

BMJ Open Digital health interventions for the management of mental health in people with chronic diseases: a rapid review

Maxime Sasseville ,^{1,2,3} Annie LeBlanc ,^{3,4} Mylène Boucher,³ Michèle Dugas,³ Gisele Mbemba,³ Jack Tchunte,³ Maud-Christine Chouinard,⁵ Marianne Beaulieu,^{2,3} Nicolas Beaudet,^{6,7} Becky Skidmore,⁸ Pascale Cholette,⁹ Christine Aspiros,¹⁰ Alain Larouche,¹¹ Guylaine Chabot,¹¹ Marie-Pierre Gagnon ^{2,3}

To cite: Sasseville M, LeBlanc A, Boucher M, *et al*. Digital health interventions for the management of mental health in people with chronic diseases: a rapid review. *BMJ Open* 2021;**11**:e044437. doi:10.1136/bmjopen-2020-044437

► Prepublication history and additional supplemental material for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2020-044437>).

Received 06 September 2020
Revised 18 January 2021
Accepted 12 March 2021



© Author(s) (or their employer(s)) 2021. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Dr Maxime Sasseville;
maxime1_sasseville@uqac.ca

ABSTRACT

Objective Determine the effectiveness of digital mental health interventions for individuals with a concomitant chronic disease.

Design We conducted a rapid review of systematic reviews. Two reviewers independently conducted study selection and risk of bias evaluation. A standardised extraction form was used. Data are reported narratively.

Interventions We included systematic reviews of digital health interventions aiming to prevent, detect or manage mental health problems in individuals with a pre-existing chronic disease, including chronic mental health illnesses, published in 2010 or after.

Main outcome measure Reports on mental health outcomes (eg, anxiety symptoms and depression symptoms).

Results We included 35 reviews, totalling 702 primary studies with a total sample of 50 692 participants. We structured the results in four population clusters: (1) chronic diseases, (2) cancer, (3) mental health and (4) children and youth. For populations presenting a chronic disease or cancer, health provider directed digital interventions (eg, web-based consultation, internet cognitive-behavioural therapy) are effective and safe. Further analyses are required in order to provide stronger recommendations regarding relevance for specific population (such as children and youth). Web-based interventions and email were the modes of administration that had the most reports of improvement. Virtual reality, smartphone applications and patient portal had limited reports of improvement.

Conclusions Digital technologies could be used to prevent and manage mental health problems in people living with chronic conditions, with consideration for the age group and type of technology used.

INTRODUCTION

Chronic diseases are the main burden on healthcare systems in developed countries and account for almost 70% of deaths worldwide.¹ An individual with a chronic condition is two to three times more likely to present a concomitant mental health

Strengths and limitations of this study

- We conducted a rapid review of systematic reviews published in the last 10 years, including a large body of evidence in four clusters of population.
- A panel of knowledge users were involved in each step of the review, from conceptualisation to publication to ensure relevance in clinical context and policy making.
- Study selection and bias evaluation were completed by two independent reviewers and data extraction used a standardised form.
- We limited the search to the most relevant databases and the last 10 years.
- The overlapping of primary studies was not evaluated.

problem than the general population.² As the number of physical chronic conditions increase in a population, so do the mental health ones. The co-occurrence of chronic and mental health conditions leads to an increase in total healthcare costs and services utilisation, as well as poorer quality of life and health outcomes for these individuals.^{3 4}

The psychosocial consequences of the current COVID-19 pandemic are alarming and will persist long after the pandemic is over.⁵ In the current COVID-19 pandemic context, efforts have been invested to rapidly produce scientific evidence in mental health for adapting the clinical setting and supporting policy making (eg, confinement measures). Adapting to telehealth, when in-person consultation is not recommended, requires efficient and relevant digital mental health interventions for the population with concomitant chronic diseases and mental health issues. While a large number of interventions using digital technologies have been

evaluated for the management of depression or anxiety,⁶⁷ the relevance of these interventions for people living with chronic diseases remains to be defined.

This rapid review of systematic reviews aimed to determine effectiveness of digital mental health interventions aiming to prevent, detect or manage mental health problems in individuals with a pre-existing chronic condition.

METHODS

We conducted a rapid review following the guidance from the Cochrane Rapid Reviews Methods Group.⁸ We report our results based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Statement.⁹ The protocol for this rapid review was registered in the National Collaborating Centre for Methods and Tools COVID-19 Rapid Evidence Service (ID 75).

Knowledge users engagement

We engaged a panel of knowledge users (patients, clinicians and decision makers), content experts, review methodologists and researchers throughout the review process, from question development, literature search, data extraction and analysis, interpretation and writing of results, and dissemination of findings.

Eligibility criteria

We followed the PICO Framework in establishing eligibility criteria¹⁰ (table 1). We considered any review that included digital health interventions aiming to prevent, detect or manage mental health problems in individuals with a pre-existing chronic disease, including chronic mental health diseases, published in 2010 or after. There was no language restriction.

Literature search

An experienced medical information specialist developed and tested the search strategies through an iterative process in consultation with the review team and knowledge users. Using the OVID platform, we searched Ovid MEDLINE, including Epub Ahead of Print and In-Process & Other Non-Indexed Citations, Embase Classic+Embase, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects and the Health Technology Assessment Database. We also searched CINAHL (EBSCO) and Web of Science. All searches were performed on 11 June 2020. We used a combination of controlled vocabulary (eg, “Chronic Disease”, “Mood Disorders” and “Internet”) and keywords (eg, “cancer”, “anxiety” and “telehealth”) and adjusted vocabulary and syntax across the databases. We applied a systematic review filter to all searches except for the Cochrane databases, where it is not required. Specific details regarding the strategies appear in online supplemental file 1).

Study selection, data extraction and synthesis

Six reviewers individually performed screening for titles, abstracts and then full text using a standardised form pilot-tested by all reviewers on 25 citations. All citations

Table 1 PICO eligibility criteria

Population (P)	Adults with any chronic disease (eg, diabetes, ischaemic heart diseases, cerebrovascular diseases, chronic obstructive pulmonary disease, asthma, hypertension, dyslipidaemia, arthritis/rheumatoid arthritis, chronic pain, cancer, chronic renal disease, inflammatory bowel diseases, mood disorders and attention deficit disorders). We will rely in the authors' definition of chronic disease and presenting, or at risk of presenting, a concomitant mental health problem (eg, mood disorders, depression, anxiety, obsessive compulsive disorder, panic disorder and post-traumatic stress disorder).
Intervention (I)	Digital health technologies, including but not limited to: telemedicine/teleconsultation, patient portal, electronic health record, web-based/internet intervention or smartphone applications.
Comparator (C)	No intervention, usual care and any other (digital or non-digital) intervention.
Outcomes (O)	Prevalence of mental health problems; scores of depression, anxiety or other mental health problem; quality of life; specific clinical indicators (eg, glycated hemoglobin (HbA1c) for diabetes); patient satisfaction; impact on care utilisation (eg, emergency department (ED) visits, hospitalisation and outpatient consultations); and costs (for the individual and the health system).

were reviewed by two reviewers independently at the first level of screening. We developed a standardised extraction form that included study characteristics (eg, authors, country and design), intervention characteristics (eg, type of digital intervention) and outcomes reported. A senior reviewer reviewed all full-text citations for inclusion. Single reviewers extracted data, which were then confirmed by a senior reviewer. We resolved discrepancies through discussion. We report data using a narrative approach that includes tables of study characteristics, intervention characteristics and mental health outcomes.

Critical appraisal

We used the AMSTAR 2 tool to critically appraise each included review.¹¹ This revised version of the AMSTAR tool was developed for the evaluation of systematic reviews that include randomised or non-randomised studies of healthcare interventions. This tool has good inter-rater reliability, is widely used for healthcare research and uses a four-level rating of overall confidence. A single reviewer rated the critical appraisal tool and all judgements were verified by a second author.¹¹

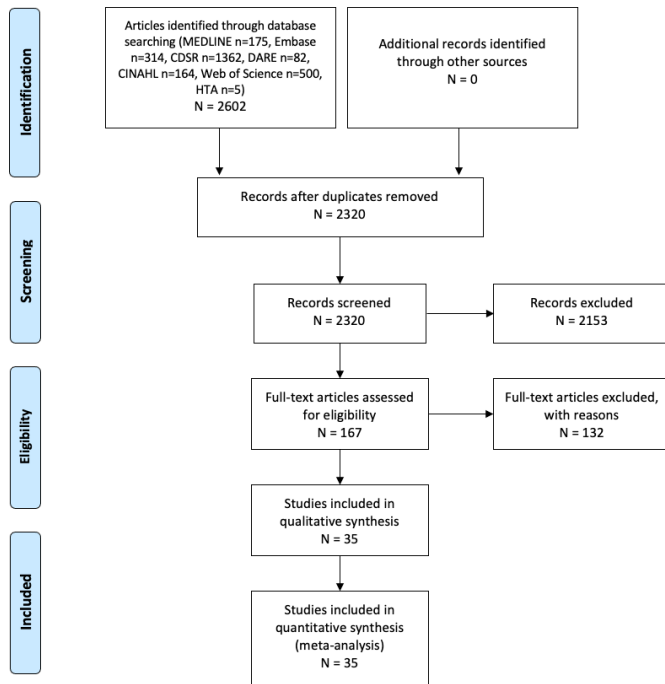


Figure 1 PRISMA flow diagram of study inclusion process. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Patient and public involvement

A panel of knowledge users (patients and clinicians) was involved throughout the research process, from funding acquisition to publication. The panel will also be involved in subsequent dissemination activities.

RESULTS

Characteristics of included reviews

Our search strategy identified 2320 individual citation. Following screening of titles and abstracts, we excluded 2153 records. We excluded an additional 132 citations during full-text screening, resulting in a total of 35 citations included in our review (figure 1).^{12–46} Of these reviews, there were 17 systematic reviews, 17 systematic reviews with meta-analysis and one integrative review, totalling 702 primary studies with a total sample of 50 692 participants.

Most reviews described digital interventions performed in a specialised care setting (42%) and targeted an adult population (83%). They were looking at interventions to manage and treat a mental health problem (60%), testing web-based and internet interventions (32%) by comparing them with usual care (48%), for people affected with cancer or various chronic diseases (77%). We present the complete description of included reviews in table 2. A presentation of the reviews by technology used is available in additional table 1.

The overall confidence ratings of the AMSTAR 2 tool were mostly high or moderate (31/35) with a limited number of low ratings (4/35) and no critically low rating (table 3). A small percentage of the AMSTAR 2 items

were not reported in the included reviews with the exception of the source of funding of primary studies in the included reviews (0%) (figure 2).

We structured our synthesis according to four population clusters: (1) chronic diseases; (2) cancer; (3) mental health; and (4) children and youth. The mental health outcomes found in the included reviews were mainly depression and anxiety symptoms, assessed through heterogeneous outcomes measures. The results are further presented by type of reporting (quantitative or narrative).

Chronic diseases cluster

We identified 13 reviews referring to people with various chronic diseases (table 2). Six of the 13 reviews reported their results using pooled difference of score mean.^{16 19 23 36 42 43} The majority of the reviews presenting quantitative results reported improvement of depressive symptoms (5/6), but only one identified improvement in anxiety symptoms (1/3). One review reported improvement of general distress.⁴² The synthesis with the largest effect size included 108 primary studies with only web-based and internet cognitive-behavioural therapy (CBT) interventions.²³ Most of the reviews that yielded narrative results reported improvement of depressive symptoms (6/7), improvement in anxiety symptoms (6/7) and psychosocial outcomes (1/1). Only one report of inferior effectiveness was identified for both depression and anxiety symptoms.¹⁸ Narrative reports described a small to moderate effect size within group in depression and anxiety symptoms. One integrative review report based on qualitative data described that digital health interventions for people with chronic diseases promoted active acceptance of their disease, improved the awareness of physical manifestations of the disease, helped identify signs and symptoms of worsening and improved management of acute events.¹⁸ The types of digital technology that had the most reports of improvements were web-based interventions, followed by email. Virtual reality and patient portal had no reports of improvements on outcomes when used (table 4).

Cancer cluster

We identified 14 reviews referring to people with cancer (table 2). Quantitative reporting was present in six reviews.^{17 24 25 30 44 46} Four (4/6) of those reported improvements of depressive symptoms, and half showed improvements in anxiety symptoms (3/6). Other quantitative reports of improvements in mental health outcomes included distress and quality of life. The quantitative report with the largest effect size included 20 primary studies, a total sample of 2190 participants, and looked at web-based and teleconsultations CBT interventions.¹⁷ Reviews that yielded narrative results reported improvements of depression symptoms (6/7), anxiety symptoms (5/5), distress (3/3), quality of life (1/1) and mood regulation (1/1). Pooling of the results was impossible in one review due to heterogeneity.¹² The narrative outcome

Table 2 Description of included reviews

Author, year	Review design	No. of primary studies, design	No. of patients (pooled)	Type of chronic diseases	Type of digital technology interventions	Depression outcomes	Anxiety outcomes	Other mental health outcomes
Chronic disease cluster								
Beatty 2013 ¹⁴	SR	24 Experimental	NR	Chronic physical diseases	Web-based/internet intervention, app, email and telemedicine/teleconsultation.	Improvement between groups comparison. Improvement within group (moderate effect size). Improvement sustained at 12-month follow-up. iCBT with and without therapist showed no differences between groups. iCBT showed no difference when compared with group CBT.	Improvement at 3 months and at 12 months.	NR
Charova 2015 ¹⁶	SR with MA	11 Experimental	1348	Any chronic disease with comorbid MH disorder	Web-based/internet intervention.	DW 0.31; 95% CI 0.17 to 0.45; p<0.01.	NR	NR
Clari, 2020 ¹⁸	SR	1 Mixed	84	COPD	Telemedicine/teleconsultation.	No difference between groups.	No difference between groups.	Qualitative data: promoted active acceptance of their disease/improved the awareness of their physical sensations /helped identify signs and symptoms /improvement of the management of acute events.
Eccleston, 2019 ¹⁹	SR with MA	14 Experimental	2012	Chronic pain	Web-based/internet intervention, app and telemedicine/teleconsultation.	SMD=-0.26 (95% CI -0.87 to 0.36).	SMD=-0.48 (95% CI -1.22 to 0.27).	NR
Hedman, 2012 ²³	SR with MA	108 Experimental	NR	Any	Web-based/internet intervention.	MD=-0.94 (95% CI 0.77 to 1.11) large effect size, within groups.	MD=1.12 (95% CI 0.61 to 1.62), large effect size.	NR
McCombie, 2015 ³¹	SR	29 Mixed	3935	Chronic physical diseases	Web-based/internet intervention.	Improvement of depression scores (4/8).	Improvement (2/7).	NR
Mehta, 2018 ³³	SR with MA	25 Experimental	3450	Any	Web-based/internet intervention and email.	Improved depression symptoms with small to medium effect size. Therapist-guided iCBT showed larger effect size than self-guided iCBT.	Improved anxiety, similar effect size than usual care.	NR
Mikolasek, 2018 ³⁴	SR with meta-analysis	17 Experimental	1855	Chronic physical diseases	Web-based/internet intervention.	Active control: 2/7 showed superior effectiveness; 4/7 equal effectiveness; 1/7 inferior effectiveness. Usual care: 1/4 showed superior effectiveness; 3/4 showed equal effectiveness.	Active control: 2/7 showed superior effectiveness; 4/7 equal effectiveness; 1/7 inferior effectiveness. Usual care: 1/4 showed superior effectiveness; 3/4 showed equal effectiveness.	NR
Palacios, 2017 ³⁶	SR	7 Experimental	1321	Chronic physical diseases	Web-based/internet intervention, app, email and text message.	PHQ-9 score mean from 12 (post) to 8.4 (follow-up).	NR	NR
Paul, 2013 ³⁷	SR	36 Experimental	NR	Any chronic disease with comorbid MH disorder.	Web-based/internet intervention and online chat.	Improved depression in comparison between groups.	Improved anxiety in comparison with control.	Mixed results in psychosocial outcomes.
Toivonen, 2017 ⁴⁰	SR	16 Experimental	NR	Any	Web-based/internet intervention, email and online chat.	Improved depression symptoms with a small effect size.	Improved anxiety symptoms with a small effect size.	NR

Continued

Table 2 Continued

Author, year	Review design	No. of primary studies, design	No. of patients (pooled)	Type of chronic diseases	Type of digital technology interventions	Depression outcomes	Anxiety outcomes	Other mental health outcomes
van Beugen, 2014 ⁴²	SR with MA	23 Experimental	2299	Any	Web-based/internet intervention, app, email, text message and online chat.	SMD=0.21 (95% CI: 0.08 to 0.34).	SMD=0.17 (95% CI 0.01 to 0.32).	General distress: SMD=0.21 (95% CI 0.00 to 0.41).
Vugt, 2018 ⁴³	SR with MA	46 Experimental	NR	Chronic physical diseases	Web-based/internet intervention, email, text message, online chat and telemedicine/teleconsultation.	SMD=-0.18 (95% CI -0.28 to -0.07), SMD=-0.18 (95% CI -0.28 to -0.07) passive control (post), SMD=-0.29 (95% CI -0.48 to -0.10) passive control (follow-up), SMD=0.14 (95% CI -0.37 to 0.09) active control (post), SMD=0.31 (95% CI: -0.78 to 0.16) active control (follow-up).	NR	NR
Cancer cluster								
Agboola, 2015 ¹²	SR	20 Experimental	3789	Cancer	Web-based/internet, app, virtual reality, text message, online chat and telemedicine/teleconsultation.	Heterogeneous studies no pooling possible.	Improvement in anxiety symptoms (3/8).	Improvement in anxiety symptoms NR
Bártolo, 2019 ¹³	SR	8 Experimental	1016	Cancer	Web-based/internet, patient portal, app, email and telemedicine/teleconsultation.	Improvement in depression symptoms 3 weeks postinterventions. Small effect size. The telephone intervention yielded medium effect size improvement.	NR	Improvement in global distress, small effect size.
Bourma, 2015 ¹⁵	SR	16 Experimental	2620	Cancer	Web-based/internet intervention.	Improvement on depression symptoms (1/7) (between groups).	Improvement in anxiety symptoms (2/10).	Improvement on quality of life (3/11).
Chen, 2018 ¹⁷	SR with MA	20 Experimental	2190	Cancer	Web-based/internet intervention and telemedicine/teleconsultation.	SMD=-1.29 (95% CI 2.28 to 0.30).	SMD=0.09 (95% CI 0.22 to 0.04).	Distress: SMD = ¼ 0.25, (95% CI 0.40 to 0.10, p<0.001).
Forbes, 2019 ²¹	SR	16 Experimental	2446	Cancer	Web-based/internet intervention, email and online chat.	Improvement of depression score within group. Better improvement with CBT compared with online forum.	NR	Psychological distress: effect size larger with ICBT compared with forum.
Fridriksdottir, 2017 ²²	SR	20 Experimental	NR	Cancer	Web-based/internet intervention and email.	Improvement in depression symptoms (2/10).	Improvement in anxiety symptoms (4/10).	Improvement on psychological distress (3/8).
Kim, 2015 ²⁴	SR with MA	37 Experimental	NR	Cancer	Web-based/internet intervention, email, text message, online chat and telemedicine/teleconsultation.	Hedges' g=-0.169 (-0.282 to -0.055).	Hedges' g=-0.293 (-0.465 to -0.122).	QOL: Hedges' g=-0.221 (-0.359 to -0.084).
Kim, 2017 ²⁵	SR with MA	19 Mixed	2381	Cancer	Web-based/internet intervention and telemedicine/teleconsultation.	d=-0.07, p=0.284 (post), d=-0.2, p=0.477 (follow-up).	d=-0.2, p=0.132.	NR
Lin, 2020 ²⁷	Mixed	16 Mixed	1053	Cancer	Web-based/internet intervention, app, email and text message.	Improvement of depression scores (5/11).	Improvement of anxiety scores (5/11).	Improvement of anxiety symptoms NR
McCaughan, 2017 ³⁰	SR	6 Experimental	492	Cancer	Web-based/internet intervention, patient portal, email and online chat.	SMD=-0.37 (95% CI -0.75 to 0.00).	Mean 0.4 lower at end of intervention (95% CI 6.42 lower to 5.62 higher). MD=-0.40 (95% CI -6.42 to 5.62); low-quality evidence between groups.	NR
Qan'ir, 2019 ³⁸	SR with MA	10 Experimental	1124	Cancer	Web-based/internet intervention, app and online chat.	Improvement of depression score (between group) (2/7). Improvement of depression score (within group)(1/7).	Improvement of anxiety score (between group) (1/5). Improvement of anxiety score (within group) (1/5).	Improvement of anxiety symptoms NR

Continued



Table 2 Continued

Author, year	Review design	No. of primary studies, design	No. of patients (pooled)	Type of chronic diseases	Type of digital technology interventions	Depression outcomes	Anxiety outcomes	Other mental health outcomes
Ugalde, 2015 ⁴¹	SR	4 Experimental	NR	Cancer	Web-based/internet intervention.	NR	NR	Improved self-efficacy for regulating negative mood.
Wang, 2020 ⁴⁴	SR with MA	7 Experimental	1220	Cancer	Web-based/internet intervention, app and email.	SMD=-0.58, 95% CI (-1.12 to -0.03), p=0.04 (between groups).	SMD=-1.03 (95% CI -2.63 to 0.57) (between groups).	NR
Zeng, 2019 ⁴⁶	SR with MA	6 Mixed	NR	Cancer	Virtual reality.	WMD=-1.11 (Z-scores=1.05, p=0.29).	SMD=-3.03 (95% CI=-6.20 to 0.15).	NR
Youth and children cluster								
Fisher, 2019 ²⁰	SR with MA	10 Mixed	697	Chronic pain	Web-based/internet intervention and app.	SMD 0.04 (95% CI -0.18 to 0.26).	SMD 0.53 (95% CI -0.63 to 1.68).	NR
Lopez-Rodriguez, 2020 ²⁸	SR	8 Mixed	286	Cancer	App and virtual reality.	Improved depression (3/3).	Improved anxiety (2/3).	NR
McGar, 2019 ³²	SR	22 Experimental	1764	Chronic physical diseases	Web-based/internet intervention.	Improved depression symptoms (3/7).	Improved anxiety (4/5) (post).	Improved PTSD symptoms (2/3) (post).
Tang, 2018 ³⁹	SR with MA	4 Experimental	404	Chronic pain	Web-based/internet intervention.	MD=-0.23 (95% CI 0.03 to 0.43) (within group). MD=-0.02 (95% CI 0.19 to 0.22) (between group) SMD=0.02 (95% CI 0.19 to 0.22, p=0.86) (follow-up).	SMD=-3.24 (95% CI 1.88 to 4.61) (within group). SMD=0.41 (95% CI 1.79 to 0.98) (between group).	NR
Mental health cluster								
Lewis, 2018 ²⁶	SR with MA	10 Experimental	720	PTSD	Web-based/internet intervention.	SMD=-0.61 (95% CI -1.17 to -0.05) (between groups/post). MD=-8.95, 95% CI -15.57 to -2.33 (between groups/follow-up).	SMD=-0.67 (95% CI -0.98 to -0.36)(between groups/post). MD=-12.59 (95% CI -20.74 to -4.44)(between groups/follow-up).	PTSD SMD=-0.60 (95% CI -0.97 to -0.24) (between groups/post). RR=0.53 (95% CI 0.28 to 1.00) (between groups/post).
Mayo-Wilson, 2013 ²⁹	SR with MA	43 Experimental	8403	Anxiety	Web-based/internet intervention, email, text message and telemedicine/teleconsultation.	NR	SMD=0.79 (95% CI 0.62 to 0.96) (internet delivered).	NR
Olthuis, 2016 ³⁵	SR with MA	38 Experimental	3214	Anxiety	Web-based/internet intervention, app, email, and rline chat.	NR	*RR=3.75 (95% CI 2.51 to 5.60) (generalised anxiety). SMD=-1.06 (95% CI -1.29 to -0.8) (disorder specific anxiety).	NR
Wickersham, 2019 ⁴⁵	SR	5 Experimental	653	PTSD	App	NR	NR	No improvement in PTSD between groups when compared with usual care.

CBT, cognitive-behavioural therapy; COPD, chronic obstructive pulmonary disease; dw, Cohen's effect size; ICBT, internet-based cognitive behavior therapy; MA, meta-analysis; MH, mental health; NR, not reported; PHQ-9, Patient Health Questionnaire; PTSD, post-traumatic stress disorder; QoL, quality of life; RR, risk ratio; SMD, standardized mean difference; SR, systematic review; WMD, weighted mean difference.

Table 3 Critical appraisal of the included reviews

	1. Question and inclusion	2. Protocol design	3. Study design	4. Comprehensive search	5. Study selection	6. Data extraction	7. Excluded studies justify	8. Included studies details	9. Risk of bias (RoB)	10. Sources of funding	11. Statistical methods	12. Meta-analysis RoB	13. Individual studies RoB	14. Heterogeneity explanation	15. Publication bias	16. Conflict of interest	Overall confidence rating
Agboola 2015 ¹²	N	PY	Y	PY	Y	Y	Y	PY	Y	N	N/A	N/A	Y	N/A	Y	Low	
Bartolo 2019	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N/A	N/A	Y	Y	Y	Moderate	
Beatty 2012	Y	PY	Y	Y	Y	Y	Y	Y	N	N	N/A	N/A	Y	N/A	N	Moderate	
Bouma 2019	Y	PY	Y	Y	Y	Y	Y	Y	N	N	N/A	N/A	Y	N/A	Y	Moderate	
Charova 2015 ¹⁶	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Moderate	
Chen 2018 ¹⁷	Y	PY	Y	Y	Y	Y	Y	Y	PY	N	Y	Y	Y	Y	Y	Moderate	
Chen 2020 ¹⁸	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N/A	N/A	Y	N/A	Y	Moderate	
Clari 2020 ¹⁸	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	High	
Eccleston 2019 ¹⁸	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	High	
Fisher 2019 ²⁰	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	High	
Forbes 2019 ²¹	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N/A	N/A	Y	N/A	Y	High	
Fridrikdotir 2017	Y	PY	Y	Y	Y	Y	Y	Y	N	N	N/A	N/A	Y	N/A	Y	Moderate	
Hedman 2012 ²³	Y	N	Y	Y	Y	Y	Y	Y	PY	N	Y	Y	Y	Y	Y	Low	
Kim 2015 ²⁴	Y	PY	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Moderate	
Kim 2017 ²⁵	Y	PY	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N	Moderate	
Lewis 2018 ²⁶	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	High	
Lin 2020 ²⁷	Y	PY	Y	Y	Y	Y	Y	Y	Y	N	N/A	N/A	Y	N/A	Y	Moderate	
Lopez-Rodriguez 2020 ²⁸	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N/A	N/A	Y	Y	Y	High	
Mayo-Wilson 2013 ²⁹	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	High	
McCaughan 2017 ³⁰	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	High	
McCombie 2015 ³¹	Y	N	Y	Y	Y	Y	Y	Y	N	N	N/A	N/A	Y	N/A	Y	Low	
McGar 2019 ³²	Y	PY	Y	Y	Y	Y	Y	Y	PY	N	N/A	N/A	Y	N/A	Y	Moderate	
Mehta 2019 ³³	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Moderate	
Mikolasek 2018 ³⁴	Y	PY	Y	Y	Y	Y	Y	Y	N	N	N/A	N/A	Y	N/A	Y	Moderate	
Oltuis 2016 ³⁵	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Moderate	
Palacios 2017 ³⁶	Y	PY	Y	Y	Y	Y	Y	Y	N	N	N/A	N/A	Y	N/A	Y	Moderate	
Paul 2013 ³⁷	Y	PY	Y	Y	N/A	N/A	Y	Y	PY	N	N/A	N/A	Y	N/A	Y	Moderate	
Qan'ir 2019 ³⁸	Y	PY	Y	Y	Y	Y	Y	Y	N	N	N/A	N/A	Y	N/A	Y	Moderate	
Tang 2018 ³⁹	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	High	
Toivonen 2017 ⁴⁰	Y	N	Y	Y	Y	Y	Y	Y	N	N	N/A	N/A	Y	N/A	Y	Low	
Ugalde 2017	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N/A	N/A	Y	N/A	Y	High	
van Beugen 2014 ⁴²	Y	PY	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Moderate	
Vaughts 2018 ⁴³	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	High	

Continued



Table 3 Continued

	1. Question and inclusion	2. Protocol design	3. Study design	4. Comprehensive search	5. Study selection	6. Data extraction	7. Excluded studies justify	8. Included studies details	9. Risk of bias (RoB)	10. Sources of funding	11. Statistical methods	12. Meta-analysis RoB	13. Individual studies RoB	14. Heterogeneity explanation	15. Publication bias	16. Conflict of interest	Overall confidence rating
Wang 2020 ⁴⁴	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	High
Wickersham 2019 ⁴⁵	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N/A	N/A	Y	Y	N/A	Y	High
Zeng 2019 ⁴⁶	Y	PY	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Moderate

NA, not applicable; N, no; P,Y, partial/yes; Y, Yes.



Figure 2 Overall critical appraisal of the included studies using the AMSTAR 2 tool.

reports described a small effect size within group for depression and anxiety symptoms.²¹ The types of digital intervention that had the most reports of improvements were web-based interventions and email. Virtual reality had no reports of improvements (table 4)

Children and youth cluster

We identified four reviews related to digital health interventions targeting children and youth (table 2). Two reviews reported a quantitative synthesis presenting mixed effects: one showing within group improvements in depression and anxiety and both showing no between group difference on these outcomes.^{20 39} As for narrative syntheses, both reported improvements on depression and anxiety, with one of the reviews reporting on post-traumatic stress disorder (PTSD) symptoms improvement.^{28 32} The limited reports on improvement for this population was associated with the used of web-based interventions (3/4), smartphone applications (2/4) and virtual reality (1/4) (table 4).

Mental health cluster

We identified four reviews related to population with mental health conditions (table 2). The quantitative reports showed improvements in anxiety symptoms for generalised anxiety disorder and disease-specific anxiety (3/3), improvements of depression symptoms (1/1) and PTSD symptoms (1/1). The only narrative report for that cluster showed no improvement on PTSD symptoms between groups.⁴⁵ The types of digital technology that had the most reports of improvement were web-based interventions (3/4) and email (2/4) with unique reports for smart phone applications, text messages and online chat (table 4).

DISCUSSION

We conducted a rapid review of systematic reviews to identify digital health interventions effective to prevent, detect or manage mental health problems in individuals with a pre-existing chronic disease. In total, 35 reviews were included.

Our findings are in line with the extensive evidence that internet CBT interventions are effective and comparable to face-to-face interventions.⁴⁷ Our analysis adds to

Table 4 Studies reporting improvements classified by the type of digital technology used

	Chronic diseases cluster			Cancer cluster			Children and youth cluster			Mental health cluster		
	Depression	Anxiety	Other	Depression	Anxiety	Other	Depression	Anxiety	Other	Depression	Anxiety	Other
Web-based interventions	23 42 43 16 36 31 14 40 33 34 37	23 31 14 40 33 34 37	37	17 44 24 21 13	17 30 44 24	24 17 21 41 13 20 39	20 39 32	20 39 32	32	26	29 35 26	26
Patient portal		30										
Smartphone application	42 36 14	14	44	44	44	20 28	20 28	20 28			35	
Virtual reality						28		28				
Email	42 43 36 14 40 33	14 40 33	44 24 21 13	44 24 21 13	30 44 24	21 24 13					29 35	
Text message	42 43 36		24	24	24	24					29	
Online chat	42 43 40 37	40 37	37	24 21	30 24	21 24					35	
Telemedicine/teleconsultation	42 14	14	17 24 13	17 24 13	17 24	24 17 13					29	

the body of evidence on effectiveness regarding concomitant chronic diseases in four clusters of population. For people with various chronic diseases, most of the included reviews showed that digital health interventions have a positive effect on depression, anxiety, distress and psychosocial outcomes. The data showed that interventions have a moderate effect size within the intervention group and a small effect size when compared with usual care. For the cluster of population affected by cancer (including survival), evidence already exists regarding the effectiveness of digital mental health interventions with positive to mixed effect.⁴⁸ Our data also showed that digital health interventions are effective in improving depression, anxiety, distress, quality of life and mood regulation. Also, teleconsultation and web-based interventions were the most effective modes of delivery for this population. Regarding the paediatric population, a meta-review targeting digital mental health interventions for children and youth reported a positive effect for the use of web-based CBT but only in children and youth with anxiety and depression with no other concomitant conditions.⁴⁹ Quantitative data were inconclusive regarding effectiveness and effect size within group but showed a non-inferiority when compared with usual care. All included reviews in this population combined smartphone applications and web-based interventions, making it difficult to draw any conclusion about the most effective mode of delivery for the intervention at this level of analysis. For the mental health population, the included reviews emphasised that digital health interventions are effective for individuals with a combination of physical and mental conditions, as well as for people with multiple mental health problems.

Available evidence suggests that digital health interventions such as web-based CBT, email messaging and teleconsultation could be effective and provide an alternative to face-to-face psychological interventions to prevent and manage mental health problems in people affected by cancer or other chronic diseases. In line with our findings, Torous *et al*⁵⁰ described that offering health provider-directed synchronous digital health solutions such as teleconsultation is the first step to increase access to quality mental healthcare in the midst of the COVID-19 pandemic. Many of these innovations support the care of people in need of special attention, including those with chronic illnesses. Due to smaller effect size, we were not able to draw any conclusion related to the other forms of digital health interventions such as online chat, text message and smartphone applications. These types of digital health interventions are asynchronous; they may improve access and promote low-threshold alternatives to mental health consultations within the healthcare system. However, more evidence regarding implementation and evaluation to be safe for patients would be required.⁵⁰ Included reviews that looked at other intervention delivery methods reported smaller to no effect, but it could be related to heterogeneity of the data. Even with reports of effectiveness, there is still a lack of evidence of economic data to perform a proper cost analysis of digital health interventions.^{51 52}

This review was rapidly performed to inform knowledge users in a timely matter. In line with recommendations for rapid reviews,⁵³ methods that would lead to a systematic review were not followed as strictly to allow for a faster methodology. We limited the scope of the search to the aim of the study by looking at limited databases and imposing a period of publication. These methodological choices resulted in the ability to perform an appropriate and structured study selection, data extraction and critical appraisal.

This rapid review of reviews has limitations. In order to respect the requirements of this urgent strategic call in response to the COVID-19 pandemic and provide stakeholders and decision makers with up-to-date evidence, we limited the search to the most relevant databases and the last 10 years. Despite our best efforts, we may have missed some publications. Moreover, we did not assess the overlapping of primary studies in the included reviews. While we rigorously followed guidance for the conduct of rapid reviews, results from this study should be interpreted with caution. Further analyses will be required for stronger recommendations, notably by considering the potential publication bias, as well as other factors that could decrease the level of confidence in the reported effects.

Future research on digital mental health interventions should provide economic data to give a broader insight for possible implementation. Research on digital mental health interventions could also further assess the safety and limitations of asynchronous and self-administered technologies. Finally, efforts should be put on developing a structured method to report what kind of technology (eg, internet based and smartphone app) and function (eg, communication, intervention and evaluation) were used in the intervention. A structured method of reporting would improve the evidence precision and knowledge implementation.

CONCLUSION

This rapid review outlines the current evidence regarding the use of digital health interventions for people with a concomitant chronic disease. For individuals with a chronic disease or cancer, health provider directed digital interventions (eg, teleconsultation) are effective and safe. However, further analyses of this large body of evidence are required in order to provide precise recommendations regarding relevance for specific populations (such as children and youth), modes of delivery and type of intervention. In response to the current crisis, but also to better prepare for the post-crisis and future crises, digital technologies could be used to prevent and manage mental health problems in people living with chronic conditions, with consideration for the age group and type of technology used.

Author affiliations

¹Department of Health Sciences, Université du Québec à Chicoutimi, Chicoutimi, Québec, Canada

²Nursing Faculty, Université Laval, Québec, Québec, Canada

³VITAM Research Center on Sustainable Health, Québec, Québec, Canada

⁴Family medicine and emergency medicine, Université Laval, Québec, Québec, Canada

⁵Nursing Faculty, Université de Montréal, Montreal, Québec, Canada

⁶Omnimed, Québec, Québec, Canada

⁷Department of Anesthesiology, Université de Sherbrooke, Sherbrooke, Québec, Canada

⁸Independent information specialist, Ottawa, Ontario, Canada

⁹Centre intégré universitaire de santé et de services sociaux de la Capitale-Nationale du Québec, Québec, Québec, Canada

¹⁰Patient partner, Québec, Québec, Canada

¹¹Groupe Santé Concerto, Montréal, Québec, Canada

Acknowledgements The authors would like to thank the knowledge users for their support throughout this review and the SPOR Evidence Alliance for their support.

Contributors MS, AL, M-PG, M-CC, MBe, NB, PC, CA, AL and GC identified the need for this study and contributed to its conception and design. BS developed and conducted the search strategy. MS, M-PG, MBo, MD, MG and JT conducted the data collection and analysis. MS developed the first draft of the report. All authors contributed to writing and editing and gave the final approval of the version submitted.

Funding This review was funded by the Canadian Institute for Health Research in the Operating Grant: Knowledge Synthesis: COVID-19 in Mental Health & Substance Use. Grant number: 202005CMS-442711-CMV-CFBA-111141.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request with the first (MS) or last (MPG) authors.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Maxime Sasseville <http://orcid.org/0000-0003-1694-1414>

Annie LeBlanc <http://orcid.org/0000-0002-5377-8102>

Marie-Pierre Gagnon <http://orcid.org/0000-0002-0782-5457>

REFERENCES

- 1 World Health Organisation. *Global status report on noncommunicable diseases*. Geneva: Switzerland, 2014.
- 2 Chapman DP, Perry GS, Strine TW. The vital link between chronic disease and depressive disorders. *Prev Chronic Dis* 2005;2:A14.
- 3 Barnett K, Mercer SW, Norbury M, et al. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. *Lancet* 2012;380:37–43.
- 4 Naylor C, Parsonage M, McDaid D. Long-term conditions and mental health: the cost of co-morbidities. *The King's Fund and Centre for Mental Health* 2012.
- 5 Shigemura J, Ursano RJ, Morganstein JC, et al. Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: mental health consequences and target populations. *Psychiatry Clin Neurosci* 2020;74:281–2.
- 6 García-Lizana F, Muñoz-Mayorga I. Telemedicine for depression: a systematic review. *Perspect Psychiatr Care* 2010;46:119–26.
- 7 Richards D, Richardson T. Computer-Based psychological treatments for depression: a systematic review and meta-analysis. *Clin Psychol Rev* 2012;32:329–42.

- 8 Garritty CGG, Kamel C, King VJ. Cochrane rapid reviews. In: CR R, ed. *Interim guidance from the Cochrane rapid reviews methods group*. Cochrane Collaboration, 2020.
- 9 Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med* 2009;6:e1000097.
- 10 Goldstein KM, Fisher DA, Wu RR, et al. An electronic family health history tool to identify and manage patients at increased risk for colorectal cancer: protocol for a randomized controlled trial. *Trials* 2019;20:576.
- 11 Shea BJ, Reeves BC, Wells G, et al. AMSTAR 2: a critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. *BMJ* 2017;358:j4008.
- 12 Agboola SO, Ju W, Elfiky A, et al. The effect of technology-based interventions on pain, depression, and quality of life in patients with cancer: a systematic review of randomized controlled trials. *J Med Internet Res* 2015;17:e665.
- 13 Bártolo A, Pacheco E, Rodrigues F, et al. Effectiveness of psycho-educational interventions with telecommunication technologies on emotional distress and quality of life of adult cancer patients: a systematic review. *Disabil Rehabil* 2019;41:870–8.
- 14 Beatty L, Lambert S. A systematic review of Internet-based self-help therapeutic interventions to improve distress and disease-control among adults with chronic health conditions. *Clin Psychol Rev* 2013;33:609–22.
- 15 Bouma G, Admiraal JM, de Vries EGE, et al. Internet-based support programs to alleviate psychosocial and physical symptoms in cancer patients: a literature analysis. *Crit Rev Oncol Hematol* 2015;95:26–37.
- 16 Charova E, Dorstyn D, Tully P, et al. Web-based interventions for comorbid depression and chronic illness: a systematic review. *J Telemed Telecare* 2015;21:189–201.
- 17 Chen Y-Y, Guan B-S, Li Z-K, et al. Effect of telehealth intervention on breast cancer patients' quality of life and psychological outcomes: a meta-analysis. *J Telemed Telecare* 2018;24:157–67.
- 18 Clari M, Conti A, Fontanella R, et al. Mindfulness-based programs for people with chronic obstructive pulmonary disease: a mixed methods systematic review. *Mindfulness* 2020;11:1848–67.
- 19 Eccleston C, Fisher E, Brown R. Psychological therapies (internet-delivered) for the management of chronic pain in adults. *Cochrane Database Syst Rev* 2019.
- 20 Fisher E, Law E, Dudeney J, et al. Psychological therapies (remotely delivered) for the management of chronic and recurrent pain in children and adolescents. *Cochrane Database Syst Rev* 2019;4:CD011118.
- 21 Forbes CC, Finlay A, McIntosh M, et al. A systematic review of the feasibility, acceptability, and efficacy of online supportive care interventions targeting men with a history of prostate cancer. *J Cancer Surviv* 2019;13:75–96.
- 22 Fridriksdottir N, Gunnarsdottir S, Zoëga S, et al. Effects of web-based interventions on cancer patients' symptoms: review of randomized trials. *Support Care Cancer* 2018;26:337–51.
- 23 Hedman E, Ljótsson B, Lindfors N. Cognitive behavior therapy via the Internet: a systematic review of applications, clinical efficacy and cost-effectiveness. *Expert Rev Pharmacoecon Outcomes Res* 2012;12:745–64.
- 24 Kim AR, Park H-A. Web-based self-management support interventions for cancer survivors: a systematic review and meta-analyses. *Stud Health Technol Inform* 2015;216:142–7.
- 25 Kim SH, Kim K, Mayer DK. Self-management intervention for adult cancer survivors after treatment: a systematic review and meta-analysis. *Oncol Nurs Forum* 2017;44:719–28.
- 26 Lewis C, Roberts NP, Bethell A, et al. Internet-based cognitive and behavioural therapies for post-traumatic stress disorder (PTSD) in adults. *Cochrane Database Syst Rev* 2018;12:CD011710.
- 27 Lin H, Ye M, Chan SW-C, et al. The effectiveness of online interventions for patients with gynecological cancer: an integrative review. *Gynecol Oncol* 2020;158:143–52.
- 28 Lopez-Rodriguez MM, Fernández-Millan A, Ruiz-Fernández MD, et al. New technologies to improve pain, anxiety and depression in children and adolescents with cancer: a systematic review. *Int J Environ Res Public Health* 2020;17:19.
- 29 Mayo-Wilson E, Montgomery P. Media-delivered cognitive behavioural therapy and behavioural therapy (self-help) for anxiety disorders in adults. *Cochrane Database Syst Rev* 2013;9:CD005330.
- 30 McCaughan E, Parahoo K, Hueter I, et al. Online support groups for women with breast cancer. *Cochrane Database Syst Rev* 2017;15:CD011652.
- 31 McCombie A, Geary R, Andrews J, et al. Computerised cognitive behavioural therapy for psychological distress in patients with physical illnesses: a systematic review. *J Clin Psychol Med Settings* 2015;22:20–44.
- 32 McGar AB, Kindler C, Marsac M. Electronic health interventions for preventing and treating negative psychological sequelae resulting from pediatric medical conditions: systematic review. *JMIR Pediatr Parent* 2019;2:e12427.
- 33 Mehta S, Peynenburg VA, Hadjistavropoulos HD. Internet-delivered cognitive behaviour therapy for chronic health conditions: a systematic review and meta-analysis. *J Behav Med* 2019;42:169–87.
- 34 Mikolasek M, Berg J, Witt CM, et al. Effectiveness of mindfulness- and relaxation-based eHealth interventions for patients with medical conditions: a systematic review and synthesis. *Int J Behav Med* 2018;25:1–16.
- 35 Olthuis JV, Watt MC, Bailey K, et al. Therapist-supported Internet cognitive-behavioural therapy for anxiety disorders in adults. *Cochrane Database Syst Rev* 2016;3:CD011565.
- 36 Palacios J, Lee GA, Duaso M, et al. Internet-delivered self-management support for improving coronary heart disease and Self-management-Related outcomes: a systematic review. *J Cardiovasc Nurs* 2017;32:E9–23.
- 37 Paul CL, Carey ML, Sanson-Fisher RW, et al. The impact of web-based approaches on psychosocial health in chronic physical and mental health conditions. *Health Educ Res* 2013;28:450–71.
- 38 Qan'ir Y, Song L. Systematic review of technology-based interventions to improve anxiety, depression, and health-related quality of life among patients with prostate cancer. *Psychooncology* 2019;28:1601–13.
- 39 Tang W-X, Zhang L-F, Ai Y-Q, et al. Efficacy of internet-delivered cognitive-behavioral therapy for the management of chronic pain in children and adolescents: a systematic review and meta-analysis. *Medicine* 2018;97:e12061.
- 40 Tiivonen KI, Zernicke K, Carlson LE. Web-based mindfulness interventions for people with physical health conditions: systematic review. *J Med Internet Res* 2017;19:e303.
- 41 Ugalde A, Haynes K, White V. Self-guided psychological interventions for people with cancer: a systematic review. *Asia-Pacific J Clin Oncol* 2015;4:146.
- 42 van Beugen S, Ferwerda M, Hoeve D, et al. Internet-based cognitive behavioral therapy for patients with chronic somatic conditions: a meta-analytic review. *J Med Internet Res* 2014;16:e88.
- 43 Vugts MAP, Joosen MCW, van der Geer JE, et al. The effectiveness of various computer-based interventions for patients with chronic pain or functional somatic syndromes: a systematic review and meta-analysis. *PLoS One* 2018;13:e0196467.
- 44 Wang Y, Lin Y, Chen J, et al. Effects of Internet-based psycho-educational interventions on mental health and quality of life among cancer patients: a systematic review and meta-analysis. *Support Care Cancer* 2020;28:2541–52.
- 45 Wickersham A, Petrides PM, Williamson V, et al. Efficacy of mobile application interventions for the treatment of post-traumatic stress disorder: a systematic review. *Digital Health* 2019;5:205520761984298.
- 46 Zeng Y, Zhang J-E, Cheng ASK, et al. Meta-Analysis of the efficacy of virtual Reality-Based interventions in cancer-related symptom management. *Integr Cancer Ther* 2019;18:1534735419871108.
- 47 Cuijpers P, van Straten A, Andersson G. Internet-administered cognitive behavior therapy for health problems: a systematic review. *J Behav Med* 2008;31:169–77.
- 48 McAlpine H, Joubert L, Martin-Sanchez F, et al. A systematic review of types and efficacy of online interventions for cancer patients. *Patient Educ Couns* 2015;98:283–95.
- 49 Hollis C, Falconer CJ, Martin JL, et al. Annual research review: digital health interventions for children and young people with mental health problems - a systematic and meta-review. *J Child Psychol Psychiatry* 2017;58:474–503.
- 50 Torous J, Jän Myrick K, Raueo-Ricupero N, et al. Digital mental health and COVID-19: using technology today to accelerate the curve on access and quality tomorrow. *JMIR Ment Health* 2020;7:e18848.
- 51 Iribarren SJ, Cato K, Falzon L, et al. What is the economic evidence for mHealth? A systematic review of economic evaluations of mHealth solutions. *PLoS One* 2017;12:e0170581.
- 52 Badawy SM, Kuhns LM. Economic evaluation of text-messaging and smartphone-based interventions to improve medication adherence in adolescents with chronic health conditions: a systematic review. *JMIR Mhealth Uhealth* 2016;4:e121.
- 53 Garritty C, Gartlehner G, Nussbaumer-Streit B, et al. Cochrane rapid reviews methods group offers evidence-informed guidance to conduct rapid reviews. *J Clin Epidemiol* 2021;130:13–22.