Effectiveness of digital mental health interventions in the workplace: An umbrella review of systematic reviews

Gillian Cameron, Maurice Mulvenna, Edel Ennis, Siobhan O'Neill, Raymond Bond, David Cameron, Alex Bunting

Table of Contents

Effectiveness of digital mental health interventions in the workplace: An umbrella review of systematic reviews

Gillian Cameron[1*] MSc; Maurice Mulvenna[1*] MPhil, PhD; Edel Ennis[2*] PhD; Siobhan O'Neill[2*] MPsychSc, PhD; Raymond Bond[1*] PhD; David Cameron[3*] PhD; Alex Bunting[3*]

[1]School of Computing Ulster University Belfast GB
[2]School of Psychology Ulster University Coleraine GB
[3]Inspire Belfast GB
[*]these authors contributed equally

Corresponding Author:
Gillian Cameron MSc
School of Computing
Ulster University
2-24 York Street
Belfast
GB

Abstract

Background: There is potential for digital mental health interventions to provide affordable, efficient, and scalable support to individuals. Digital interventions, including CBT, stress-management, and mindfulness programs, have shown promise when applied in workplace settings.

Objective: The aim of this study is to conduct an umbrella review of systematic reviews in order to critically evaluate, synthesise, and summarise evidence of various digital mental health interventions available within a workplace setting.

Methods: A systematic search was conducted to identify systematic reviews relating to digital interventions for the workplace, using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). The review protocol was registered in the Open Science Framework (OSF) https://doi.org/10.17605/OSF.IO/RC6DS
The following databases were searched: Pubmed, Web of Science, Medline, and Cochrane Library. Data was extracted using a pre-defined extraction table. To assess the methodological quality of a study, the AMSTAR-2 tool was used to critically appraise systematic reviews of healthcare interventions.

Results: The literature search resulted in 4,122 records, which was reduced to 13 full-text systematic literature reviews with the use of Covidence to remove duplicates and screen titles and abstracts. The 13 included reviews were published between 2014 and 2023, comprising of eight systematic reviews and five systematic reviews and meta-analysis. AMSTAR-2 was used to complete a quality assessment of the reviews, the results were critically low (n = 7), and low (n = 6).
The most common types of digital intervention studied were cognitive behavioural therapy (CBT), mindfulness/meditation, stress-management followed by other self-help interventions. Effectiveness of digital interventions was found for many mental health symptoms and conditions in employee populations, such as stress, anxiety, depression, burnout and psychological wellbeing. Factors such as type of technology, guidance, recruitment, tailoring, and demographics were found to impact on effectiveness.

Conclusions: This umbrella review aimed to critically evaluate, synthesise and summarise evidence of various digital mental health interventions available within a workplace setting. Despite the low quality of the reviews, best practice guidelines can be derived from factors that impact the effectiveness of digital interventions in the workplace.

Preprint Settings

1) Would you like to publish your submitted manuscript as preprint?

✔ **Please make my preprint PDF available to anyone at any time (recommended).**

Please make my preprint PDF available only to logged-in users; I understand that my title and abstract will remain visible to all users.

Only make the preprint title and abstract visible.

No, I do not wish to publish my submitted manuscript as a preprint.

2) If accepted for publication in a JMIR journal, would you like the PDF to be visible to the public?

✔ **Yes, please make my accepted manuscript PDF available to anyone at any time (Recommended).**

Yes, but please make my accepted manuscript PDF available only to logged-in users; I understand that the title and abstract will remain v

Yes, but only make the title and abstract visible (see Important note, above). I understand that if I later pay to participate in <a href="http

Original Manuscript

Effectiveness of digital mental health interventions in the workplace: An umbrella review of systematic reviews

Gillian Cameron[1,3], David Cameron[3], Maurice Mulvenna[1], Edel Ennis[2], Siobhan O'Neill[2], Raymond Bond[1,] Alex Bunting[3]

[1]School of Computing, Ulster University, Belfast, United Kingdom

[2]School of Psychology, Ulster University, Coleraine, United Kingdom

[3]Inspire, Belfast, United Kingdom

Corresponding Author:

Gillian Cameron

School of Computing

Ulster University

York St

Belfast

United Kingdom

BT15 1ED

Email: cameron-g2@ulster.ac.uk

Abstract

Background: There is potential for digital mental health interventions to provide affordable, efficient, and

scalable support to individuals. Digital interventions, including CBT, stress-management, and mindfulness programs, have shown promise when applied in workplace settings.

Aim: The aim of this study is to conduct an umbrella review of systematic reviews in order to critically evaluate, synthesise, and summarise evidence of various digital mental health interventions available within a workplace setting.

Methods: A systematic search was conducted to identify systematic reviews relating to digital interventions for the workplace, using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). The review protocol was registered in the Open Science Framework (OSF) https://doi.org/10.17605/OSF.IO/RC6DS.

The following databases were searched: Pubmed, Web of Science, Medline, and Cochrane Library. Data was extracted using a pre-defined extraction table. To assess the methodological quality of a study, the AMSTAR-2 tool was used to critically appraise systematic reviews of healthcare interventions.

Results: The literature search resulted in 4,122 records, which was reduced to 13 full-text systematic literature reviews with the use of Covidence to remove duplicates and screen titles and abstracts. The 13 included reviews were published between 2014 and 2023, comprising of eight systematic reviews and five systematic reviews and meta-analysis. AMSTAR-2 was used to complete a quality assessment of the reviews, the results were critically low (n = 7), and low (n = 6).

The most common types of digital intervention studied were cognitive behavioural therapy (CBT), mindfulness/meditation, stress-management followed by other self-help interventions. Effectiveness of digital interventions was found for many mental health symptoms and conditions in employee populations, such as stress, anxiety, depression, burnout and psychological wellbeing. Factors such as type of technology, guidance, recruitment, tailoring, and demographics were found to impact on effectiveness.

Conclusion: This umbrella review aimed to critically evaluate, synthesise and summarise evidence of various digital mental health interventions available within a workplace setting. Despite the low quality of the reviews, best practice guidelines can be derived from factors that impact the effectiveness of digital interventions in the workplace.

Introduction

Digital mental health interventions in the workplace

Digital mental health interventions can provide support to individuals, in a potentially low cost, efficient and scalable way. Digital interventions that have been generalised from clinical or community settings, to the workplace, primarily cognitive behavioural therapy (CBT) (Philips et al., 2019) stress-management (Carolan et al., 2017), and mindfulness-based stress reduction programs (Taylor et al., 2022) have shown promise.

However, a criticism of digital interventions for mental health is their absence of evidence-based frameworks. A review of 293 commercially available apps for anxiety and

depression found just over 55% contained information on an evidence-based framework, and of these only 6.2% published evidence to support their efficacy (Marshall, Dunstand and Bartik, 2020). Furthermore, in 2020, Organisation for the Review of Care and Health Apps (ORCHA), a UK organisation that assess the quality of digital health apps, reviewed almost 600 mental health apps that are commercially available, and only 29.6% met their quality thresholds across different criterions including Clinical Assurance, Data Privacy, and User Experience (ORCHA, 2020).

Implementation of evidence based digital mental health interventions into real-world care is therefore lacking, resulting in the need to prioritise research exploring workflow considerations (Torous et al., 2021). Linardon et al. (2019) found that studies that took a blended approach improved engagement (a blended approach includes human support supplementing a digital intervention). There is also a lack of gold standard evidence and best practices to determine which interventions are effective for specific industry sectors or work-force populations alongside identifying those which may potentially cause harm (Stratton et al. 2017).

Torous et al. (2021) also highlight the need to re-think and expand traditional integrated care pathways to include digital interventions to maximise their full benefit, where rapid advances in digital health technology capabilities, digital health standards and regulation, the post COVID-19 era presents a unique opportunity to realise this ambition. Digital interventions, used in conjunction with

and to enhance traditional support options could provide a way to encourage help-seeking within an Employee Assistance Programme, and provide different industries and occupational groups with personalised wellbeing support.

Many systematic reviews focus on specific delivery methods of digital interventions, such as "web-based" or a "mobile app" delivered in the workplace. There are also reviews focused solely on specific mental health conditions and methods of treatment, such as stress or mindfulness. There are also existing reviews that focus on specific workplace populations, such as "white-collar" workers, healthcare professionals, and teachers.

Aim

The aim of this study is to conduct an umbrella review of systematic reviews to critically evaluate, synthesise and summarise the best available evidence for a variety of digital mental health interventions currently available within a workplace setting, identifying those which enhance mental health and wellbeing alongside highlight gaps in the knowledge base to guide further research.

Methods

A systematic search was conducted in January 2024 to identify systematic reviews relating to the effectiveness of digital interventions for a workplace population. The following four databases were searched: 1) Pubmed, 2) Web of Science, 3) Medline, and 4) Cochrane Library. Three categories of search terms were used: 1) "mental health", 2) "digital

interventions" and 3) "workplace", with the Boolean operator 'AND' to separate categories and 'OR' within categories. Google Scholar was also used to identify any further systematic reviews. The review protocol was registered in the Open Science Framework (OSF)

https://doi.org/10.17605/OSF.IO/RC6DS.

Search terms:

Mental Health & Wellbeing:

depress* OR anxiet* OR anxious OR mood OR "mental health" OR "psychological wellbeing" OR "mental wellbeing" OR "behavioral health" OR "mental illness" OR stress (Borghouts et al. 2021)

Digital interventions:

"online intervention" OR "online treatment" OR "digital intervention" OR "digital treatment" OR "mobile intervention" OR "mobile treatment" OR "smartphone intervention" OR "smartphone treatment" OR "web-based intervention" OR "web based treatment" OR "internet intervention" OR "internet treatment" OR "computer intervention" OR "computer treatment" OR "cyber intervention" OR "cyber treatment" OR "electronic intervention" OR "electronic treatment" OR (mobile AND program*) OR mhealth OR ehealth OR mtherap* OR etherap* OR telehealth OR telemedicine OR "mobile app*" (Borghouts et al. 2021)

Workplaces:

workplace OR occupation* OR "work place" OR worksite OR office OR work (Zhu et al. 2020)

Study selection and inclusion

Covidence, a software designed to streamline the systematic review process was used to determine which studies were systematic reviews. Using keywords "systematic" and "review", systematic reviews were identified by their title or abstract.

Systematic reviews covering the effectiveness of digital mental health interventions within a working adult population were included. Exclusion criteria were (1) studies that did not assess effectiveness or impact on mental health or wellbeing outcomes (2) non-systematic reviews (3) studies that were not available in English.

Data extraction and quality assessments

The following data were extracted using a pre-defined extraction table: journal, publication year, databases searched, number of studies, types of study design, time period, population details, sample size (overall and mean if reported), intervention type, main findings, and limitations. To assess the methodological quality of a study, the AMSTAR-2 tool was used to critically appraise systematic reviews of healthcare interventions, that include randomised and non-randomised studies (Shea et al. 2017).

The critical domains AMSTAR-2 evaluates are having a protocol registered before the review begins, adequacy of the literature search, justification for excluding studies, risk of bias, and considering this when interpreting results, and appropriate meta-analytical methods and

likely impact of publication bias if a meta-analysis was conducted. One author carried out the AMSTAR-2 assessments (GC), and a second author (EE) checked the assessment outcomes independently. Any queries and conflicts were resolved through consensus between some members of the team.

Results

The literature search extracted a total of 10,022 studies with a further 4 studies identified through Google Scholar. A total of 2,460 duplicates were removed using Covidence, and a further 6774 were excluded as they were not systematic reviews. Reviewing titles and abstracts of 792 reviews resulted in a further 752 studies being excluded based on the inclusion/exclusion criteria.

A total of 40 full-text articles were then assessed for eligibility and 27 were excluded for the following reasons: 1) reviews that did not focus on digital interventions (7); 2) had an ineligible population – not employed individuals (6), 3) did not study effectiveness (5); 4) were not reviews (3); 5) did not study mental health (3), 6) other factors such as pre-published work (1), 7) full-text language not being available in English (1), or 8) another review's full-text was requested, with no response (1). The final number of reviews included in this systematic review was 13.
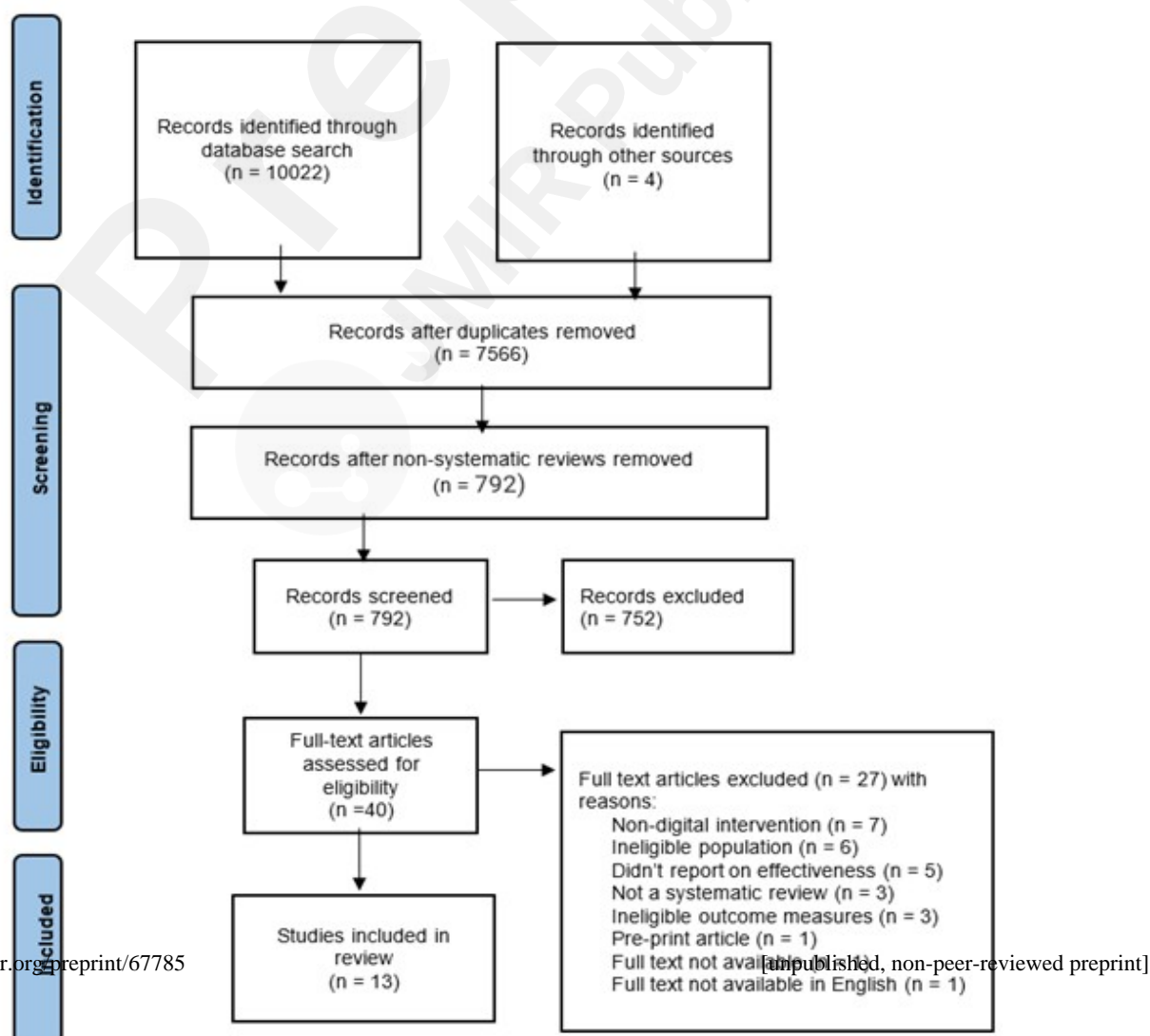
Figure 1 shows the PRISMA flowchart.

Figure 1.   PRISMA Flowchart showing identification, screening and inclusion of systematic review

General Characteristics of reviews

The 13 included reviews comprised of systematic reviews (n = 8) and systematic reviews with meta-analysis (n = 5). The full characteristics of this umbrella review are detailed in Table 1. The specific criteria for inclusion were notably varied across each of the reviews; most reviews only included Randomised Controlled Trials (RCTs) (n = 7). Vertola et al. (2022) included mainly RCTs, and one clinical trial (CT) which compared two interventions; however, the participants were not randomised to either of the groups. Other study designs included RCTs and Quasi-experimental research (Armaou et al., 2022), Quantitative or Qualitative Research Design (Paganin et al., 2020).

Stratton et al. (2022) required studies to have a control group to meet their inclusion criteria. Narváez et al. (2014) did not state the specific inclusion criteria but required the methodology to be published. In their review, Drissi et al. (2021) examined published research that focused on digital mental health solutions for healthcare workers in the context of COVID-19.

Most systematic reviews (n = 9) included a wide range of workplace sectors, including Healthcare, Manufacturing, Information Technology, Public services, and Education. 2 reviews did not report on the type of sector included in the studies (Vertola et al., 2022, Narvaez et al. 2014) and one review included studies solely looking at nurses (Park et al., 2022) and another on health care workers, specifically during the time of Covid-19 (Drissi et al. 2021). Reviews were published from 2014 – 2023, with Figure 2 depicting the number of systematic reviews by year.

Figure 2.   The number of systematic reviews by year

Quality assessment of reviews

AMSTAR-2 was used to complete a quality assessment of the reviews included in this umbrella review, the results were Critically Low (n = 6), Low (n = 1), Moderate (n = 5), and High (n = 1).

A total of 8 studies provided reasons for excluding articles, however none of the reviews provided a full list of studies that were excluded. Another non-critical item that no review met was item 10, reporting on the funding of primary studies. A total of 11 studies declared no conflict of interest or provided justification, and only one study met the full "adequacy of the literature search" critical item. Many systematic reviews (n = 10) did include the components of PICO - Population, Intervention, Comparison and Outcomes. Although many reviews (n = 8) provided an overarching list of reasons why full-text articles were excluded, none of the reviews provided a full list detailing all

Number of Systematic Reviews By Year

[unpublished, non-peer-reviewed preprint]
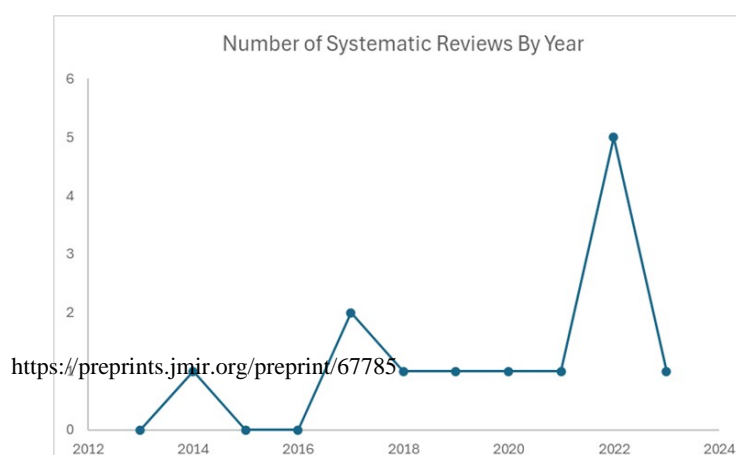
potentially relevant studies that were read and excluded. The judgement for each AMSTAR-2 critical item area for each systematic review can be found in Appendix 1.

In terms of the risk of bias checklists used within the individual systematic reviews, Cochrane's Risk of Bias (n = 9) was the most widely used, followed by JBI Critical Appraisal Checklist (n = 1) and Downs and Black Checklist (n = 1). Armaou et al. (2022) used both the Cochrane and JBI Checklists, and four studies did not report on using any risk of bias checklists.

Table 1 Characteristics of systematic reviews and meta-analyses of digital mental health interventions for the workplace.

Authors and Year	No of studies included	Population	Digital Intervention Context	Outcomes	Main Findings	Quality Checklist used
Xiong et al. 2023	19	Studies were across multiple sectors - including local authorities, healthcare, IT, Education	iCBT Platform used - Computer-based, web-based, mobile-based and app-based	Depression	Computer-based, web-based, mobile-based and app-based interventions all have potential in improving depression disorder among employees. In the RCTs, ICBT demonstrated small (Hedges' g = 0.31, 95% CI [0.17, 0.44]; p < 0.001) potentially sustained effects on employees' mental health	Cochrane risk of-bias tool (RoB 2)
Park et al. 2022	7	Study focused on the nursing staff population	Career identity training (n = 1) Stress management programme (n = 1), Positive Thinking (n = 1), Cognitive rehearsal intervention (n = 1), Emotional freedom technique (n = 1), Biofeedback training (n = 1), Work functioning (n = 1) Platform used - web-based (n = 3), smart-phone based (n=3) and real-time online intervention (n = 1)	Burnout was the primary outcome Secondary outcomes included workplace measures, such as career identity, workplace bullying, turnover, distress and work They also looked at anxiety and resilience	1 study reported on Burnout (primary outcome) found significant lower levels of burnout compared to the control group – who had no intervention (P<.001) Secondary outcomes were also reportedly improved	Cochrane's Risk of Bias
Stratton et al. 2022	75	Most studies included health care professionals (n = 18), insurance industry (n = 7), managers (n = 6), IT (n=	Three most common interventions were based on CBT, Stress-management and mindfulness. Platform used - Most interventions were delivered via web-based	Depression, anxiety, stress	Found that the body of evidence for workplace digital interventions has tripled in the past decade, but no evidence to support effectiveness has increased. Found small positive effects on anxiety (Hedges g=0.26, 95% CI 0.13-0.39;	Cochrane risk of bias tool for RCTs (RoB version 2.0)

Authors and Year	No of studies included	Population	Digital Intervention Context	Outcomes	Main Findings	Quality Checklist used
		6) education (n=6), male-dominated industries (n = 5), telecommunications (n = 5), marketing and sales (n=3) banking (n=1) and HR (n=1)	platforms as opposed to smartphone apps.		P<.001) For depression there was - small positive effects (Hedges g=0.26, 95% CI 0.19-0.34; P<.001) And stress (Hedges g=0.25, 95% CI 0.17-0.34; P<.001)	
Vertola et al. 2022	11	Adult workers – sectors not specified	Mindfulness/meditation, Stress, Well-being, mental health psychoeducation, sleep quality, emotional regulation Platform used - Mobile applications	Wellbeing - general and work-related Anxiety, Depression, Stress, Perceived stress Job Stress, Emotional Labor, Self-Regulation, Life satisfaction, Compassion satisfaction, Burnout	Range of outcomes, studies reported an Increase in wellbeing (n = 7), Reduction in perceived stress (n =4), Reduction in stress (n = 3), Decrease in anxiety symptoms (n = 2), Decrease in Depressive symptoms (n = 2), Reduction in burnout symptoms (n = 2) , Decrease in job stress (n = 2)	NR
Armaou et al. 2022	51	RCTs were across multiple sectors, with the most in Healthcare (n = 8), technology/IT companies (n = 5), manufacturing (n = 3) Quasi-Experimental studies were across multiple sectors, most within Healthcare (n = 11), governmental or public enterprises (n = 3) and university employees (n = 2)	Categorised into four clusters of interventions, "self-help interventions" (n = 18), followed by Stress-management (n=14), Mindfulness/meditation (n=14) and CBT (n = 5) Platform used - A mix of web-based and smart-phone based interventions	Primary Outcomes - Grouped into 3 areas: Mental Health concerns: Depression, anxiety and dysfunctional attitudes. Work-related wellbeing: Perceived stress, psychological distress and job strain Psychological wellness: general mental wellbeing/ positive mental health, happiness and life satisfaction. Mindfulness and resilience, self-efficacy, coping and gratitude.	Mental Health concerns: 10/51 (19.6%) Studies reported positive effects Work-related wellbeing: 28/51 (54.9%) Studies reported positive effects Psychological wellness indicators: 19/51 (37.3%) studies reported positive effects	Cochrane Collaboration's Risk of Bias and JBI Critical Appraisal Checklist
Moe-Byrne 2022	7	Participants were recruited from a variety	All studies used CBT as a theoretical background - 2 stated	depression, anxiety and stress and work-related	All studies reported psychological outcomes:	Cochrane Risk of Bias

Authors and Year	No of studies included	Population	Digital Intervention Context	Outcomes	Main Findings	Quality Checklist used
		of workplaces. Office based organisations (n=4) healthcare professionals (n=2) private and public sector (n = 1)	the use of mindfulness. Two used stress model or the job demands resources model - Increase wellbeing - preventative interventions (n = 3), Work performance and Occupational health guidance (n = 1) Platform used - A web-based intervention (n =5) a smartphone app intervention (n = 1) and a combined web based and smartphone app intervention (n = 1)	outcomes (absenteeism, presenteeism), Physical measures - sleeping problems (n = 2), sleep and workplace performance (n=1), somatisation (n = 1), physical health impairment (n = 1)	significant improvement for both anxiety and depression (n = 2) significantly lower stress scores (n = 3) Wellbeing – mixed results, significantly more wellbeing over time (n = 1) did not find a statistically significant positive effect(n = 1) Other mental health outcomes: significant effects for positive mental health (F = 3.46, p = 0.03, Cohen's d = 0.37 at three months follow-up, 0.28 at six months follow-up) (n = 2) employee's worry and quality of life regarding mental health (p <0.001 at six months (n = 1)	tool
Drissi et al. 2021	11	Health care workers	Peer support (n = 2) E-learning (n = 3) online resources (n = 3) PTSD Coach (n = 1) Headspace (n = 1) hotline (n = 1) screening (n = 1) Virtual care (n = 1) Platform used - Social media (n = 2) Online support platform/resources (n =8) Mobile apps (n = 1)	Only 3 studies included an evaluation, 71% participants stated one platform helped them adjust faster to the situation, and another platform was used by 82% of participants in their work or home lives, another handbook was reported to have positive qualitative feedback	Lack of empirical evidence for health care workers, evidence mainly targeted health care workers in China	NR
Paganin and Simbula 2020	31	General workers (n = 11), Health and social care (n = 8), Office-based (n = 5), Technology (n = 2), Middle managers (n = 1), Construction (n=1), Airplane pilots (n=1), Faculty members (n = 1), General workers with serious mental	Behavioural Change Techniques (n = 5) Mindfulness (n = 3) Stress models (n=3) CBT (n = 2) Other interventions/models such as Acceptance and Commitment Therapy Did not report on theory used (n=12) Platform used - Smart-phone based interventions	Stress-management, psychological wellbeing, secondary outcomes of resilience, and burnout	Studies reported on positive results for wellbeing and stress-management – on intervention effectiveness, usability, and feasibility	NR

Authors and Year	No of studies included	Population	Digital Intervention Context	Outcomes	Main Findings	Quality Checklist used
		illness (n = 1)				
Philips et al. 2019	50	Varied sectors – IT (n= 7) Healthcare (n = 6) Education (n =3) Communication and media (n = 3) Public sector (n = 3) Banking (2)	CBT (n = 22) Personalised feedback – general health check (n = 7) Mindfulness (n=6) Psychoeducation (n = 5) Remaining studies used a variety of training methods, such as cognitive, positive psychology or problem-solving Platform used – Web-based interventions (n = 47) smartphone- or app-based interventions (n = 3)	Stress Depression Anxiety Burnout Insomnia Mental wellbeing mindfulness Alcohol Intake	22 studies on stress had a medium positive effect on perceived stress (with g=0.54 (95% CI 0.35–0.72, P<0.0001) 17 studies with depression as an outcome observed a significant small positive effect (g=0.30, 95% CI 0.18–0.42, P<0.0001) And 15 studies on anxiety had a small positive effect on anxiety (g=0.34; 95% CI 0.18–0.50, P=0.0001).	Cochrane risk of-bias tool (RoB 2)
Howarth et al. 2018	22	Varity of workplaces – public and private companies, healthcare professionals, education and manufacturing plants.	Interventions aimed at improving: alcohol (n =5), mental health (n=5), sedentary behaviour (n = 3), musculoskeletal symptoms (n = 2), heart health (n = 2), insomnia (n = 1), mix of work-related rumination, fatigue and sleep (n = 1) mix of outcomes including coping, diet, stress and general health (n = 3) Platform used - Web-based (n = 11) Web-based with Email (n = 5) Web-based with both Email and SMS (n = 2) Downloaded software (n = 2) Web-based with SMS (n = 1) Smartphone with SMS (n= 1)	Psychological measures - anxiety and depression (n = 6). Others include mindfulness and help-seeking attitude Workplace measures - Job stress, work engagement, work productivity	Studies reported positive significant (n = 9) findings for: sedentary behaviour (n = 3), mental health (n = 2), job satisfaction (n = 1) diet, exercise, self-efficacy (n = 1) and insomnia (n = 1) work-related levels of rumination, problem solving, pondering, fatigue and sleep quality (n = 1)	Cochrane's Risk of Bias
Stratton et al.2017	23	Studies were across multiple sectors - Including Education, Healthcare, Manufacturin	CBT intervention (n=11) Stress management (n = 6) Mindfulness-based approaches (n=6) Platform used - Mixed - Web-based (n = 20)	Effectiveness – Stress, Anxiety, Depression	Overall, post intervention found significant small effect - (g = 0.24, 95% CI 0.13 to 0.35, p = <0.00). For CBT, a significant but very small positive effect was found Mindfulness had a moderate to large effect, but stress management	Downs and Black checklist Risk of Bias using the Cochrane Guidelines

Authors and Year	No of studies included	Population	Digital Intervention Context	Outcomes	Main Findings	Quality Checklist used
		g, IT and Media	Smart-phone - (n =3)		interventions produced a non-significant small positive effect	
Carolan et al. 2017	21	Most studies were from the general working population (n = 4), and local authorities (n = 3), education (n = 3), technology (n = 2)	CBT - Based (n = 12), stress and coping (3) mindfulness (n = 2) social cognitive theory (n = 1), positive psychology (n = 1), problem solving training (n = 1), acceptance and commitment therapy (n = 1) Self-guided (n=11) some guidance (n = 10) Platform used - web-based (n = 17), computer application (2), email (n=1), standalone computer (n = 1)	Psychological Well-being and work effectiveness	Found digital interventions had statistically significant positive effects on psychological well-being (g=0.37, 95% CI 0.23-0.50) and work effectiveness (g=0.25, 95% CI 0.09-0.41) when compared to the control group	Cochrane Collaboration's risk of bias tool
Narvaez et al. 2014	21	NR	CBT (n = 10) Combination of therapies (n =5)Problem solving therapy (n=1) other types of therapies (n = 5) Platform used - web-based (n = 17), sensor networks (n=2), mobile (n=1)	Occupational stress	12 studies had a positive effect on occupational stress, 3 had a positive effect but there not statistically significant, 2 studies had an indefinite effect	NR

Digital Interventions
Intervention Delivery

The type of digital platforms that were used to deliver the intervention was mostly mixed, including reviews reporting on studies that utilised web-based and mobile/smartphone-based interventions (n = 10). Two reviews reported only on mobile/smartphone-based interventions (Paganin and Simbula, 2020; Vertola et al. 2022) and one focused only on web-based interventions (Carolan et al. 2017).

Intervention Type

The umbrella review identified four different types of digital interventions:

- cognitive behavioural therapy (CBT)
- mindfulness/meditation
- stress-management
- other self-help interventions

This is consistent with other systematic reviews, including Armaou et al. (2022) and

Stratton et al. (2017) which found the most common type of intervention was CBT based, followed by stress-management and mindfulness-based approaches. Likewise, Philips et al. (2019), Narvaez et al. (2014), and Moe-Byrne et al. (2022) found that CBT was the most common intervention in the majority of studies they reviewed. Xiong et al. (2023) focused their review solely on iCBT, delivered through computer-based, web-based, mobile-based and app-based platforms. Park et al. (2022) identified different, unique types of digital interventions compared to the rest of the reviews, including studies on career identity training (n = 1) and biofeedback training (n = 1). Drissi et al. (2021) reviewed studies on interventions utilising social media (n = 2) for healthcare workers during the pandemic. Across all reviews, the most common and frequent interventions included were CBT based, followed by Mindfulness and stress-management interventions.

Outcome Measures

For the majority of the reviews the primary outcome measure focused on the symptoms of Depression (n = 9), this includes Xiong et al. (2022) who only included studies that focused on depression. Furthermore reviews reported on studies measuring Anxiety (n=8), stress (n = 4), wellbeing (n = 5), burnout (n=4), occupational/job stress (n=4), perceived stress (n=2). Other reviews reported on outcomes such as resilience (n = 2), sleep problems (n =2), alcohol, physical health, mindfulness, and help-seeking attitudes.

Park et al. (2022) found other workplace-

related outcome measures within their review of studies within the nursing population, such as workplace bullying, career identity, quality of work life, and turnover. Carolan's (2017) review reported on work effectiveness, two on presenteeism and absenteeism. Outcome measures varied greatly across reviews, with 158 specific measures being mentioned across 8 reviews that reported on outcome measures. The most frequently used outcome measures are displayed in Figure 3.
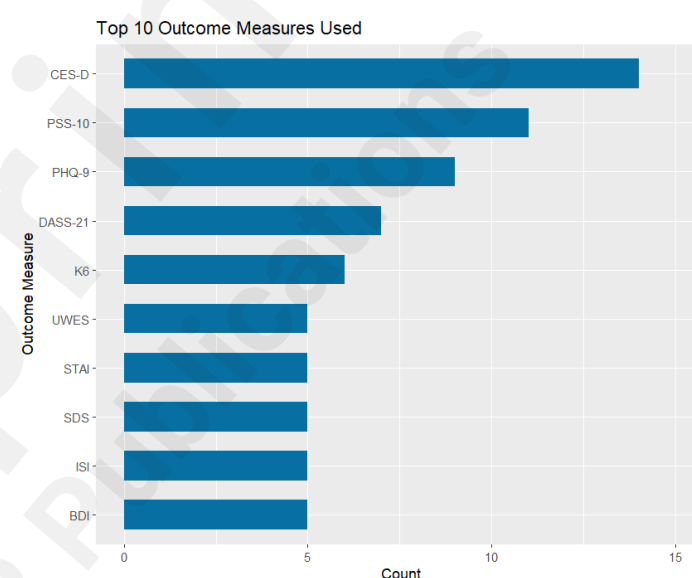

Figure 3. Top 10 Frequently used outcome measures

CES-D: Center for Epidemiologic Studies Depression Scale, PSS: Perceived Stress Scale 10 Items, PHQ: Patient Health Questionnaire 9 Items, DASS: Depression Anxiety and Stress Scale 21 Items, K6: Kessler Psychological Distress Scale, UWES: Utrecht Work Engagement Scale, STAI: State Trait Anxiety Inventory, SDS: The Symptoms of Distress Scale, ISI: Insomnia Severity Index, BDI: Beck's Depression Inventory.

The most frequently used scales measured perceived stress, depression, anxiety, stress, and psychological distress, however there were two scales that measured workplace specific outcomes, the UWES followed by the BJSQ (Brief Job Stress Questionnaire). Cronbach's α coefficients ranged between 0.70 and 0.95 each of the ten most frequently used

scales.

In an analysis of co-associations amongst outcome measures, patterns emerge regarding the usage of instruments used together. The GAD-7 scale for generalised anxiety was used in conjunction with the PHQ-9 for depression, in a total of four studies. Another pair of outcome measures were the MBI-EE for burnout, and the PSS-10 for perceived stress appearing together in three studies. Similarly, the PSS-10 for perceived stress was paired with the CES-D for depression in three studies. In terms of workplace specific outcome measures, the UWES was utilised in conjunction with HADS-A, CES-D, PSS-10, ISI, and MBI-EE in two studies.

Effectiveness

CBT

Xiong et al. (2023) found iCBT had a small positive effect on symptoms of depression. Armaou et al. (2022) found three CBT digital interventions that had a significant effect on anxiety and depression symptoms. Stratton et al. (2017) found CBT-based interventions had a small significant positive effect (g = 0.15, 95% CI 0.02 to 0.29, p = 0.03, I2 = 1.9%) on reducing mental health conditions in employees.

Mindfulness-based interventions

Positive effects for mindfulness-based interventions were found for anxiety and depression symptoms, with Stratton et al. (2017) finding a moderate to large positive effect size (Hedges g = 0.60, 95% CI 0.34 to 0.85, p = < 0.00, I2 = 0.0%). Stratton et al. (2022) found mindfulness-based interventions

to have moderate but higher effect sizes (Hedges g=0.46, 95% CI 0.28-0.64; P<.001) on depressive symptoms than CBT (Hedges g=0.11, 95% CI 0.06-0.17; P<.001). Vertola et al. (2022) reported that mobile health interventions, particularly those focused on mindfulness/meditation had moderate to high efficacy for supporting stress management and emotional self-regulation in the workplace.

Stress-management

Armaou et al. (2022) found positive effects of stress-management interventions on work-related and psychological wellbeing, but equally found four studies which had no significant effect. Stratton et al. (2022) found stress-management interventions (Hedges g=0.61, 95% CI 0.47-0.75; P<.001) to be more effective than CBT (Hedges g=0.11, 95% CI 0.06-0.17; P<.001), for stress, depression, and anxiety.

Other Self-Help interventions

Three mobile-based resilience interventions had no effect on resilience and three online positive psychology interventions had no effect on psychological wellbeing (Armaou et al. 2022). In contrast Philips et al's (2019) review indicated that positive psychology was more effective than CBT evidencing a larger effect size.

Factors influencing effectiveness

Of the 13 reviews, there were several reported factors that potentially influenced within study effectiveness. These include the type of technology or platform used, if the intervention was guided or self-guided, recruitment of participants, tailoring or

personalisation of the intervention, and demographics such as gender or age.

Xiong et al. (2023) found that effectiveness was not impacted substantially by the type of platform iCBT was delivered on, i.e. web-based or mobile based. Park et al. (2022) found that studies using interventions that were mobile-based reported significant improvements compared to web-based interventions, however their findings were not conclusive, as the studies within the review had poor methodological quality, a wide variation of interventions, and high heterogeneity of outcomes.

Carolan et al. (2017) did not find a significant difference between interventions that were guided (guidance by a person) or self-guided, in contrast Philips et al. (2019) found an advantage for guidance, however their subgroup analyses were underpowered and must be interpreted with caution. Supported - guided interventions for stress and depression were found to have a larger effect size than self-guided, in contrast there was no significant difference between guided and self-guided for anxiety (Stratton et al. 2022).

Howarth et al. (2018) found that studies targeting one specific outcome, rather that multifactorial, were more effective. Furthermore, Armaou et al. (2022) found that studies demonstrated a high risk of contamination effects and attrition bias, and concluded further high-quality evidence is needed. In terms of recruitment, Philips et al. (2019) found that participants recruited from the community, evidenced a significant increase in the treatment effect (g=0.79) comparative to those recruited within the

workplace and called for future research to examine and focus on the impact of this.

Tailoring or personalising interventions was found to be effective for presenteeism, stress and sleep, but less so for anxiety, depression, and absenteeism (Moe-Byrne et al. 2022). Furthermore, Stratton et al. (2022) argue that the limited evidence in the literature for tailored digital interventions suggest no greater efficacy for bespoke or tailored interventions in addressing mental health in the workplace.

A total of 7 studies reported the mean age and gender balance of some or all studies but did not comment further. Philips et al. (2019) assessed age and gender as moderators for effect size, with a total population of 15,258. Older participants showed significantly higher effect sizes for stress, depression and burnout, while gender did not show any significant moderating effects.

Discussion

This umbrella review aimed to critically evaluate, synthesise and summarise the best available evidence of various digital mental health interventions being deployed within a workplace setting to (1) identify which digital mental health interventions are most effective for enhancing mental health and wellbeing in the workplace and (2) identify gaps in the knowledge base which require further research. Based on the 13 systematic reviews and meta-analyses reviewed there is evidence to support the effectiveness of digital interventions within a workplace setting.

The most common type of digital intervention was CBT, followed by mindfulness and stress-management, and other more generic interventions, for example resilience based or positive psychology interventions. Given the variation of language used to describe mental health digital interventions both in the general populations, and in the workplace, clear and concise operational definitions could help with standardisation.

Web-based was the most common delivery platform, and Xiong et al. (2023) found evidence to suggest that type of platform did not significantly impact effectiveness. The latter indicates further consideration should be given to implementing other rapidly advancing platform technologies such as chatbots, virtual and augmented reality interventions.

In terms of mental health outcomes, the reviews found statistically significant positive effects primarily with self-report outcome measures which screen for depression, stress, anxiety, psychological wellbeing, and burnout. Armaou et al. (2022) found that digital interventions that were theory-informed were associated with increased effectiveness, in contrast psychoeducation alone was the least effective and only minimally effective for improving wellbeing in the workplace. Xiong et al. (2023) and Stratton et al. (2017) found internet-based CBT was moderately effective in reducing the symptoms of depression in employees, while Xiong et al. (2023) called for further high-quality studies to add to this evidence base.

There was an especially high heterogeneity of outcomes measured as with the assessments and tools used to measure these across many studies and within reviews. The most frequent assessment measures used were self-report screening questionnaires for stress, anxiety, and depression with moderate to high levels of reliability, concurrent and predictive validity. Studies would benefit from using well validated, standardised mental health outcome measures to enable comparisons across studies and across populations, albeit reporting effect sizes does allow for comparing relative efficacy. Consideration should be given to how the different outcome measures used in previous studies can be harmonised for meta-analysis to enable reliable benchmarking, through using tools such as Harmony (McElroy et al., 2023). Furthermore, given the high heterogeneity of outcome measures used, a recommendation for standards bodies such as the Employee Assistance Professionals Association (EAPA) to create an industry wide standard approach to measuring mental health outcomes of employee as for example with the Workplace outcome Suite (WOS) (Lennox et al., 2010).

Very few reviews included studies that reported on absenteeism or presenteeism, which are associated with anxiety and depression in the workplace (Dewa, Thompson, Jacobs, 2011). Moe-Byrne et al. (2022) found the definition of presenteeism can vary and was not comparable between studies, as many utilised different assessment tools. However, a study that assessed presenteeism using a valid and reliable measure, TiC-P, found a statistically significant improvement, in contrast two studies utilising a direct measure of absenteeism found no significant improvement.

When interpreting the results of systematic reviews, the risk of bias needs to be considered. Using the AMSTAR-2 quality impact assessment for systematic reviews of RCTs or non-randomised trials, six of the 13 systematic reviews were found to be low, and seven were found to be critically low which places considerable limitations on the overall findings.

For all employees within the workplace while considering generic wellbeing, there is evidence that mindfulness-based interventions may have a stronger, albeit moderate effect for employees, while stress-management interventions may have a stronger effect on those employees presenting with higher levels of stress (Stratton et al. 2017). However, there is evidence that mindfulness may cause adverse effects in some populations who have been exposed to or witnessed work-place trauma, such as re-experiencing of traumatic memories (Britton et al., 2021). Employers, therefore, could consider including Trauma-Informed Mindfulness-Based Stress Reduction (Kelly and Garland, 2016) which has shown promising results for those who have experienced interpersonal violence. There is also a lack of best practice and evidence to determine which interventions are effective for specific workforce populations alongside identifying those which may potentially cause harm (Stratton et al., 2017).

Philips et al. (2019) highlighted how community recruitment, as opposed to recruiting from a workplace population improved the treatment effect. Equity in digital mental health is a key and growing concern, and often interventions are developed to reach mass populations, with no consideration given to how demographic factors such as age or gender and or mental health not least trauma related presentations may moderate effect size or even lead to negative outcomes. Philips et al. (2019) found older age was positive a moderating factor on effect size for a digital intervention targeting stress, depression and burnout, however many developers of digital interventions do not consider digital divides, in terms of access, literacy and skills (Torous et al. 2023). Two reviews focused specifically on interventions for health care workers (Park et al. 2022) and Drissi et al. (2021) during the time of the COVID-19 Pandemic. Both reviews highlighted the lack of high-quality studies in this specific workforce population, and the poor methodological quality of studies to date. The prevalence of mental health disorders and levels of help-seeking vary amongst employees within different occupational groups and industry sectors, combined with a lack of robust evidence and best practices to determine which interventions are effective for specific industry sectors (Stratton et al. 2017), highlight an urgent need for future research in this area.

One review focused on studies that tailored or personalised interventions, including recommending content based on user screening, and material being tailored based on user characteristics and usage data. Tailoring or personalisation of digital tools to suit the needs of different populations is still uncommon but could have significant impact (Torous et al. 2023). Future research therefore should consider personalising or tailoring their interventions and which should include the

preference of the service-user while evaluating the effectiveness within different industry sectors and occupational groups.

Previous studies have shown the positive impact of guidance or human support supplementing a digital intervention (Linardon et al. 2019), where Philips et al.'s (2019) review of in particular stress reduction interventions found the treatment effect was significantly increased by guidance. However, in contrast Carolan et al.'s (2017) review found no significant difference between interventions that had guidance, and those that did not. Torous et al. (2023) have identified the pressing research need of assessing the "optimal degree and mode of human support necessary" to make digital interventions more effective.

Many reviews did not report on factors increasing engagement, user experience or preference where the primary aim was evaluating effectiveness. However, Carolan's (2017) review suggests interventions that are shorter (6 to 7 weeks), and utilise notifications

and tailoring to the user, may increase engagement with the intervention. Vertola et al. (2022) reiterates that studies which used reminder notifications such as push notifications or emails, led to improved adherence with digital interventions. Furthermore, Vertola et al. (2022) suggests that a short demonstration or tutorial before the first use would improve the user experience and promote ease of use and acceptance.

Although quality assurance is not included in the scope of this review, it is important to note that when implementing digital interventions employers should be aware of best practices and standards such as ORCHA. Furthermore, this review looked at effectiveness rather than cost-effectiveness, and future studies should consider return on investment as an outcome, due to the large economic impact mental health in the workplace can have. Table 2 summarises the key findings, and details recommendations for both policy and practice, and future research.

Table 2. Key Findings and Recommendations

Key Findings	Recommendations
Personalisation of digital interventions was found to be effective for improving employee mental health and wellbeing.	Consider personalising and adapting digital interventions to suit the needs and preferences of different populations and industry sectors.
There is no consensus on the differential impact of the mix of human and digital on the effectiveness of an intervention.	Further research needs to be undertaken to understand the right blend of digital and human engagement for mental health in the workplace.
Mindfulness is the most effective generic wellbeing intervention for employees, and psychoeducation alone is the least effective.	Consider incorporating mindfulness-based interventions into employee wellbeing offerings, including trauma informed mindfulness for specific occupational groups

Key Findings	Recommendations
There is high heterogeneity in outcome measures used, with 108 different scales documented within the reviews.	Consider the outcome measures that were used in previous similar studies. Otherwise, consider how the different outcome measures used in previous studies can be harmonised for meta-analysis and benchmarking.
The effectiveness of the intervention is the same regardless of the platform used, whether web-based or mobile applications.	Consider all types and technologies of digital platforms to maximise reach.
There is a lack of robust evidence and best practices to determine which interventions are effective for specific industry sectors.	Robust research, such as Randomised Control Trials (RCTs) need to be undertaken to clearly understand the efficacy of digital mental health interventions across different workplace populations.

Conclusion

This umbrella review aimed to critically evaluate, synthesise, and summarise evidence of various digital mental health interventions available within a workplace setting. Broadly speaking the most common types of digital intervention being utilised in the workplace can be categorised as CBT-Based, Mindfulness, Stress-management interventions, and other self-help interventions.

Digital interventions were found to moderately reduce the symptoms of stress, anxiety, depression, burnout and increase psychological wellbeing. Interventions based on theory, and recruitment within the community increased effectiveness. Studies vary greatly in the outcomes they report on, and the tools used to measure these. The most effective type of intervention for generic wellbeing across all employee populations was Mindfulness-based interventions.

Personalisation or tailoring of digital interventions was found to be an effective way to improve employee wellbeing, and future research into this area could have significant impact. The review found mixed and conflicting evidence on the role and impact of self-guided compared to guided help for increasing effectiveness. Further high-quality research which systematically investigates these issues in more detail could significantly add to the growing evidence base and inform best practice guidelines for developing and implementing effective digital interventions in the workplace.

Strengths and Limitations

To the best of our knowledge, this umbrella review provides the first systematic synthesis of systematic reviews on digital interventions for mental health in the workplace. The review has several strengths as well as limitations.

The rigour, robustness and strength of the findings depends on the quality of the studies that were included in the initial systematic reviews and meta-analysis where, using the

AMSTAR-2 quality assessment, six of the 13 reviews were found to be low, and seven critically low. The latter was largely attributable to one critical item which required authors to list all potentially relevant studies that were read in full-text form but excluded from the systematic review along with justification for why they were excluded. This one critical item dropped the overall quality rating of 5 reviews from moderate to low, and one from high to low, introducing the significant risk of inherent bias. Furthermore, because many of the reviews focused broadly on general workplace populations it is possible individual studies were repeated within all the numerous reviews considered.

Finally, the heterogeneity of the various and numerous outcome measures is problematic, while it is also unclear to what extent the largely small to moderate, statistically significant effect sizes translate into clinically meaningful change – improved functioning. For the above reasons it is therefore important to exercise caution when interpreting the results.

Despite the above limitations, the umbrella review by including only systematic reviews provides a useful summary and synthesis of the best available evidence on mental health work-place digital interventions for a large population of employees. In addition, extracting and synthesizing the reviews on different populations and occupational groups for example health care professionals and general workforce sectors will help fine-tune and adapt interventions for specific groups alongside identify gaps in the research knowledge base to guide areas for further systematic exploration.

Disclosure of interest

Gillian Cameron is an Industrial Fellow supported by the Royal Commission for the Exhibition of 1851 affiliated with Ulster University, and an employee in Inspire. There are no other conflicts of interest.

References

Aris, A.Z.Z. and Othman, S.Z., 2022. Help-Seeking Behavior for Mental Health Problems among Employees: A Systematic Review. Journal of Positive School Psychology, pp.4214-4228.

Armaou, M., Araviaki, E., Dutta, S., Konstantinidis, S. and Blake, H., 2022. Effectiveness of digital interventions for deficit-oriented and asset-oriented psychological outcomes in the workplace: a systematic review and narrative synthesis. European Journal of Investigation in Health, Psychology and Education, 12(10), pp.1471-1497. https://doi.org/10.3390/ejihpe12100102

Borghouts, J., Eikey, E., Mark, G., De Leon, C., Schueller, S.M., Schneider, M., Stadnick, N., Zheng, K., Mukamel, D. and Sorkin, D.H., 2021. Barriers to and facilitators of user engagement with digital mental health interventions: systematic review. Journal of medical Internet research, 23(3), p.e24387.

Britton, W.B., Lindahl, J.R., Cooper, D.J., Canby, N.K. and Palitsky, R., 2021. Defining and measuring meditation-related adverse effects in mindfulness-based programs. Clinical Psychological Science, 9(6), pp.1185-1204.

Carolan, S., Harris, P.R. and Cavanagh, K., 2017. Improving employee well-being and effectiveness: systematic review and meta-analysis of web-based psychological interventions delivered in the workplace. Journal of medical Internet research, 19(7)

Carolan, S., Harris, P.R., Greenwood, K. and Cavanagh, K., 2017. Increasing engagement with an occupational digital stress management program through the use of an online facilitated discussion group: results of a pilot randomised controlled trial. Internet interventions, 10, pp.1-11.

CIPD, 2021. Health and wellbeing at work survey 2021. London: Chartered Institute of Personnel and Development.

Deloitte, 2022. Mental health and employers. The case for investment – pandemic and beyond. [online] Available at:

https://www2.deloitte.com/content/dam/ Deloitte/uk/Documents/consultancy/deloitte-uk-mentalhealth-report-2022.pdf

Dewa, C.S., et al., 2011. The association of treatment of depressive episodes and work productivity. The Canadian Journal of Psychiatry, 56(12).

Drissi, N., Ouhbi, S., Marques, G., de la Torre Díez, I., Ghogho, M. and Janati Idrissi, M.A., 2021. A systematic literature review on e-mental health solutions to assist health care workers during COVID-19. Telemedicine and e-Health, 27(6), pp.594-602.

Health and Safety Executive, 2023. Working days lost in Great Britain https://www.hse.gov.uk/statistics/dayslost.htm

Howarth, A., Quesada, J., Silva, J., Judycki, S. and Mills, P.R., 2018. The impact of digital health interventions on health-related outcomes in the workplace: a systematic review. Digital health, 4, p.2055207618770861.

Joyce, S. et al. 2016. Workplace interventions for common mental disorders: a systematic metareview. Psychological Medicine, 46(4), pp.683-697.

Kang, W., Park, W.J., Jang, K.H., Lim, H.M., Ann, J.S., Cho, S.H. and Moon, J.D., 2016. Comparison of anxiety and depression status between office and manufacturing job employees in a large manufacturing company: a cross sectional study. Annals of occupational and environmental medicine, 28(1), pp.1-7.

Kelly, A. and Garland, E.L., 2016. Trauma-informed mindfulness-based stress reduction for female survivors of interpersonal violence: Results from a stage I RCT. Journal of Clinical Psychology, 72(4), pp.311-328.

Lau, Y., Chee, D.G.H., Chow, X.P., Cheng, L.J. and Wong, S.N., 2020. Personalised eHealth interventions in adults with overweight and obesity: A systematic review and meta-analysis of randomised controlled trials. Preventive Medicine, 132, p.106001.

Lawn, S., Roberts, L., Willis, E., Couzner, L., Mohammadi, L. and Goble, E., 2020. The effects of emergency medical service work on the psychological, physical, and social well-being of ambulance personnel: a systematic review of qualitative research. BMC psychiatry, 20(1), pp.1-16.

Lennox, R. D., Sharar, D., Schmitz, E., & Goehner, D. B, 2010. Development and validation of the Chestnut Global Partners Workplace Outcome Suite. Journal of Workplace Behavioral Health, 25(2), 107–131. https://doi.org/10.1080/15555241003760995

Linardon, J., Cuijpers, P., Carlbring, P., Messer, M. and Fuller-Tyszkiewicz, M., 2019. The efficacy of app-supported smartphone interventions for mental health problems: A meta-analysis of randomized controlled trials. World Psychiatry, 18(3), pp.325-336.

Marshall J, Dunstan D, Bartik W, 2022. Apps with maps – anxiety and depression mobile apps with evidence-based frameworks: systematic search of major app stores. JMIR Mental Health;7:e16525.

McElroy, E., Wood, T., Bond, R., Mulvenna, M.D., Shevlin, M., Ploubidis, G., Hoffmann, M.S. and Moltrecht, B., 2023. Using natural language processing to facilitate the harmonization of mental health questionnaires: a validation study using real-world data.

Moe-Byrne, T., Shepherd, J., Merecz-Kot, D., Sinokki, M., Naumanen, P., Hakkaart-van Roijen, L. and Van Der Feltz-Cornelis, C., 2022. Effectiveness of tailored digital health interventions for mental health at the workplace: A systematic review of randomised controlled trials. PLOS Digital Health, 1(10), p.e0000123.

Narváez, S., Tobar, Á.M. and López, D.M., 2014. Systematic review of interventions supported by ICT for the prevention treatment of occupational stress. pHealth 2014, pp.71-80.

ORCHA. 2020. What is the health of mental health apps? - ORCHA. https://orchahealth.com/healthof-mental-health-apps/

Paganin, G. and Simbula, S., 2020. Smartphone-based interventions for employees' well-being promotion: a systematic review. Electronic Journal of Applied Statistical Analysis, 13(3), pp.682-712.

Park, J.H., Jung, S.E., Ha, D.J., Lee, B., Kim, M.S., Sim, K.L., Choi, Y.H. and Kwon, C.Y., 2022. The effectiveness of e-healthcare interventions for mental health of nurses: A PRISMA-compliant systematic review of randomized controlled trials. Medicine, 101(25).

Phillips, E.A., Gordeev, V.S. and Schreyögg, J., 2019. Effectiveness of occupational e-mental health interventions. Scandinavian journal of work, environment & health, 45(6), pp.560-576.

Roche, A.M., Pidd, K., Fischer, J.A., Lee, N., Scarfe, A. and Kostadinov, V., 2016. Men, work, and mental health: a systematic review of depression in male-dominated industries and occupations. Safety and health at work, 7(4), pp.268-283.

Rosso BD, Dekas KH, Wrzesniewski A, 2010. On the meaning of work: A theoretical integration and review. Res Org Behav, 30, 91–127.

Shea, B.J., Reeves, B.C., Wells, G., Thuku, M., Hamel, C., Moran, J., Moher, D., Tugwell, P., Welch, V., Kristjansson, E. and Henry, D.A., 2017. AMSTAR 2: a critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. bmj, 358.

Stratton, E., Lampit, A., Choi, I., Calvo, R.A., Harvey, S.B. and Glozier, N., 2017. Effectiveness of eHealth interventions for reducing mental health conditions in employees: a systematic review and meta-analysis. PloS one, 12(12), p.e0189904.

Stratton, E., Lampit, A., Choi, I., Malmberg Gavelin, H., Aji, M., Taylor, J., Calvo, R.A., Harvey, S.B. and Glozier, N., 2022. Trends in effectiveness of organizational eHealth interventions in addressing employee mental health: Systematic review and meta-analysis. Journal of Medical Internet Research, 24(9), p.e37776.

Taylor, H., Cavanagh, K., Field, A.P. and Strauss, C., 2022. Health Care Workers' Need for Headspace: Findings From a Multisite Definitive Randomized Controlled Trial of an Unguided Digital Mindfulness-Based Self-help App to Reduce Healthcare Worker Stress. JMIR mHealth and uHealth, 10(8), p.e31744.

Torous J, Benson NM, Myrick K, Eysenbach G, 2023. Focusing on Digital Research Priorities for Advancing the Access and Quality of Mental Health. JMIR Ment Health. 2023 Apr 24;10:e47898. doi: 10.2196/47898. PMID: 37093624; PMCID: PMC10167575.

Torous, J., Bucci, S., Bell, I.H., Kessing, L.V., Faurholt-Jepsen, M., Whelan, P., Carvalho, A.F., Keshavan, M., Linardon, J. and Firth, J., 2021. The growing field of digital psychiatry: current evidence and the future of apps, social media, chatbots, and virtual reality. World Psychiatry, 20(3), pp.318-335.

Vertola, G., Marcello, A., Bottone, M., Sperandeo, R., Muzii, B., Scandurra, C. and Maldonato, N.M., 2022, September. Use and Effectiveness of Mobile Health Applications for Stress Management and Emotional Self-Regulation in Adult Workers: A Systematic Review. In 2022 13th IEEE International Conference on Cognitive Infocommunications (CogInfoCom) (pp. 000081-000086). IEEE.

World Health Organization 2022. World Health Organization -Mental health at work. Available at: https://www.who.int/news-room/fact-sheets/detail/mental-health-at-work

Xiong, J., Wen, J.L., Pei, G.S., Han, X. and He, D.Q., 2023. Effectiveness of Internet-based cognitive behavioural therapy for employees with depression: a systematic review and meta-analysis. International Journal of Occupational Safety and Ergonomics, 29(1), pp.268-281.

Zhu, X., Yoshikawa, A., Qiu, L., Lu, Z., Lee, C. and Ory, M., 2020. Healthy workplaces, active employees: A systematic literature review on impacts of workplace environments on employees' physical activity and sedentary behavior. Building and Environment, 168, p.106
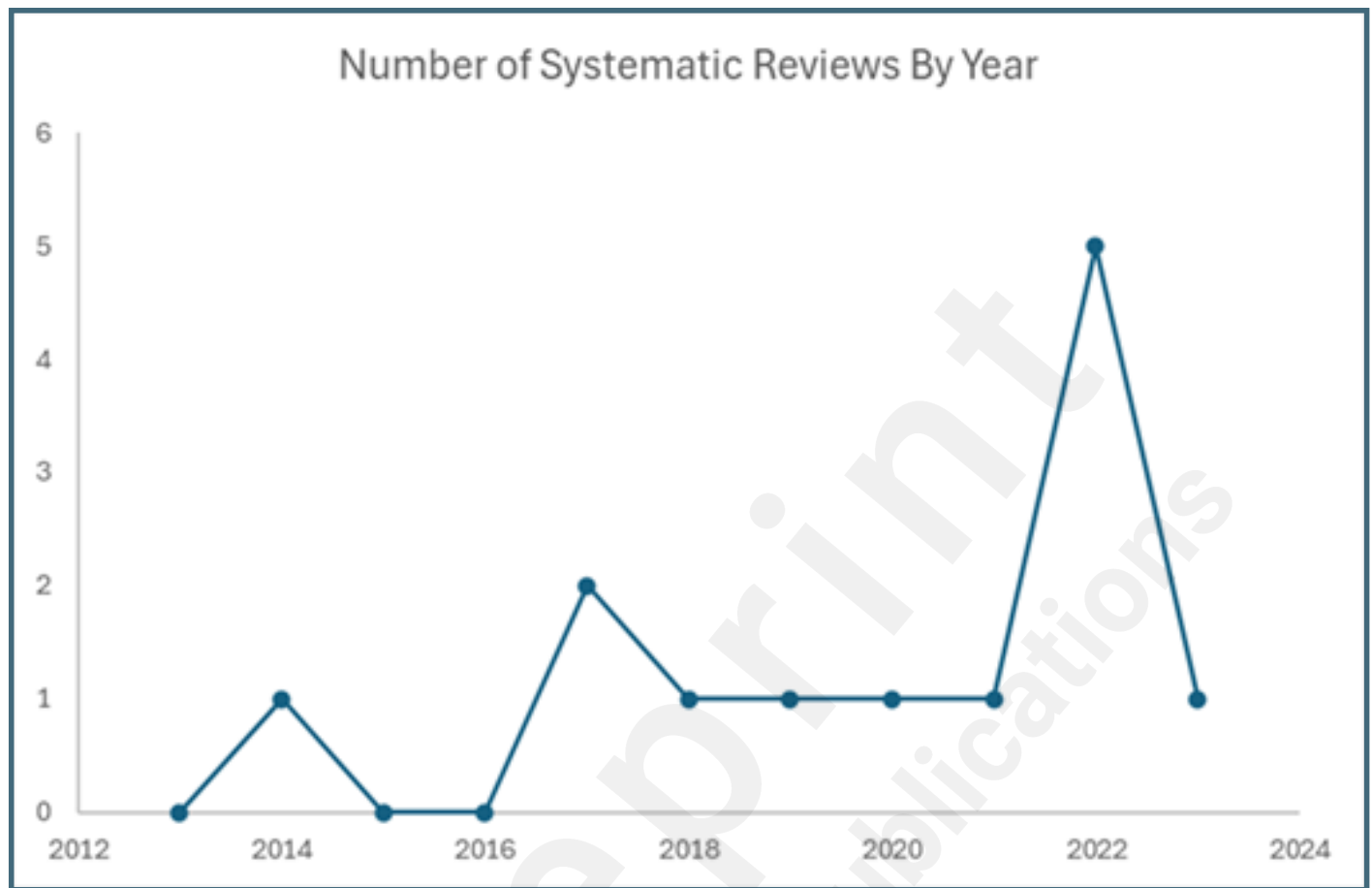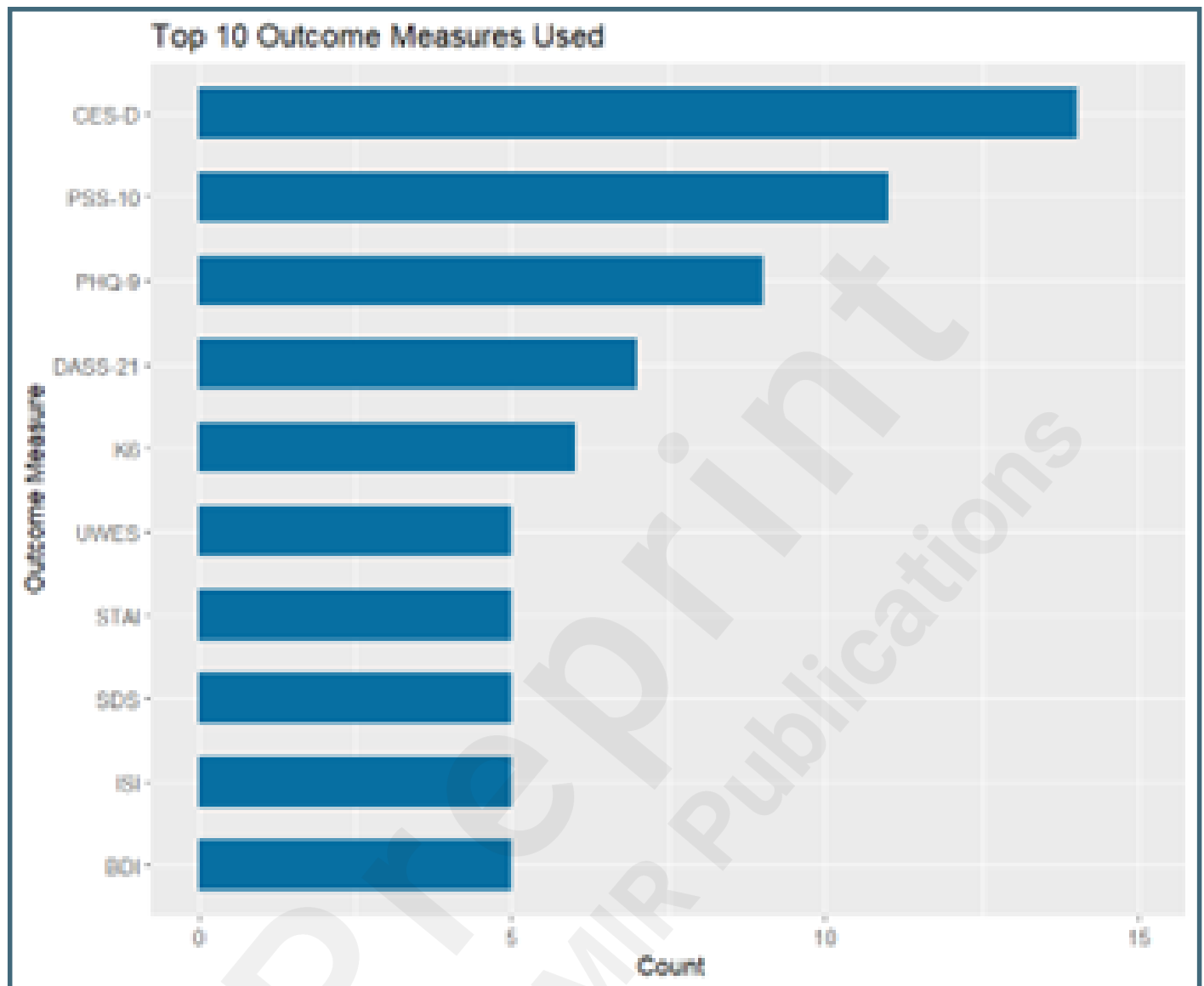
Supplementary Files

Figures

PRISMA Flowchart showing identification, screening and inclusion of systematic review.

The number of systematic reviews by year.
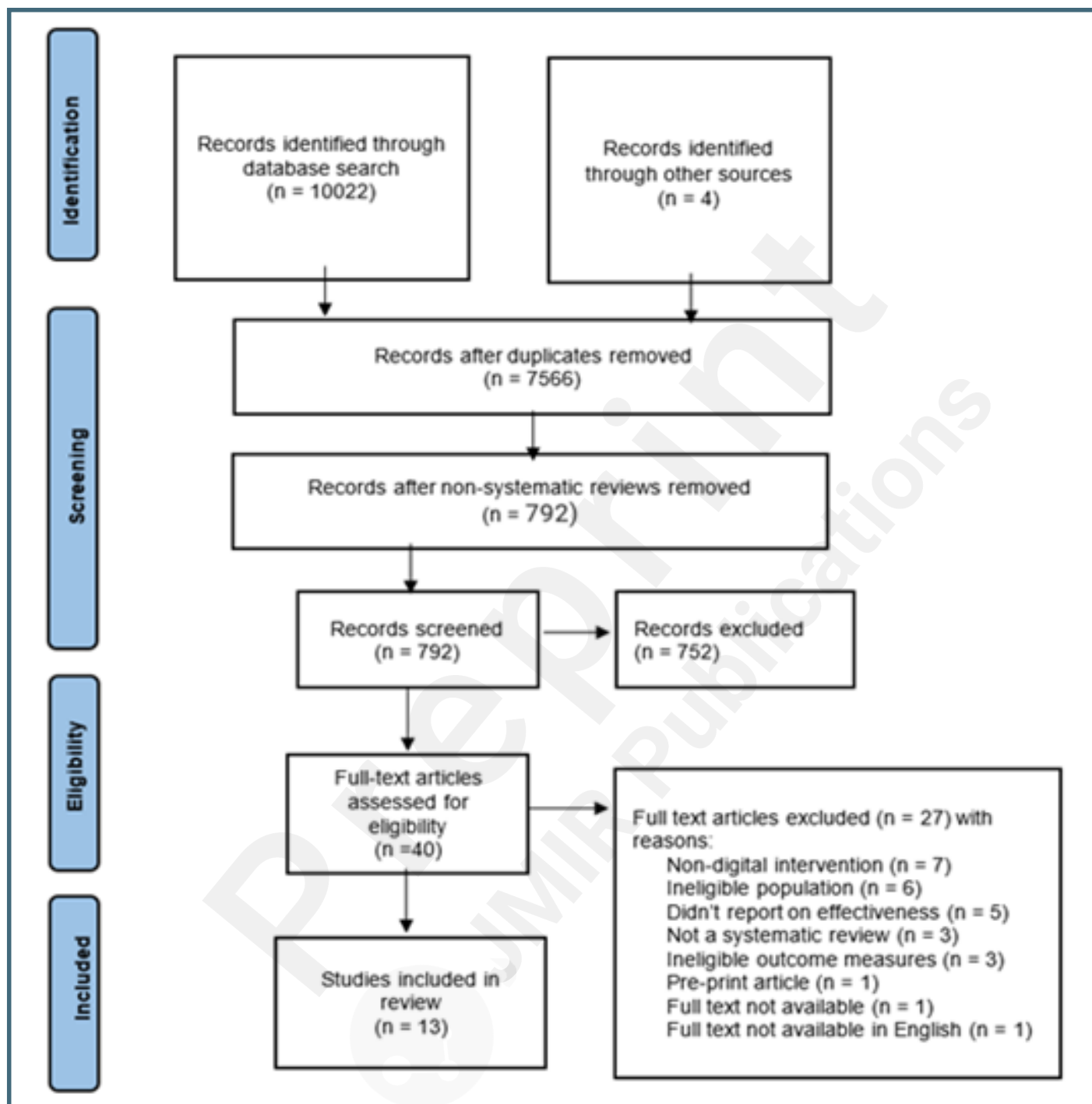
Number of Systematic Reviews By Year

Top 10 Frequently used outcome measures.

Multimedia Appendixes

Search strategy.
URL: http://asset.jmir.pub/assets/f26944ccd8be1ed8fc23b48e0bc79697.docx

Characteristics of reviews.
URL: http://asset.jmir.pub/assets/4c0d64430c344abbbe07c39512b4c5a4.docx

AMSTAR-2 Assessment Results.
URL: http://asset.jmir.pub/assets/2aa80728b31a7cdd5e8232b4a2381fc0.docx

PRISMA Checklists.
URL: http://asset.jmir.pub/assets/0810c08407dd2450e209b7a652811e89.docx