Clinical Child and Family Psychology Review (2022) 25:413–434
https://doi.org/10.1007/s10567-022-00385-5

Promoting Mental Health in Parents of Young Children Using eHealth Interventions: A Systematic Review and Meta-analysis

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Accepted: 5 February 2022 / Published online: 20 February 2022

Abstract

Parent stress and mental health problems negatively impact early child development. This study aimed to systematically review and meta-analyze the effect of eHealth interventions on parent stress and mental health outcomes, and identify family- and program-level factors that may moderate treatment effects. A search of PsycINFO, Medline, CINAHL, Cochrane and Embase databases was conducted from their inception dates to July 2020. English-language controlled and open trials were included if they reported: (a) administration of an eHealth intervention, and (b) stress or mental health outcomes such as self-report or clinical diagnosis of anxiety and depression, among (c) parents of children who were aged 1–5 years old. Non-human studies, case reports, reviews, editorials, letters, dissertations, and books were excluded. Risk of bias was assessed using the National Institutes of Health (NIH) Study Quality Assessment Tools. Random-effects meta-analyses of standardized mean differences (SMD) were conducted and meta-regressions tested potential moderators. 38 studies were included ($N = 4360$ parents), from 13 countries (47.4% USA). Meta-analyses indicated eHealth interventions were associated with better self-reported mental health among parents (overall SMD = .368, 95% CI 0.228, 0.509), regardless of study design ($k = 30$ controlled, $k = 8$ pre-post) and across most outcomes ($k = 17$ anxiety, $k = 19$ depression, $k = 12$ parenting stress), with small to medium effect sizes. No significant family- or program-level moderators emerged. Despite different types and targets, eHealth interventions offer a promising and accessible option to promote mental health among parents of young children. Further research is needed on moderators and the long-term outcomes of eHealth interventions. Prospero Registration: CRD42020190719.

Keywords eHealth · Parent · Mental health · Stress · Meta-analysis

Introduction

Families have faced unprecedented challenges during the COVID-19 pandemic. Our recent family health research of 3000 Canadian families (Cameron et al., 2020) found that more than 50% of mothers are experiencing clinically significant psychosocial distress, including depression (48%), anxiety (67%), and relationship problems (19%). Pandemic stressors are exacerbating domestic conflict (Arenas-Arroyo et al., 2021), parenting requirements such as loss of regular childcare (Neece et al., 2020; Patrick et al., 2020), financial problems (Cameron et al., 2020; Gassman-Pines et al., 2020), and loneliness (Killgore et al., 2020; Li & Wang, 2020). These pandemic-related impacts are of particular concern given that children exposed to adversities such as maternal mental illness, cumulative stress, and unsupportive parenting are at-risk for health and developmental

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impairments. For example, exposure to maternal depression in the first 5 years of life is linked to alterations in physiological regulation, cognitive impairments, and mental illness, with up to 60% of exposed children developing psychological disorders during their life course (Rahman et al., 2013; Rasic et al., 2014). Cumulative parenting stress (e.g., life stress, daily hassles) when children are 3 to 5 years old is associated with poor child functioning (e.g., negativity, behavioural problems) at 5 years of age as well as negative parent–child relationship quality (e.g., less positive affect, more conflict) (Crnic et al., 2005).

Innovative programs are needed to manage stress and treat widespread mental health problems among parents and buffer children from serious stressors of the COVID-19 pandemic. Interventions to promote parent mental health capacities during the first 5 years of a child's life are expected to yield high health and economic benefits (Doyle et al., 2009), and optimize the chances that children become healthy and productive members of society (Campbell et al., 2014). For example, an individual participant data meta-analysis of 14 randomized trials indicated that the Incredible Years parenting programme for families with children aged 2–10 years old is associated with significant improvement in child behavior and reduced health and social service utilization (e.g., hospital/doctor visits, psychological and social work services, educational resources) costs (Frances et al., 2017). Early interventions can also prevent the long-term consequences of parent mental illness from becoming imbedded in children's biological and behavioral development (Bernard-Bonnin et al., 2004). Moreover, in a three-year patient-oriented research-priority setting initiative (Bright et al., 2018), parents of young children (from conception to age 2) identified their top priority as support for families to develop healthy coping and emotion regulation (Brockway et al., 2021). Families also wanted access to evidence-based information, tailored to their needs, delivered in timely formats (Brockway et al., 2021).

With limited access to in-person services during the pandemic due to the restrictions and measures put in place to limit the spread of COVID-19, there is an unprecedented need for accessible delivery of programs for parents. eHealth is an emerging field focused on delivery of health services and information through or enhanced by Web-based programs, remote monitoring, teleconsultation, and mobile device-supported care (World Health Organization, 2011). eHealth can also help overcome barriers to in-person mental health care faced by families such as stigma, long waitlists and provider unavailability, financial and logistical issues with transportation, childcare and missed work, limited insurance coverage for private services, limited access to evidenced-based treatments in rural areas, and preferences by mothers for accessing in-home mental health services (Dennis & Chung-Lee, 2006; Flynn et al., 2010; Kim et al., 2010; Osborn et al., 2020; Smith et al., 2019). Parents face many challenges with managing their own health, relationships, and careers while balancing taking care of their children's health, promoting their social and emotional development, and overseeing their education. Engagement in, and success of, treatment may be hindered by parents believing that they should not experience distress, by thinking their children's needs should be tended to before their own, or due to fear of being judged as a bad parent or fear of losing custody of their children (Abrams et al., 2009; Anderson et al., 2006). General mental health services may not be as effective because the unique stressors and beliefs about parenthood are not adequately addressed.

Evidence-based eHealth programs have been developed for the prevention (Deady et al., 2017) and treatment (Păsărelu et al., 2017) of depression and anxiety, often with large to medium effect sizes. However, the use of eHealth is a relatively new area in family care. To date there have been only a few eHealth-related meta-analyses, including four looking at online or technology-assisted parenting programs (Florean et al., 2020; Harris et al., 2020; Spencer et al., 2020; Thongseiratch et al., 2020) and one of telehealth family therapy programs (McLean et al., 2021), all with parent mental health as secondary outcomes. Some recent meta-analyses have also examined eHealth interventions for postpartum mental health (Feng et al., 2021; Zhao et al., 2021; Zhou et al., 2020), which represents a distinct period with unique challenges and care provisions where treatment needs and content would differ from that after infancy. However, there have been no systematic reviews or meta-analyses of the literature that identifies the effectiveness of a broader range of eHealth programs on mental health among parents of young children, specifically. There is thus a clear need to synthesize the findings to date on the potential for eHealth interventions to promote mental health among parents of young children, as well as improve our understanding of the factors that influence treatment response.

The present study is a systematic review and meta-analysis of available data on eHealth interventions and mental health outcomes of parents with young children (1–5 years of age). The objectives of the current study were to: (1) meta-analyze the effect of eHealth interventions on parent stress and mental health such as anxiety and depression symptoms, and (2) identify family- and program-level factors that may moderate the magnitude of treatment effects. Potential moderators for consideration included family-level demographics (such as child age) and baseline severity (of child and parent symptomatology), as well as program-level characteristics (such as intervention target, comparison, delivery, modality, retention and engagement) and study quality.

Methods

This investigation follows the methods outlined by the Cochrane Collaboration's Handbook (Higgins et al., 2011) and the standards set by Preferred Reporting Items for Systematic review and Meta-Analysis (PRISMA) (Moher et al., 2015; Page et al., 2020). The protocol for this study was registered with Prospero (CRD42020190719) through the University of York Centre for Reviews and Dissemination (MacKinnon et al., 2020).

Eligibility Criteria

The methods for this review follow the Population, Intervention, Comparator, Outcome (PICO) framework (Schardt et al., 2007). The population of interest was parents (adults over 18 years of age) who are the biological or primary caregivers of young children (mean or 25% of sample aged 1 to 5 years, 11 months old). The current review included studies that evaluated eHealth interventions and parent mental health outcomes. eHealth interventions could be administered to parents alone or with their children, with or without referral, targeting a wide range of content including parent mental health, parenting skills, and child behaviour. Programs that comprised additional components utilizing technology (e.g., texting, video-conferencing) were included, whereas non-adapted programs that were simply delivered via telehealth (e.g., manualized CBT over the phone) were excluded in order to provide a more robust evaluation of interventions designed for eHealth, which would help inform further program development. In terms of comparators, both controlled (e.g., randomized controlled trials or those with comparison groups, such as active conditions, waitlists, treatment as usual or standard care) and pre-post (e.g., open trials) design studies were included given this is a relatively new field. The outcome of interest was parent mental health, such as anxiety, depression, and/or stress; studies were included that assessed level of symptomatology (as measured on validated self-report scales) or change in clinical diagnosis (using either the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric, 2013) or the International Classification of Diseases (World Health Organization, 1993) Mental and Behavioural Disorders criteria and determined using a diagnostic interview or assessment and/or information available from medical record review).

Secondary outcomes of interest (not required for inclusion) related to feasibility and acceptability of eHealth interventions for parents included engagement (e.g., number or percent of video/session/homework completion), retention (e.g., $<20\%$ missing data or drop-outs), and participant satisfaction (e.g., subjective reports).

Search Strategy

Relevant literature was identified through a comprehensive search of five electronic databases including Cochrane, Embase, Medline and PsycINFO via OVID, and CINAHL via EBSCOhost, from inception to July 2020. In addition, we hand searched the references of reviews and meta-analyses from the database search, and checked whether data from protocols, posters and dissertations from the database search had been subsequently published. Search criteria was constructed collaboratively with a research librarian with expertise in the area of psychology. The search terms included database specific controlled vocabulary, field codes, operators, relevant keywords, and subject headings to identify the participant population (parents), the exposure (eHealth interventions), and the outcome (mental health). A broad list of search terms to capture parental stress and mental health problems were included (see Supplementary Material for the full list). Studies were restricted to those published in English.

Study Selection

After all relevant articles were identified and duplicates removed using Covidence Systemic Review software (Veritas Health Innovation, http://www.covidence.org), two reviewers (KP and KS) independently screened the titles and abstracts to determine eligibility for inclusion in the full-text review, and a third reviewer (ALM) supervised and reviewed 100 records to ensure $>85\%$ consistency. Peer-reviewed studies that reported original data on eHealth intervention outcomes for parents of young children (mean or 25% of sample within 1–5 years, 11 months old) including anxiety, depressed mood, and/or stress were retained for full-text review, while non-human studies, case reports, reviews, editorials, letters, dissertations, and books were excluded. The two reviewers subsequently conducted a full-text review to determine eligibility for inclusion in the systematic review and meta-analysis, and discrepancies were resolved by consensus with the third reviewer. Where multiple studies using data from the same larger study met inclusion criteria, consensus was used to determine which would be included, based on having the largest and least restricted sample and/or most recent publication date. Study investigators were contacted by email to confirm population criteria (i.e., children's age) if not reported.

Data Extraction

The following data were extracted: general study information (e.g., year, country, design, comparison group, sample size), participant demographics (e.g., age, race/ethnicity, gender/sex, income, education), description of the eHealth intervention (e.g., target, delivery method, duration), methodology (e.g., recruitment, randomization, comparison, statistical analysis), mental health outcomes (e.g., type of distress, measurement tool, means and standard deviations of scores), as well as any available feasibility and acceptability information (e.g., engagement, retention, satisfaction). Data extraction was conducted independently by the two reviewers (KP and KS) and discrepancies were resolved by consensus with the third reviewer (ALM). Study investigators were contacted by email to obtain outcome data (e.g., means and standard deviations for measures of mental health) if not reported.

Quality Assessment

Study quality was assessed using the National Institutes of Health (NIH) Study Quality Assessment Tools for Controlled Intervention Studies and for Before-After (Pre-Post) Studies with No Control Group (NIH, 2020), which include 14 and 12 items, respectively, to evaluate studies for potential flaws in *reported* methods or implementation, including sources of bias such as selection, performance, attrition and detection, as well as confounding and power. The last item of the pre-post tool, regarding interventions conducted at group level, was removed as it was not applicable to any of the included studies. Study quality was assessed independently by the two reviewers (KP and KS), and discrepancies were resolved through consensus with the third reviewer (ALM). Total scores were converted to percentages (Maass et al., 2015) for ease of comparability and sensitivity analyses. Scores of 50.0% or above on the NIH Quality Assessment Tools indicate good quality (Maass et al., 2015). The NIH tools are commonly used and recommended (Ma et al., 2020).

Data Analysis

All analyses were conducted with the Comprehensive Meta-Analysis (CMA; Version 3.0) software (Borenstein et al., 2019). Random-effects models were used to be conservative due to presumed heterogeneity across studies (due to differences in sample, interventions, and outcome measures), using the DerSimonian and Laird estimator (DerSimonian & Laird, 1986). A combined mean treatment effect was computed for studies with multiple comparisons and/or outcomes (Borenstein, 2009) and standardized mean differences (SMD) were compared across studies to account for the use of different measurement tools (Egger et al., 2008). The overall meta-analysis used the inverse variance method to compute a pooled SMD point estimate and a Hedge's *g* effect size, with 95% confidence intervals (CI), for eHealth interventions across all included studies (using composite scales over subscales where available). A positive SMD estimate indicates that those in the eHealth intervention group had a greater decrease in symptoms than those in the comparison group in controlled studies, or that symptoms significantly decreased after receiving the eHealth intervention in pre-post studies. SMD and Hedge's *g* of 0.20, 0.50, and 0.80 can be interpreted as small, medium, and large effect sizes, respectively (Cohen, 1988; Faraone, 2008). Stratified meta-analyses were also conducted by study type (controlled, pre-post) and outcome (anxiety, depression, general stress, parenting stress, trauma). Meta-regression with random effects models were conducted when there were enough studies ($k = 3$) that included a moderator of interest, those without data were excluded. Potential moderators included: family-level demographics (child age, parent ethnicity, education, income, and partnered status) and baseline severity (of child and parent mental health symptomatology), as well as program-level characteristics (intervention target, comparison group, delivery, modality, retention and engagement) and study quality.

Heterogeneity was assessed using Cochrane's *Q* test, which evaluates variance between studies, and the I^2 index, which evaluates the proportion of heterogeneity between studies (Higgins & Thompson, 2002). Potential publication bias was assessed through visual inspection of funnel plots as well as Begg and Mazumdar's rank correlation and Egger's regression intercept tests. A sensitivity analysis was conducted to determine the impact of each study on the meta-estimate by sequentially removing one study at a time. Methodologically flawed studies were retained if the analysis indicated they did not significantly affect the meta-estimate (Paulson & Bazemore, 2010; Stroup et al., 2000).

Results

Literature Search

As outlined in Fig. 1, the database search resulted in 8128 records and hand searching resulted in 40 records, for a total of 8168 imported into Covidence. Following removal of 3202 duplicates, the abstracts of 4966 articles were screened. The full-text of 225 articles were reviewed for eligibility (with 29 discrepancies resolved by the third reviewer, the proportion of agreement was 87%). Investigators of 13 studies were contacted to clarify the parent population (i.e., children's age), of which 7 were excluded for not meeting criteria (Bragadóttir, 2008; Kaplan et al., 2014; Kuhlthau et al.,

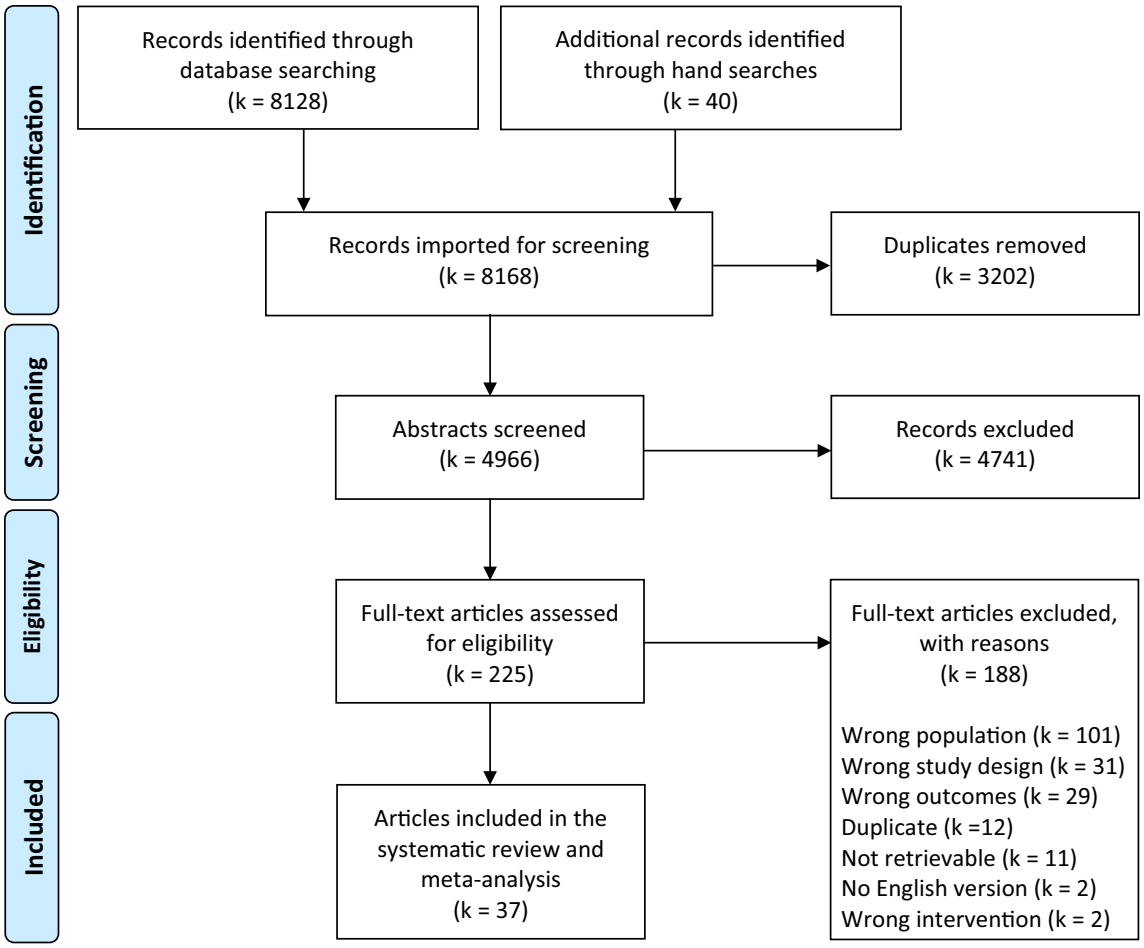


Fig. 1 Flow diagram

2019; Love et al., 2016; Phipps et al., 2020; Sairanen et al., 2020) or not responding (Moghimi et al., 2018), while 6 were included (Book et al., 2020; James Riegler et al., 2020; Jones et al., 2017; Nicholson et al., 2009; Sheeber et al., 2017; Whitney & Smith, 2015). A total of 37 articles met inclusion criteria, with one comprising two separate studies (David et al., 2017), therefore 38 studies (testing 34 unique interventions) were included.

Study Characteristics

Characteristics for each of the 38 eligible studies are reported in Table 1. Studies were published between 2000 and 2020, with samples ranging from 5 to 464 individual parents, from 13 countries, where the majority ($k = 18$) came from the United States. The total sample included in the meta-analysis was $N = 4360$, with 34 studies having samples composed of 51% or more mothers. Of the 38 studies included, eight comprised pre-post designs and 30 controlled designs, including 27 randomized and three non-randomized trials. Among the controlled studies, 19 used a non-specific comparison (e.g., waitlist, standard care, treatment as usual) not intended to be therapeutic, 9 used a specific active comparison (e.g., booklet or non-eHealth version of intervention, education or health promotion) intended to be an active condition (Wampold, 2015), and 2 used both. In terms of program delivery and modality, 23 of the eHealth interventions were classified as fully digital (3 App-based, 20 Web-based; e.g., online modules), 9 were clinician led (e.g., phone, video-conferencing, etc.), and 6 included both digital components and clinician contact. 22 interventions targeted parent mental health or stress (in general or related to having children with medical conditions) and 16 targeted parenting skills or children's behaviour problems. In terms of recruitment, 10 studies were open (e.g., online ads & posters), 16 used specific settings (e.g., clinics, hospitals, schools), 4 allowed both program/clinical referral (e.g., Head Start Centers) and open recruitment (e.g., self-referral, ads), 3 were follow-up studies, and 5 did not report.

In the 32 studies that reported children's age, the means ranged from 1.6 to 6.6 years old, and in the 31 studies that reported parents' age, the means ranged from 24.4 to

Table 1 Characteristics of Included Studies

Source	Design; comparison group(s)	Sample size	Parent age M (SD); female, %	Study population	Country	Race/ethnicity majority, %	Child age M (SD) or range; Boys, %	Intervention name; duration	E-health method	Relevant findings M (SD) or *b* (p)[c]	Study quality rating[b]
Controlled studies ($n=30$)											
Baker et al. (2015)	Controlled; waitlist	15	39; 80	Parents of adopted children	USA	Caucasian, 73.3	3.51[a]; 60	Emotional attachment and emotional availability (EA2); 6 weeks	Online video-conferencing	PSI: I: 225 (26.6) C: 233.6 (30.9)	50.0
Book et al. (2020)	RCT; active (no video)	50	36.6[a]; 85	Parents of children scheduled for inguinal hernia repair	Germany	NR	2.6; 76	Video educating parents on hernia repair; NR	Online video	STAI: I: 50 (10) C: 58 (11)	57.1
Boyle et al. (2017)	RCT; Standard Care	200	36.05[a]; 100	Mothers of children with a food allergy	United Kingdom	"Non-white", 59	4.00[a]; 61	Psychoeducation food allergy information; 6 weeks	CBT sessions with phone calls	STAI-S: I: 31.9 (10.2) C: 34 (10.2) STAI-T: I: 35.9 (10.1) C: 37.2 (9.1) PSS: I: 14.5 (6.5) C:15.3 (6.1)	42.9
Breitenstein et al. (2016)	RCT; active (health promotion)	83	30–49 (63.3%); 100	Low-income, ethnic minority parents	USA	African-American, 64.6 Hispanic, 30.4	3.52; 57	The ezPAR-ENT Program; 12 weeks	App	PSI-SF: I: 70.2 (19.3) C: 70.95 (21.0)	57.1
Cernvall et al. (2015)	RCT; waitlist	58	38 (7.2); 67	Parents of children with cancer	Sweden	NR	Median = 5; 46	Self-help CBT principles; 10 weeks	Online modules	BDI-II: I: 12.9 (9.5) C: 19.8 (8.3) BAI: I: 10.1 (10.0) C: 11.3 (9.4) PCL-C I: 35.9 (14.5) C: 45.1 (13.0)	50.0
David et al. (2017) (Study 1)	RCT; Waitlist	42	32.9 (5.3); 86	NR	Romania	NR	5.9 (2.6); NR	Attention Bias Modification (ABM); 1 week	Online sessions	PSS: I: 34.7 (6.0) C: 35.2 (11.36)	42.9
David et al. (2017) (Study 2)	RCT; active (no ABT)	53	35.9 (5.3); 91	NR	Romania	NR	6.45 (3.3); NR	Rational Positive Parenting program (Rppp) + ABM; 1 week	Online sessions/ modules	PSS: I: 32.5 (9.1) C: 28.6 (7.86)	42.9

Table 1 (continued)

Source	Design; comparison group(s)	Sample size	Parent age M (SD); female, %	Study population	Country	Race/ethnicity majority, %	Child age M (SD) or range; Boys, %	Intervention name; duration	E-health method	Relevant findings M (SD) or *b* (p)[c]	Study quality rating[b]
Ehrensaft et al. (2016)	RCT; waitlist	52	24.37[a]; 100	Young post-secondary mothers	USA	NR	2–6; NR	Triple P Online (TPOL); 12 weeks	Website	PSI- SF: I: 70.5 (18.6) C: 77.5 (17.67)	42.9
Farris et al. (2013)	RCT; Active (Face-to-face intervention, booklet)	133	30.7 (5.9); 100	NR	USA	European-American, 81.6	2–3; 47	Adventures in Parenting; 12 weeks	Booklet with web sessions	SCL-D: I: 51.01 (5.21) C: 52.1 (6.6) SCL-A I: 44.1 (8.1) C: 43.1 (9.2) SCL-GS: I: 49.4 (6.73) C: 50.2 (8.1)	42.9
Fortier et al. (2015)	RCT; Standard care	80	32 (5); 92.3	Parents of children undergoing surgery	USA	Caucasian, 76.9	4.35[a]; 56	WebTIPS; 7 days	Website	STAI: I: 32.7 (7.9) C: 36.8 (7.1)	64.3
Franke et al. (2020)	RCT; waitlist	53	38.16[a]; 18.8	Parents of children with ADHD symptoms	New Zealand	European, 79.2	4; 71.7	TPOL; 16 weeks	Online modules	DASS-A: I: 3.01 (4.2) C: 5 (6.41) DASS-D: I: 3.53 (4.0) C: 6.96 (7.2) DASS-S: I: 9.65 (7.0) C: 13.9 (8.0)	57.1
Hemdi and Daley (2017)	RCT; TAU	62	33.64[a]; 100	Mothers of children with ASD	Saudi Arabia	NR	4.89[a]; N/a	"Models of stress and coping"; NR	App	HADS-A: I: 7.59 (2.09) C: 7.83 (2.64) HADS-D: I: 3.84 (2.49) C: 11.36 (3.42) PSI-SF: I: 116.18 (12.7) C: 139.4 (13.34)	85.7
Jones et al. (2017)	RCT; waitlist	97	36.63[a]; 78	Parents with a bipolar diagnosis	United Kingdom	Caucasian, 94.8	6.64; 2.08	Integrated bipolar parenting intervention (IBPI); 16 weeks	Online modules	PSI: I: 82.5 (18.9) C: 94.3 (23.9)	85.7

Table 1 (continued)

Source	Design; comparison group(s)	Sample size	Parent age M (SD); female, %	Study population	Country	Race/ethnicity majority, %	Child age M (SD) or range; Boys, %	Intervention name; duration	E-health method	Relevant findings M (SD) or *b* (p)[c]	Study quality rating[b]
Kierfeld et al. (2013)	RCT; waitlist	48	NR; NR	Parents of children with externalizing behaviour problems	Germany	German, 83.3	5.2 (.8); 50	"Behavioural family intervention"; 11 weeks	Self-help book with telephone	DASS: I: 55.3 (8.94) C: 68.9 (20.3)	64.3
Lefever et al. (2017)	RCT; waitlist	371	28.9 (5.8); 100	Parents at-risk of child maltreatment	USA	Hispanic, 46	4.6 (0.57); 56	Parent–child interaction (PCI); 1.5–4 weeks	In-person sessions with telephone	BDI-II: I: 7.45 (6.05) C: 7.66 (6.56)	64.3
MacKenzie and Hilgedick (2000)	Controlled; No intervention, or Active (booklet)	46	35.7 (5.1); 89.7	Parents with well-adjusted pre-school children	USA	Caucasian, 82.1	4.3 (0.73); 49.1	Computer-Assisted Parenting Program (CAPP); 4 weeks	Online modules	PSI: I: 117.19 (22.3) No intervention: C: 123.73 (23.2) Booklet: C: 120.5 (19.6)	21.4
Mascarenhas et al. (2018)	RCT; Waitlist	64	37, 100	Exercising for parents	USA	Caucasian, 67	2.85[a], NR	The Moms Online Video Exercise (MOVE); 8 weeks	Website with video-conferencing and mobile apps	PROMIS- A: (b = -1.1, p = .50) PROMIS-D: (b = -3.0, p = .05)	78.6
Mindell et al. (2011)	RCT; No intervention (regular routine)	264	30–39 (59%); 100	Parents of children with sleep disturbances	USA	NR	1.61 (.74); 49.6	Individualized recommendations for child sleep; 3 weeks	Internet	POMS-D I: 5 (7.9) C: 5.08 (8.7)	50.0
Monaghan et al. (2011)	RCT; waitlist	24	34.8 (6.2); 88	Parents of children with Type 1 diabetes	USA	Caucasian, 75	4.1 (0.8); 50	The Supporting Parents Program; 3 weeks	Telephone sessions	STAI-S: I: 37.4 (11.6) C: 37.5 (11.6) CESD: I: 13.5 (9.0) C: 16.33 (11.5)	35.7
Patton et al. (2020)	RCT; waitlist	42	35.2 (5); 97.6	Parents of children with hypoglycemia	USA	Caucasian, 95.20	4.4 (1.4); 59.5	REDCHip; 10 weeks	Online video-conferencing	HFS-PYC: I: 61.67 (19.27) C: 66.8 (12.8) PIP: I: 72.06 (27.9) C: 68.39 (30.9)	50.0

Table 1 (continued)

Source	Design; comparison group(s)	Sample size	Parent age M (SD); female, %	Study population	Country	Race/ethnicity majority, %	Child age M (SD) or range; Boys, %	Intervention name; duration	E-health method	Relevant findings M (SD) or *b* (p)[c]	Study quality rating[b]
Potharst et al. (2019)	RCT; waitlist	67	36.20; 100	Mothers with elevated stress levels	Netherlands	NR	3.5; 43	"Mindful parenting training"; 10 weeks	Online modules	PHQ-4: I: 3.11 (3.18) C: 3.3 (3.1) PSQ: I: 14.5 (2.8) C: 14.2 (3.3)	42.9
Raj et al. (2015)	RCT; active (web resources)	37	32.66[a]; 95	Parents of children hospitalized due to Traumatic brain injury	USA	Caucasian, 62	5.4 (2.1); 68	I-InTERACT; 6 months	Web-based parent program + videoconferencing	CESD: I: 12.71 (11.35) C: 7.73 (6.4) SCL: I: 50.47 (12.74) C: 52 (9.8) PSI: I: 54.31 (36.4) C: 52.2 (33.8)	50.0
Sanders et al. (2008)	RCT; delayed intervention	454	NR; 94.7	N/a	Australia	White, 94.7	5.5 (2.24); 64.8	Driving mum and dad mad; 10 weeks	TV series	DASS-T: I: 23.4 (23.9) C: 29.7 (26.9)	50.0
Sanders et al. (2014)	RCT; active (booklet)	193	38.18[a]; NR	Parents of children with of disruptive behaviour problems	New Zealand	European, 90	5.63 (1.64); 67	TPOL; NR	Online modules	DASS-A: I: 1.65 (2.8) C: 2.04 (3.6) DASS-D: I: 3.52 (5.36) C: 3.86 (5.91) DASS-S: I: 6.9 (5.7) C: 7.7 (6.7)	42.9
Sheeber et al. (2012)	RCT; TAU	70	31[a]; 100	Mothers with depression	USA	Caucasian, 93	4.6[a]; 50	Mom-Net; 14 weeks	Online modules	BDI:II: I: 13.4 (10.4) C: 22.5 (11)	85.7
Sheeber et al. (2017)	RCT; waitlist	266	31.8 (7.2); 100	Low-income mothers	USA	Caucasian, 79.3 Hispanic, 11.7	4.4 (1.3); 48.8	Mom-Net; 26 weeks	Online modules	PHQ-9: I: 6.27 (5) C: 7.9 (5.4)	71.4
Sourander et al. (2016)	RCT; active (education)	464	NR; NR	Parents of children with disruptive behaviour problems	Finland	NR	4; 61.9	Strongest families smart website; 11 weeks	Online sessions	DASS: I: 14.9 (1) C: 17.6 (1)	50.0

Table 1 (continued)

Source	Design; comparison group(s)	Sample size	Parent age M (SD); female, %	Study population	Country	Race/ethnicity majority, %	Child age M (SD) or range; Boys, %	Intervention name; duration	E-health method	Relevant findings M (SD) or *b* (p)[c]	Study quality rating[b]
Sveen et al. (2016)	RCT; waitlist	62	37.35[a]; 68	Parents of children with severe burns	Sweden	NR	5.80[a]; 55	Caring for a child with burns; 6 weeks	Online modules	MADRS: I: 4.6 (6.3) C: 6 (6.9) PSS: I: 23.3 (7.3) C: 22.9 (9) PSI: I: 50.7 (10.6) C: 51.1 (20.6)	50.0
Wang et al. (2018)	Controlled; standard care	101	31–40 (55%); 72	Parents of children with acute lymphoblastic leukemia	China	Han Nationality, 99	3–7 (47%); 64	Care assistant; 3 months	App	SDS: I: 49.1 (12.2) C: 49.5 (10.8) SAS: I: 50.6 (12.9) C: 55.9 (13.7)	35.7
Whitney and Smith (2015)	RCT; waitlist	120	41 (N/a); 100	Mothers of children with socially disruptive conduct behaviour	USA	Caucasian, 91	1.6–5; 72	NR; 8 weeks	Online journaling	PSI-SF: I: 36.97 (1.12) C: 35.4 (0.79)	42.9
Pre-post studies ($n=8$)											
Fidika et al. (2015)	Pre-post	23	37 (6.2); 91.3	Caregivers of children with cystic fibrosis	Germany	NR	5.8 (4.8); 53.8	WEP-CARE; 3.5 months	Writing-therapy	HADS-A: pre: 11.4 (2.6), post: 6.7 (2.6) HADS-D: pre: 16.96 (6.6), post: 12.09 (7.04)	81.8
Nicholson et al. (2009)	Pre-post	22	36.59 (8.3); 100	Mothers with serious mental illness	USA	Caucasian, 77.2	0–5 (26.9%); 48.1	Family options; 6 months	In-person sessions with phone calls	PSS-FOA: pre: 16.95 (11.45), post: 14.4 (12.86) BSI: pre: 62.86 (10.69), post: 60.9 (11.6)	72.7
Piotrowska et al. (2020)	Pre-post	456	37.7 (8.7); 62.9	Parents of children with conduct problems	Australia	NR	5.8 (3.5); 60.3	ParentWorks; 6 weeks	Online modules	K6: Pre: 16.39 (6.3), post: 13.15 (6.5)	63.6

Table 1 (continued)

Source	Design; comparison group(s)	Sample size	Parent age M (SD); female, %	Study population	Country	Race/ethnicity majority, %	Child age M (SD) or range; Boys, %	Intervention name; duration	E-health method	Relevant findings M (SD) or *b* (p)[c]	Study quality rating[b]
Rayner et al. (2016)	Pre-post	11	40.2 (6.7); 100	Parents of seriously ill children	Australia	NR	3.0 (3.6); 50	TAB Online; 2 months	Video-conferencing	DASS-A&D: pre: 7.43 (9.23), post: 6.98 (8.59) DASS-S: pre: 12.4 (8.9), post: 11.89 (8.2) PCL-C: pre: 34.2 (12.3), post: 33.27 (11.7)	63.6
James Riegler et al. (2020)	Pre-post	41	M > 30; "Predominantly men"	Military veterans	USA	NR	5.95 (1.85)	Online parenting ProTips (OPPT); 14 weeks	Earpiece telehealth with online modules	CESD: pre: 23.49 (13.1), post: 20.65 (13.06) PSI: pre: 93.37 (25.64), post: 79.1 (26.5)	72.7
Skranes et al. (2015)	Pre-post	99	33.1 (5.9); 100	Parents of "sick children"	Norway	NR	1.6 (1.6); NR	Sick Child www.syktbarn.no; 6 to 12 months	Website	PHCS: pre: 12 (3.7), post: 12 (3.9)	54.5
Wade et al. (2007)	Pre-post	5	38.4 (N/a); 100	Parents of children with sleep problems	USA	Hispanic, 60; African-American, 40	4.9; 20	"Two-session Group parent training"; 28 days	In-person workshop with telephone	BDI-II: pre: 3.33 (1.2), post: 1.37 (0.89) PSI-SF: pre: 10.4 (12.7), post: 2.2 (2.7)	81.8
Wright et al. (2017)	Pre-post	32	35.1 (5.8); 78	Parents of children receiving surgery	Canada	Caucasian, 81.3	5.2 (1.04); 69	I-PPP; NR	Online modules	STAI-S: pre: 35.32 (10.8), post: 30.87 (10.2)	72.7

M mean; *SD* standard deviation; *b* beta regression coefficient, *p* p value, *I* intervention group, *C* control group, *NR* not reported, *RCT* randomized controlled trial, *TAU* treatment as usual, *BAI* Beck Anxiety Inventory, *BDI-II* Beck Depression Inventory, *CES-D* Center for Epidemiologic Studies Depression Scale, *DASS* Depression Anxiety and Stress Scale, *DASS-A* DASS anxiety scale, *DASS-D* DASS depression scale, *DASS-S* DASS stress scale, *HADS* Hospital Anxiety and Depression Scale, *HADS-A* HADS anxiety score, *HADS-D* HADS depression score, *HFS-PYC* Hypoglycemia fear survey for parents of young children, *K6* K-6 Psychological Distress Scale, *MADRS* Montgomery-Asberg Depression Scale, *PHQ-4 & 9* Patient Health Questionnaire, *POMS* Profile of Mood States, *POMS-D* POMS depression score, *PROMIS* Patient-Reported Outcomes Measurement Information System, *PROMOS-A* PROMIS anxiety score, *PROMIS-D* PROMIS depression score, *PIP* Pediatric Inventory for Parents, *PSI* Parenting Stress Index, *PSI-SF* PSI- Short Form, *PSS* Perceived Stress Scale, *PSQ* Perceived Stress Questionnaire, *PHCS* Perceived Health Competence Scale, *PCL-C* PTSD Checklist-Civilian Version, *SCL* Symptom Checklist 90-R, *SCL-A* SCL anxiety score, *SCL-D* SCL depression score, *SCL-GS* SCL global severity of symptoms score, *SDS* Symptom Distress Scale, *STAI* State-Trait Anxiety Inventory, *STAI-S* STAI state anxiety scale, *STAI-T* trait anxiety scale

[a]Weighted average

[b]NIH Quality Assessment Tools ratings (total scores converted to percentages)

[c]Only one study did not provide means and standard deviations, in this case CMA computed an effect estimate based on sample size and *p* value

41.0 years old. Of the 23 studies that reported on race or ethnicity, 18 studies had samples where more than half of the participants were of European descent. Of the 29 studies that reported education, seven samples were classified as disadvantaged following the procedure used by Penner-Goeke et al. (2020): i.e., mean or > 15% of sample without high school completion (American average in 2016-2017 school year; McFarland et al., 2019). 12 studies had samples that were classified as income disadvantaged following the procedure used by Penner-Goeke et al. (2020): i.e., mean or > 10.5% (American poverty rate in 2019) (Semega et al., 2020) of the sample below the American poverty level ($21,720) for a family of three in 2020 (Amadeo, 2021), or if income data were not collected a subjective determination was based on other information (e.g., employment status, sampling methods, representativeness). Of the 27 studies that reported marital status, the proportion of partnered (e.g., married, in a relationship) parents ranged from 27.8 to 100%. Of the 16 studies that reported child baseline data, eight studies had mean child behaviour problems above a clinical cut-off. Of the 32 studies that reported parent baseline data, 12 studies had mean parent mental health problems above a clinical cut-off level.

As for mental health outcomes, the majority of studies either reported symptoms of depression ($k = 19$) or anxiety ($k = 17$). 12 studies reported parenting stress, 10 reported general stress, and 4 reported on symptoms of trauma. 5 studies only reported composite scores (e.g., combined scores of anxiety, depression and stress). All of the included studies used self-report questionnaires, only one reported using a scale that had not been validated yet (Skranes et al., 2015). The full breakdown of outcome measures by study is available in the Supplementary Materials. The investigator of one study was contacted to obtain outcome data (Patton et al., 2020).

Quality Assessment

The majority of studies (71.1%) scored 50.0% or above on the NIH Quality Assessment Tools (see last column in Table 1), indicating good quality and overall low risk of bias (Maass et al., 2015). Selection bias was low, as 90.0% of the controlled studies were described as randomized, 73.3% used adequate sequence generation, but only 26.7% reported allocation concealment, while all of the pre-post studies had prespecified eligibility criteria and were deemed to comprise representative samples. There is a low risk of confounding, as 73.3% of the controlled studies reported no differences between groups at baseline. There is some risk of performance bias as only three of the controlled studies reported blinding of participants and providers, likely due to the behavioral nature of the interventions (versus pharmacological), and only three reported that other interventions were avoided or were similar for both groups. However, 56.7% of controlled studies were deemed to have high adherence (based on author statements or reports indicating > 50% completion such as session attendance, module completion, video access) and all of the pre-post studies reported the intervention was delivered consistently. There is potential risk of detection bias as only six of the included studies reported blinding of outcome assessors, however all but one reported using validated self-report measures. In terms of attrition bias, 55.3% of included studies reported < 20% drop-outs and 60.5% reported accounting for missing data in their analyses.

eHealth Treatment Effects on Parent Mental Health

Findings from the meta-analyses, as outlined in Fig. 2, indicated that overall eHealth interventions are associated with significant improvement in mental health symptomatology among parents ($SMD = 0.368$, $SE = 0.072$, 95% CI: 0.228, 0.509, $p < 0.001$; Hedges's $g = 0.362$, $SE = 0.071$, 95% CI: 0.224, 0.501, $p < 0.001$). Significant heterogeneity was observed among studies ($Q = 175.09$, $p < 0.001$, $I^2 = 78.87$). The Egger's regression intercept was non-significant ($b = -0.596$, $t = 0.916$, $p = 0.366$), however Begg and Mazumdar rank correlation was significant (Kendall's $tau = 0.228$, $\chi^2 = 161$, $p = 0.044$), and the funnel plot (Fig. 3) indicated slight asymmetry, which suggests some evidence of publication bias among studies.

Stratified meta-analyses indicated that eHealth interventions are associated with improved mental health symptoms regardless of whether the study had a control group or not ($SMD_{controlled} = 0.339$, $SE = 0.093$, 95% CI: 0.157, 0.521, $p < 0.001$, Hedge's $g = 0.334$, $SE = 0.092$, 95% CI: 0.154, 0.514, $p < 0.001$; $SMD_{pre\text{-}post} = 0.463$, $SE = 0.124$, 95% CI: 0.221, 0.706, $p < 0.001$, Hedge's $g = 0.450$, $SE = 0.119$, 95% CI: 0.217, 0.683, $p < 0.001$), and across most of outcomes measured including anxiety ($SMD_{anxiety} = 0.533$, $SE = 0.140$, 95% CI: 0.259, 0.807, $p < 0.001$, Hedge's $g = 0.525$, SE = 0.138, 95% CI: 0.254, 0.796, $p < 0.001$), depression ($SMD_{depression} = 0.379$, $SE = 0.106$, 95% CI: 0.170, 0.587, $p < 0.001$, Hedge's $g = 0.372$, $SE = 0.104$, 95% CI: 0.168, 0.576, $p < 0.001$), and parenting stress ($SMD_{parenting\ stress} = 0.341$, $SE = 0.147$, 95% CI: 0.052, 0.630, $p = 0.021$, Hedge's $g = 0.330$, $SE = 0.142$, 95% CI: 0.051, 0.609, $p = 0.020$), but not general stress ($SMD_{stress} = 0.274$, $SE = 0.359$, 95% CI: − 0.430, 0.978, $p = 0.446$, Hedge's $g = 0.271$, $SE = 0.355$, 95% CI: − 0.426, 0.967, $p = 0.446$) or trauma ($SMD_{trauma} = 0.461$, $SE = 0.311$, 95% CI: − 0.148, 1.070, $p = 0.138$, Hedge's $g = 0.447$, $SE = 0.303$, 95% CI: − 0.147, 1.042, $p = 0.140$).

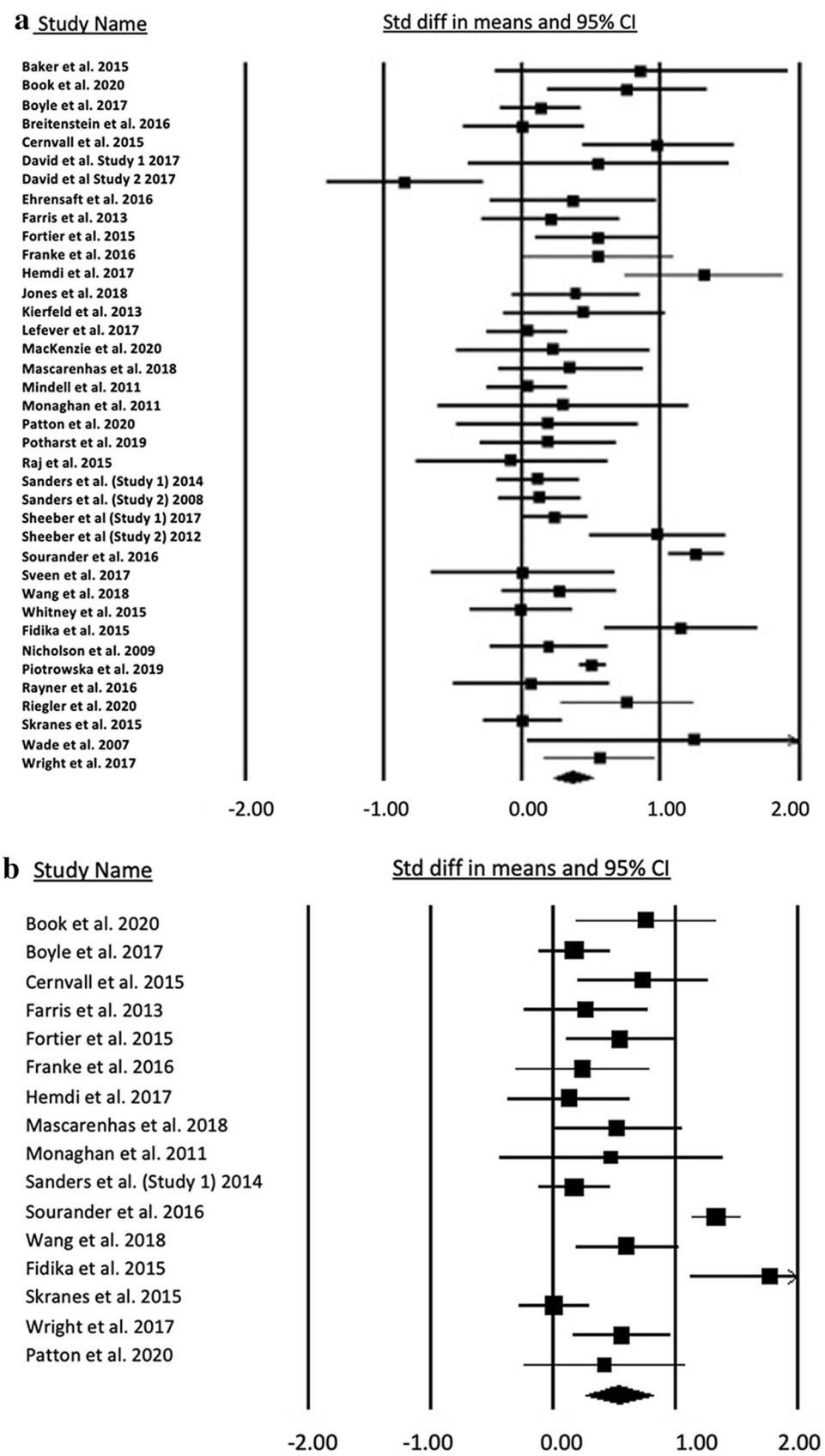
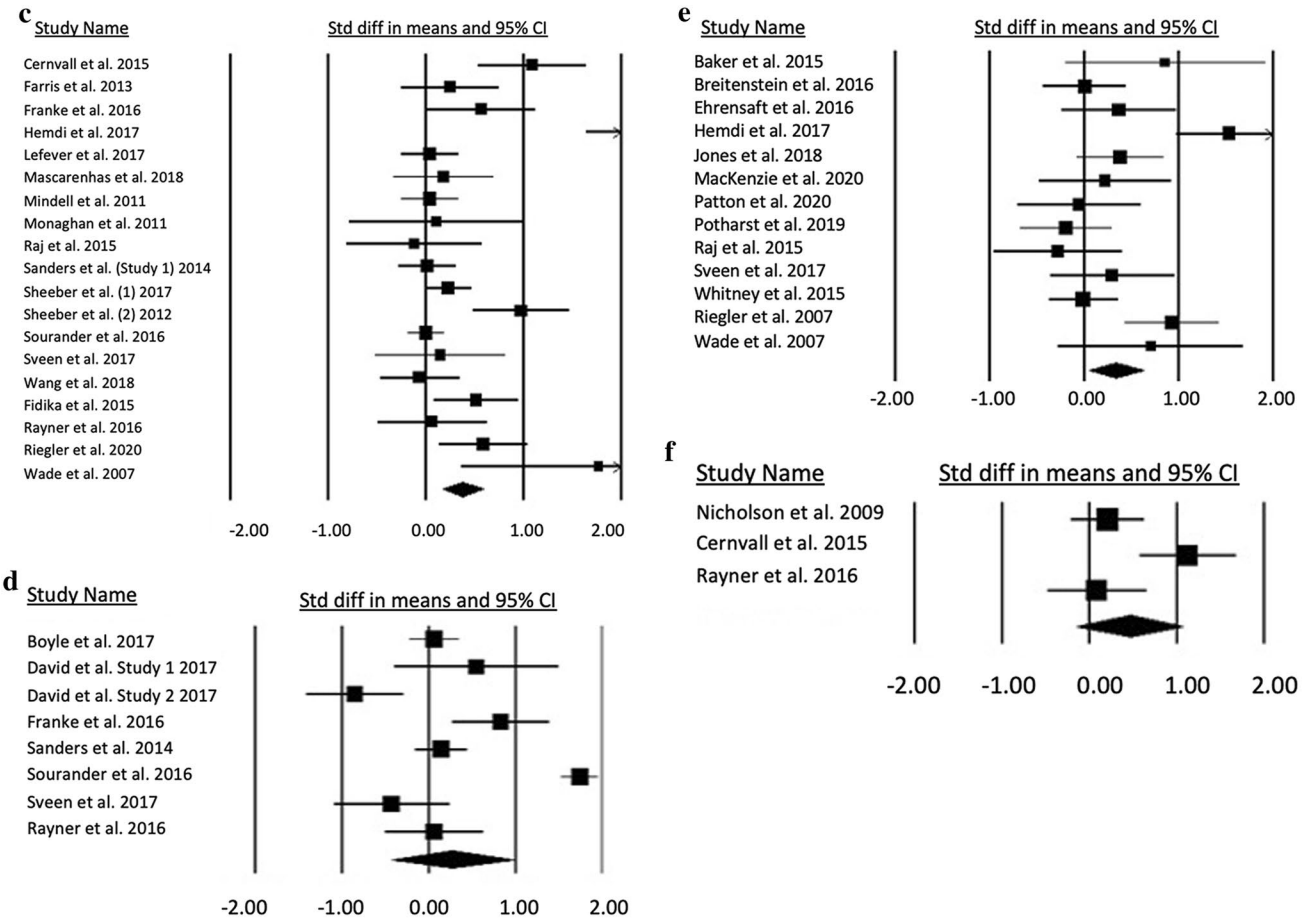


Fig. 2 Forest plots of e-health intervention standardized mean differences on parent mental health

Fig. 2 (continued)



Sensitivity Analyses

After systematically removing one study at a time, it was observed that four studies affected the meta-estimate of the effect size of parenting eHealth interventions by more than 5% (David et al., 2017; Fidika et al., 2015; Hemdi & Daley, 2017; Sourander et al., 2016). One study (David et al., 2017) affected the meta-estimate such that it made the estimate less conservative, although a significant association was still noted without the study included ($p < 0.001$). Three studies affected the meta-estimate such that they made the estimate more conservative; a significant association was still noted without the studies included ($p < 0.001$). Upon evaluation of study quality, two of the studies (David et al., 2017; Sourander et al., 2016) were deemed to be moderate quality (rated as 6 and 7 out of 14) and two studies were evaluated to be of high quality with one study being rated as 12 of 14 (Hemdi & Daley, 2017), and the other study being rated as 9 of 11 (Fidika et al., 2015). As such, all of the identified studies were included in the analyses.

Moderators of eHealth Treatment Effects

Results of the meta-regression indicated no statistically significant differences in the eHealth interventions' treatment effect by family- or program-level factors (see Table 2). However, higher study quality was associated with larger effect sizes.

Feasibility and Acceptability

In terms of feasibility, 22 studies reported on measures of engagement (e.g., session attendance, module completion, video access), of which there were 12 studies where the majority of the sample completed at least 75% of the intervention, and 18 where the majority completed at least 50%. Regarding retention, 21 studies reported a drop out rate of 20% or less. In addition, 16 studies reported on measures of acceptability (e.g., satisfaction, found helpful, would recommend), of which there were 13 studies where 75% of the sample or "high levels" indicated acceptability, and all had 50% or "high levels" of acceptability.

Discussion

The current systematic review and meta-analysis synthesized the literature on the effectiveness of eHealth interventions for promoting mental health among parents of young children. Meta-analyses of the 38 included studies indicated that eHealth interventions are associated with improved parental mental health, with small to medium effect sizes observed across trial designs (controlled or pre-post) and outcomes measured (symptoms of anxiety, depression, and parenting stress). No significant family- or program-level moderators of eHealth intervention effectiveness for parent mental health were identified. Results also suggested good feasibility and acceptability of eHealth interventions for parents of young children, with the majority of included studies reporting high levels of engagement, retention, and satisfaction among participants. These findings highlight the potential value of eHealth interventions for addressing unmet parent mental health needs, which may be particularly widespread during and following the COVID-19 pandemic.

Our findings demonstrate slightly higher effectiveness for improving parent mental health than other meta-analyses of online parenting and telehealth family therapy interventions, which reported small to moderate effect sizes, with Hedge's *g* ranging from − 0.29 to − 0.31 (McLean et al., 2021; Spencer et al., 2020; Thongseiratch et al., 2020). Prior meta-analyses focused exclusively on parenting or family health interventions with children ranging from 0 to over 18 years old, whereas the current investigation included a broad range of programs and focused on mental health outcomes among parents of young children. Similarly, meta-analyses of eHealth interventions for general mental health indicate small to moderate effects for depression (Massoudi et al., 2019). A recent meta review of meta-analyses specifically examining mobile apps for mental health in the general population also revealed small to medium effects (Lecomte et al., 2020). Finally, the pooled eHealth intervention effect we observed for parent mental health is comparable to the small to medium effect sizes reported in meta-analyses for in-person psychological interventions targeting parenting stress and maternal depression, which fall within the Hedge's *g* range of 0.30 to 0.64 (Burgdorf et al., 2019; Cuijpers et al., 2015). Therefore, eHealth interventions represent an accessible alternative that yield effect sizes that are comparable to traditional face-to-face psychotherapy for parent mental health.

The stratified meta-analyses results indicated a medium effect of eHealth interventions for parent mental health in pre-post studies, whereas controlled studies had a small effect. It is possible that treatment effects were obscured by symptom changes in the comparison groups. Indeed, small effects are often observed in waitlist groups (Steinert et al., 2017), perhaps due to participating in a mental health study and/or expectancies about eventually receiving treatment. Interestingly, moderation analyses in the current investigation indicated no statistically significant difference in eHealth treatment effects between studies that used active (e.g., in-person, education) vs. waitlist or usual care comparison groups.

We also found a medium effect of eHealth interventions for symptoms of anxiety, and small to moderate effects for symptoms of depression and parenting stress. Anxiety symptoms may be particularly responsive to eHealth intervention, whereas parents experiencing depression may struggle with motivation to engage in these forms of treatment with less clinical contact or guidance. This highlights the expected importance of incorporating behavioral activation in eHealth interventions. Results of the stratified analyses also indicated

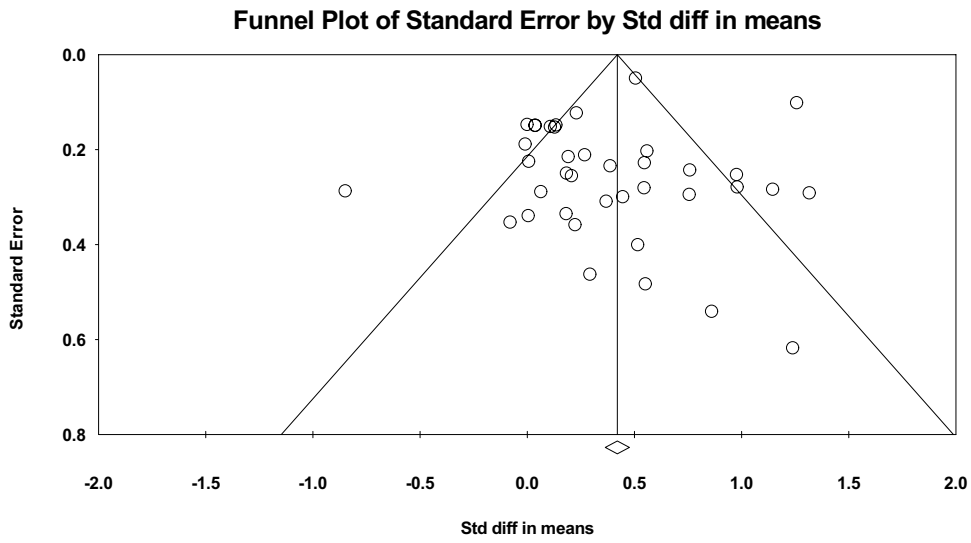


Fig. 3 Funnel plot of random effects for the standard error by standardized mean differences

Table 2 Meta-regression analyses of potential moderators of eHealth intervention effectiveness on mental health outcomes

Potential moderators	*n*	*β*	*SE*	95% CI	*Q*	*P*
Family-level						
Child age (*M*)	34	0.045	0.059	− 0.070, 0.160	0.59	0.443
European descent (%)	23	0.002	0.002	− 0.001, 0.005	1.19	0.275
Education disadvantage	29	− 0.0078	0.215	− 0.4291, 0.414	0.00	0.971
Income disadvantage	35	− 0.0320	0.161	− 0.347, 0.283	0.04	0.842
Married/partnered (%)	27	0.0000	0.004	− 0.007, 0.007,	0.00	0.994
Child MH at baseline[a]	15	− 0.0891	0.2855	− 0.649, 0.470	0.10	0.755
Parent MH at baseline[b]	32	0.236	0.163	− 0.083, 0.556	2.1	0.1476
Program-level						
Specific comparison group	28	− 1.870	0.210	− 0.598, 0.224	0.80	0.372
Parent targeted intervention	38	− 0.0538	0.1515	− 0.351, 0.243	0.13	0.7227
Delivery of eHealth intervention[c]	38	–	–	–	3.45	0.1781
Clinician led		− 0.0032	0.1684	0.1282, 0.4826	–	0.9846
Digital + clinician contact		0.3183	0.1786	− 0.0317, 0.6684	–	0.0747
Modality of eHealth intervention[d]	38	–	–	–	3.90	0.2720
App-based		0.1936	0.2859	− .3668, 0.7537	–	0.4985
Web-based		− 0.0034	0.1799	− 0.3560, 0.3492	–	0.9850
Digital + clinician contact		0.3350	0.2177	− 0.0918, 0.7617	–	0.1240
Attendance (> 75%)	21	0.220	0.1459	− 0.066, 0.506	2.28	0.1311
Satisfaction (> 75%)	15	0.005	0.358	− 0.696, 0.706	0.00	0.9889
Dropout rate (> 20%)	36	− 0.169	0.1574	− 0.477, 0.139	1.15	0.284
Study quality (%)	38	0.013	0.005	30.004, 0.022	7.21	0.0073

Separate random effects models were run for each potential moderator

MH mental health

[a]Children with MH symptoms below the clinical cut-off were used as the reference group

[b]Parents with MH symptoms below the clinical cut-off were used as the reference group

[c]Studies that used a digital only intervention were used as the reference group

[d]Studies that used a clinical led intervention were used as the reference group

the effect of eHealth interventions on general stress and trauma symptomatology were not statistically significant, potentially due to the relatively small number of studies that measured these outcomes ($k = 8$ and $k = 3$, respectively). Additionally, a cursory review of the general stress measures used suggests that they may be capturing multiple layers of stress related to chronic stress, uncertainty or uncontrollable situations (e.g., job insecurity, structural inequities), which would not be proximal targets of parenting or parent mental health interventions. It is also possible that programs targeting parenting-related stress and mental health problems are not easily generalized to other non-parenting stressors.

The identification of family-level moderators can help to streamline the referral process by prioritizing for or matching programs to those who will benefit most from eHealth interventions. Similarly, identifying program-level moderators helps to highlight the barriers and components of the treatment process that are important for success, and thus can inform and improve the future development and delivery of eHealth interventions. Interestingly, none of the potential moderators tested in the current investigation were found to significantly modify the eHealth treatment effect. This finding is consistent with other recent meta-analyses of online parenting programs in which results did not differ by children's baseline behavior or emotional problems severity, delivery method, or type of comparison condition (Thongseiratch et al., 2020), nor by children's mean age, parents' education, session completion, or dropout rate (Florean et al., 2020). It may be that these family- and program-level factors are not as relevant for the unique challenges faced by parents of young children compared to those for general adult mental health services (i.e., eHealth in and of itself addresses some of the barriers parents face), or for eHealth interventions compared to in-person treatment. Although previous research indicated that guided web-based interventions are more effective in general (Heber et al., 2017), it has been suggested that therapeutic alliance is not as important for online intervention effectiveness as it is for face-to-face psychotherapy, and that practical or supportive guidance may be sufficient for online interventions (Andersson & Titov, 2014). One recent meta-analysis found no differences in outcomes of online parenting programs with and without

access to clinical support (Spencer et al., 2020), while another demonstrated that interventions involving direct contact were more effective for parents experiencing social disadvantage (Harris et al., 2020). It is possible that certain program-level factors only moderate eHealth treatment effects for certain family-level factors, thus necessitating a further analysis of their interplay. In the current investigation, only study quality emerged as a significant moderator, such that higher quality ratings were associated with higher eHealth treatment effect size.

The non-significance of target (parent mental health or stress versus parenting skills or children's behaviour problems) as a moderator indicates that even eHealth interventions specifically designed to treat children's needs and/or improve parenting skills have a secondary benefit of promoting the mental health of parents. This finding is consistent with previous meta-analyses of online parenting programs showing small to moderate effect sizes for parental stress and depression (Spencer et al., 2020; Thongseiratch et al., 2020). Future research is warranted to examine the potential underlying pathways, including whether reducing child behavioral and emotional problems may lead to less parental distress and/or whether increases in positive parenting skills and self-efficacy to manage children's problems may reduce parental distress.

Preventing exposure to parental stress and mental health problems is critical during the first 5 years of children's lives, as it impacts their developmental outcomes. The findings of this meta-analysis have important implications for practice and policy. As part of a stepped care model that could improve the efficiency of health care systems, family care providers should consider recommending eHealth interventions to parents experiencing low to moderate stress or mental health problems as a first line treatment option, given its effectiveness, accessibility and lower resource use. Response to eHealth interventions should be monitored and more intensive services (e.g., in-person therapy, psychiatry referral) recommended as necessary.

Strengths and Limitations

This systematic review and meta-analysis represents the largest and most comprehensive synthesis of the literature to date, as it included a broad range of eHealth interventions and mental health outcomes. We employed a thorough search strategy developed with a librarian (ZP) who has expertise in this area. Nevertheless, the results of the current investigation should be interpreted within the context of several limitations. Although the included studies utilized different designs and measured different mental health outcomes, the results were consistent and remained significant across the stratified meta-analyses. There was also a wide variety of types of eHealth interventions including apps, video-conferencing, and website-based programs, as well as differences in level of contact with clinicians, which could have contributed to heterogeneity of treatment effects. However, whether the eHealth programs were fully digital or included some clinician contact was not found to be a significant moderator of treatment effectiveness. As the number of studies on eHealth programs for parents increases, future meta-analyses could further examine differences in modalities and use of technology. The current meta-analyses included pre and post-intervention, but not follow-up, data, so we cannot draw conclusions on the long-term effectiveness of eHealth programs for parent mental health. It is also important to note that the results are limited to mental health symptomatology, as almost all of the included studies used validated self-report questionnaires. Future meta-analyses with studies reporting on clinical diagnosis and remission rates (which requires contact) would provide a fuller picture of the potential impact of eHealth interventions on parent mental health. Given the majority of studies that reported on race/ethnicity had samples with more than half of participants from European descent (18/23), and that 15 studies did not provide this information, the findings from the current meta-analysis may not be generalizable to Black, Indigenous, and people-of-color (BIPOC) groups. Similarly, the current review only included parents who were 18 years of age or older. Thus, the results may not apply to parents who are teenagers, who often have unique circumstances and treatment program needs (Jamison & Feistman, 2021). There was also some indication of publication bias, such that there is a lack of small studies with small or statistically insignificant effects. This bias may have been more pronounced with the inclusion of gray literature (e.g., abstracts from conference proceedings, dissertations). However, a recent study suggested that including grey literature has minimal impact on the results of reviews (Hartling et al., 2017). Lastly, one potentially eligible study was excluded (Moghimi et al., 2018) from the current investigation as the authors could not be contacted to determine the age range of participants' children, and thus it is unknown if and how it would influence the pooled effect size.

Conclusion

Given the importance and influence of parents during the first 5 years of life for child development, eHealth interventions offer a promising and accessible option to promote mental health among parents of young children, particularly for symptoms of anxiety and depression as well as parenting stress.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10567-022-00385-5.

Acknowledgements For consultation on the database search strategy, we thank Dr. Zahra Premji, PhD MLIS, Research and Learning Librarian, University of Calgary. For consultation on the data analysis approach, we thank Dr. Paul Ronksley, PhD, Department of Community Health Sciences, University of Calgary. Dr. MacKinnon was supported by a Social Sciences and Humanities Research Council (SSHRC) Postdoctoral Fellowship (756-2019-0669).

Data Availability Available upon request from corresponding author.

Code Availability Not applicable.

Declarations

Conflict of interest The authors have no conflicts of interests to declare.

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent for Publication Not applicable.

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