack of self-discipline (Stjernsward & Hansson, 2017). Some participants also viewed the program as a stressor which hindered their participation (Lange, 2020; Stjernsward & Hansson, 2017, 2020). They reported being behind with the program schedule and struggling with daily chaos. Some participants reported MBI training as another stressful demand in their daily life, noting an inability to complete the training within the given schedule, which in turn generated stress for them (Stjernsward & Hansson, 2020). Similarly, unmet expectations from the program also negatively influenced participation in the program (Stjernsward & Hansson, 2020).

External Factors Preventing Participation

All studies identified external factors as barriers to participation (Atreya et al., 2018; Dragomanovich et al., 2021; Lange, 2020; Llaneza et al., 2022; Lunsky et al., 2021; Stjernsward & Hansson, 2017, 2018, 2020; Zarei et al., 2022). Life circumstances such as carers' health issues (Dragomanovich et al., 2021; Lange, 2020) and advanced age were indicated as barriers to participation (Lange, 2020). All studies identified time constraints as a barrier. These time constraints included health deterioration of the care recipient (Stjernsward & Hansson, 2020), providing medical care (Dragomanovich et al., 2021), and supporting the daily activities including taking them to medical appointments (Lange, 2020; Llaneza et al., 2022). Training that generated negative feelings was another barrier to participation (Stjernsward & Hansson, 2017, 2018, 2020). Feelings such as anxiety and stress were identified as factors by one participant who was in crisis (Stjernsward & Hansson, 2020). Some participants noted that their environment was not suitable for training (Stjernsward & Hansson, 2017, 2020).

Program Structure and Delivery

Participants in 2 studies reported difficulty in understanding or following the program instructions (Atreya et al., 2018; Stjernsward & Hansson, 2020). Some participants had trouble understanding exactly what was expected of them, which induced a sense of insecurity as to whether they were doing the training properly and if they were gaining its benefits (Stjernsward & Hansson, 2020). Two carers ($n = 20$) from another study reported that they had trouble understanding the instructions or content (Atreya et al., 2018). The study was conducted to assess feasibility, acceptability, and preliminary efficacy of an online MBI among patients with colorectal cancer and their informal carers. Technology issues were identified as a barrier in 4 studies (Atreya et al., 2018; Dragomanovich et al., 2021; Lange, 2020; Stjernsward & Hansson, 2020). One participant experienced computer problems with website issues and inaccessible content (Lange, 2020). This study investigated the feasibility and acceptability of online MBI comprising of 15 informal carers of stroke survivors (Lange, 2020). Belonging to the control group also acted as a barrier in one study, meaning participants had to wait long periods for exposure to the online MBI (Stjernsward & Hansson, 2020).

Relationship of Enablers and Barriers

Several concepts were identified for each of the enablers and barriers. These concepts were related to each other within and between the descriptive themes. Lack of self-motivation and external factors preventing participation can be interrelated due to their dependability with each other. For instance, care recipient illness may lead to procrastination in participating in online MBI. Program structure and delivery can positively or negatively be interrelated with remaining enablers and barriers. A conceptual map related to this is presented in Fig. 2.

Discussion

This review has identified the potential enablers and barriers to participating in an online MBI for informal carers. Though earlier reviews have synthesised evidence of some of these enablers and barriers among other populations (Guay et al., 2017; Linardon & Fuller-Tyszkiewicz, 2020; Marks et al., 2022; Winter et al., 2022), this review added to the existing knowledge by applying a systematic synthesis of evidence of enablers and barriers in all studies of online MBI specific to the informal carer population. The review identifies that online delivery of MBI programs can be a suitable mode to provide support for informal carers who may not be capable of attending face-to-face MBI programs.

This review identified self-motivation as an enabler for participating in online MBI. Similarly, previous studies have identified that carer motivation can be influenced by their perceptions, meanings and experiences, cultural values, beliefs, spiritual beliefs, illness beliefs, and socialisation (Zarzycki et al., 2023). This review revealed that previous positive experiences of mindfulness were a key enabler for participation in online MBI programs (Atreya et al., 2018; Lange, 2020; Stjernsward & Hansson, 2017, 2020). This finding is in keeping with a previous study conducted by Guay et al. (2017), which reported interventions tailored for behavioural change can have a positive effect on the psychological wellbeing of informal carers.

In contrast, identified barriers related to lack of self-motivation for participating in an online MBI have also been well documented in previous studies. Issues such as individual characteristics, viewing the program as a stressor, and unmet expectations of the program were discussed. Some of these findings have been reported in a previous systematic review which investigated the engagement strategies to improve participant adherence and retention in online mindfulness programs. It was identified that participants with poorer psychological wellbeing were more likely to drop out and disengage with interventions (Winter et al., 2022). Another study also identified that rumination and worry can hinder the participant retention rate in online MBI (Banerjee et al., 2018).

Aligning with our findings, difficulty understanding the program structure has been reported as a barrier in a previous study of online MBI for cancer patients (Compen et al., 2017). Saleem et al. (2021), in their study of understanding engagement strategies in online interventions, suggested some mitigation strategies such as sending reminders to participants, including colourful pictures, visual content, large colourful icons, and easy-to-understand content. Similarly, the broader literature has also identified negative effects of the training as a barrier for MBI support (Britton et al., 2021; Taylor et al., 2022). A systematic review was conducted to identify adverse effects of meditation interventions and mind-body practices, including 61 studies divided commonly reported negative effects from meditation interventions into 2 categories: mental distress and somatic distress (Taylor et al., 2022). Britton et al. (2021) have shown that MBI practices can be associated with transient distress and negative impacts on participants, with mild to severe levels of depression and persistently high levels of negative affect. Therefore, it is recommended that facilitators are aware of this risk and identify potential areas that require monitoring and intervention to maximise the safety and efficacy of MBI (Britton et al., 2021). Thus, creation of a strategic approach and clear protocols for distress management align with goals that are essential to safe interaction of participants with online MBI (Taylor et al., 2022).

This review has identified the relationship between program structure and delivery and external factors preventing participation (Fig. 2). Similar to our findings, previous studies have also identified competing priorities, programs not meeting participant needs, and lack of technical skills, time, and motivation (Boele et al., 2018; Moscato et al., 2019; Piil et al., 2015; van der Linden et al., 2018) as barriers to online MBI. It is also important to recognise here the relationship of sample characteristics for participating in web-based interventions including socio-economic background, education, and perceived health, as they can impact the adherence (Wu et al., 2022).

It is well known that co-design and meaningful engagement of end-users at all aspects of intervention development impacts on the outcomes of a project (Slattery et al., 2020; Talevski et al., 2023). In the current review, 2 studies incorporated advisory committee input for developing online interventions (Atreya et al., 2018; Dragomanovich et al., 2021). Co-design of internet-based interventions is known to be complex, as it involves interaction between researchers, users, and software developers (Thabrew et al., 2018). However, this is a good strategy to employ when developing online MBI within the informal carer population. Carer peer groups can also be involved with online MBI development, as carers are more likely to connect with other carers to share their experiences and knowledge (Schirmer et al., 2022). Solutions created for informal carers need to be internally motivating than decided for them (Hudson, 2013). Therefore, involving informal carers in the development process of online MBI may increase commitment to complete activities as they know what works best and what to include as they have lived experience of being a carer. Incorporating stakeholders to introduce online MBI and active governmental support for alternative interventions to improve health and wellbeing of informal carers are much needed. There is an

opportunity for online MBI to be designed and adapted to meet the needs of informal carers, supporting access, and enabling their participation.

The integration of theoretical frameworks has been suggested when designing interventions to enhance retention rates of participants. One such framework is the Theoretical Domain Framework (TDF) (Michie et al., 2005), which explores implementation problems, and seek to better understand behaviour-change processes in the application of evidence-based care (Francis et al., 2012). This framework is comprised of 12 key constructs relevant to changing the behaviour of consumers (Michie et al., 2005). The TDF has been widely used by health professionals and investigated for further application and key developments (Francis et al., 2012; Phillips et al., 2015; Sarmast et al., 2014). Identified self-motivation and positive experience of mindfulness are related to one of the domains from the framework which is motivation and goals. Program structure and delivery and external factors preventing participation are related to environmental contexts and the resources domain (Michie et al., 2005). We have explored the relationships of the domains and how it impacts on participant engagement through the concept map in this study. Hence, the current review has so far identified only two aspects of the TDF. This acknowledgement could lead to future studies investigating the influence of the relationship between remaining domains.

Limitation and Future Research

There are some limitations to this review. We acknowledge that there were limitations of the terms used; however, we consulted with a health librarian to ensure that the current search terms provided an exhaustive approach to our search strategy. As a result, a comprehensive search was conducted across ten databases in total: eight health databases and two comprising grey literature. A hand search of relevant literature was also conducted. Due to the dearth of literature exploring the enablers and barriers of MBI for informal carers, no study was excluded during appraisal of methodological quality. Secondly, the findings were mainly qualitative as data were mainly extracted from qualitative findings, free text answers, and recruitment. Program attrition rate was varied between studies and high attrition was noted in most studies. This was also a limitation when interpreting findings. To establish trustworthiness, the research process was reported in detail. To enable transparency and to preserve the context for the evaluation of the reader, each study was reported in detail, according to the aim, participants, online intervention, data collection, analysis, findings, and comments related to enablers and barriers.

This systematic review has explored and synthesised evidence to provide a comprehensive understanding of enablers and barriers of online MBI for informal carers. The findings provide evidence of the enablers and barriers that should be considered when developing online MBI for informal carers to promote their participation. Developing co-designed carer-focused online MBI interventions is of vital importance to reduce the carer burden and enhance carer wellbeing. The effects of the identified enablers and barriers to participation in online MBI should be further researched. This would provide further evidence about enablers and barriers by engaging stakeholders in the process, so that programs can be developed in response to the needs of informal carers and promote their engagement with these interventions.

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