

A mixed-method systematic review of text-based telehealth interventions in eating disorder management

Text-based
telehealth in
ED
management

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Abstract

Purpose – Eating disorders (EDs) is a major health condition affecting 9% of the global population and 10% of those with EDs lost their lives as a result. Text-based telehealth interventions (TTIs) seem to provide a low-cost and convenient treatment option; however, the evidence is scarce. This study aimed to synthesize evidence relating to the use of TTIs for the management of EDs.

Design/methodology/approach – Five databases were searched published between January 2020 and May 2019. The authors used keywords relating to telehealth and EDs. The authors used Joanna Briggs Institute's (JBI's) critical appraisal instrument to assess the methodology quality of included studies.

Findings – Fifteen studies were included in this mix-method systematic review and assessed for methodology quality. Email, web-based texting, text-messaging and online chat room were used as mode for deliver healthcare for patients with EDs. In the treatment phase, all studies (nine studies; $n = 860$ participants) showed effectiveness (for RCTs) and usefulness (for non-RCT studies). In the aftercare phase (six studies; $n = 364$ participants), the results regarding the effectiveness of TTIs were mixed. Two studies showed effectiveness whilst four studies did not find statistically significant change of ED outcomes.

Research limitations/implications – The qualities of these studies varied; firstly, 66% ($n = 10$) of the studies were non-randomized studies (e.g. single-arm trial, case report) with small samples. Moreover, one-fourth ($n = 4$) of the studies did not use validated instruments or indicate the instrument. Also, half ($n = 7$) of the studies used TTIs as adjunct to face-to-face treatment or bigger online treatment, it is hard to make conclusion that the changes were due to TTIs' effect. In addition, follow-up rate is not satisfactory, thus results should be interpreted cautiously.

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Practical implications – TTIs seem to be promising for management of EDs, particularly in the treatment phase. This provides an important treatment option for health practitioners and people with EDs as an alternative or in adjunct with face-to-face services.

Originality/value – This is the first review to synthesis the use of TTIs for ED management.

Keywords Telehealth, Telemedicine, Text-based, Eating disorders

Paper type Review

Introduction

Eating disorders (EDs) include a range of health issues characterized by a persistent disturbance of eating or eating-related behaviors resulting in the altered consumption or absorption of food [1]. Globally, this is a major health problem that requires high utilization of health services and medical attention. Worldwide, 8.4% of women and 2.2% of men were diagnosed with EDs in 2019 [2, 3]. The use of healthcare services by the people with EDs is comparatively high [1, 4, 5]. Annual costs per ED patient in 2012 ranged from 1,288 to 8,042 US\$ 2008 purchasing power parities [6].

EDs significantly impair patients' daily functioning and quality of life. They are linked with cardiovascular disease, neurological symptoms and disruptions to the gastrointestinal system [7, 8]. EDs are also strongly associated with mental health issues, such as anxiety, depression, self-harm, substance abuse and personality disorders [2, 7, 9]. ED patients often show significant social isolation, poor quality of life, poor academic performance and higher rates of substance abuse. Recovery rates for those who receive treatments for EDs are reportedly low, and the relapse rates are high [10–12]. Approximately 30% of patients with bulimia nervosa (BN) and eating disorder not otherwise specified (EDNOS) remain ill for 10 to 20 years following the initial presentation [15]. Mortality rates for individuals with EDs are about twice as high as people without Eds [13].

Despite the severity and negative impact of EDs, up to 45% of individuals with EDs never receive treatment for their eating-related problems [14]. Some of the main reasons that ED patients do not to seek treatments include the lack of knowledge about available health services [15, 16], high cost of treatment [15, 17] and stigma [15, 16] associated with EDs. Specialist services for EDs are generally available at tertiary hospitals. Lack of access is the main barrier to seeking treatment for patients living in rural and remote areas [18].

Telemedicine has been effectively used to provide healthcare services to people with Eds [19–22]. It has also been successfully used to assess, treat and monitor people with Eds [20, 22–24]. Telemedicine is the use of information and communication technologies (ICTs) for delivering healthcare at a distance. It includes telephone counseling, video consultations and remote monitoring. Previous studies found that the use of video-consultation for providing treatment to patients with BN had similar outcomes to face-to-face consultations [17, 25–27]. A systematic review also suggested that videoconferencing is a promising approach to treat EDs [28]. Videoconferencing for counseling sessions is accepted by both patients and medical professionals [29]. The advantages of videoconferencing include that people feel more control over the verbal interactions and less intimidated compared to face-to-face sessions [30]. However, the disadvantages of videoconferencing include scheduling constraints, compromised anonymity [31] and the need for patients to have sophisticated computer equipment and network capacity [32].

Text-based online communication is gaining popularity over the last decade globally. In 2017, over 4.2 billion people texted worldwide, sending out 15 million texts every minute of each day [33]. In response, healthcare facilities have explored the use of text-based communications to deliver healthcare (i.e. text-based telehealth interventions, abbreviated as TTIs) [34]. Evidence for the effectiveness of TTIs in various health disciplines is rapidly

growing [35–37]. For example, TTIs have shown promising results in management of diabetes [38], smoking cessation [39], obesity [40], as well as for mental health problems (e.g. anxiety, depression and EDs) [35, 36, 41].

Previous research examined the use of text-based telemedicine techniques for providing healthcare services to patients with EDs. However, to our knowledge, no review has attempted to appraise the evidence for the utility of TTIs, techniques and technologies used and the impact of TTIs on patient outcomes. In order to expand knowledge of these topics, we conducted a review of qualitative and quantitative studies to synthesize the evidence on the use of TTIs.

Methods

Search procedures

We conducted a literature search using the keywords related to EDs and text-based telemedicine in five electronic databases, including PsycINFO, PubMed, Embase, Cochrane Library and ProQuest, with the assistance of an experienced library consultant (JH). We used this combination of search terms: (telemedicine OR mHealth OR “mobile health” OR “text message” OR text-messaging OR text-messages OR text-based OR email OR e-mail OR chatroom OR “chat room” OR forum OR “discussion board” OR “message board”) AND (“eating disorder” OR “eating disorders” OR bulimi* OR anorexi* OR binge eat* OR EDNOS) (Appendix 1). Additional hand searches with reference lists were also performed. Reviewed papers included the research papers published between January 2000 and May 2021.

The inclusion and exclusion criteria for reviewed papers were formulated using the following PICO statement: (1) *Population*: participants have ED-related symptoms or are formally diagnosed with EDs, including anorexia nervosa (AN), BN, binge-eating disorder (BED) and EDNOS. Thus, preventive programs were excluded; (2) *Intervention*: therapy related communication between therapist and patient used text-based telemedicine techniques. Interventions that were delivered by videoconferencing and phone were excluded. Studies examining self-help interventions were excluded; (3) *Comparison*: randomized controlled studies assessing the effectiveness of text based telemedicine interventions in EDs were included. Since evidence relating to text-based telemedicine interventions on EDs were relatively limited, single arm trials and qualitative studies were also included. (4) *Outcomes*: studies reporting ED-related outcomes related to text-based telemedicine techniques were included. We screened the selected articles against inclusion and exclusion criteria according to the PRISMA checklist [42].

Data extraction

In addition to basic demographic details of the research articles (ex: author, year, country and study design), two independent researchers (XZ&SE) collected and tabulated information about the type of TTI, disease area, type of therapy and outcomes.

Assessment of methodological quality

Qualitative studies were assessed by using Joanna Briggs Institute’s (JBI) critical appraisal instrument for qualitative research [43]. Quantitative studies were assessed by using the JBI’s critical appraisal instrument for RCTs and non-randomized experimental studies [44, 45]. Two reviewers (XZ and SE) conducted the assessment independently. Discrepancies were resolved by the involvement of a third reviewer (MB). For randomized controlled trials, studies meeting at least ten out of thirteen criteria were categorized into “good” quality, seven to nine were categorized into “moderate” quality, less than seven were deemed “poor” quality.

For quasi-experimental studies, studies meeting at least seven out of nine criteria were categorized into “good” quality, five to seven criteria were “moderate” quality, less than five were “poor”. For qualitative studies, studies meeting eight out of ten criteria were deemed “good” quality, five to seven were “moderate” quality, and less than five were categorized into “poor” quality.

Protocol registration

This systematic review has been registered via PROSPERO, registration ID: CRD42019130604.

Results

The initial search resulted in 653 articles. After duplicate records were removed, 341 articles remained for review. After screening titles and abstracts, we excluded 270 articles (Figure 1).

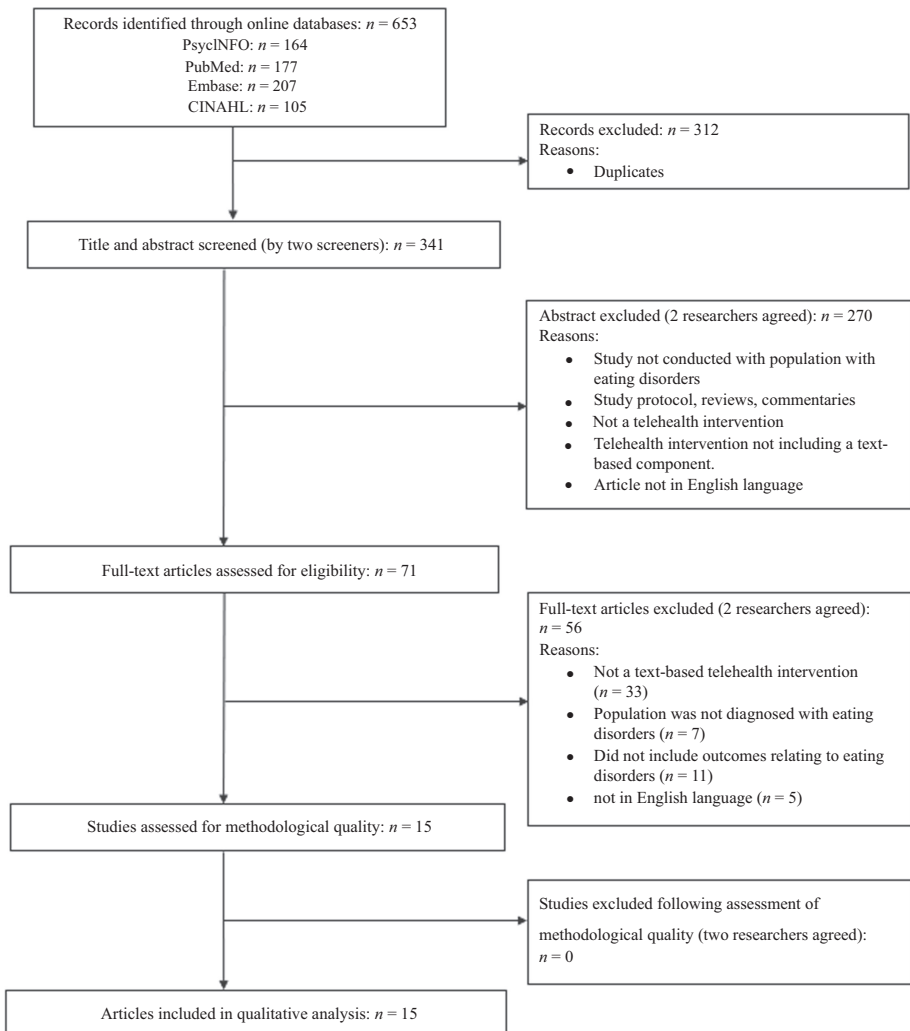


Figure 1.
PRISMA flow chart for study inclusion

We reviewed 71 full text articles using the inclusion and exclusion criteria. We removed 56 ineligible articles. Thus, fifteen research papers were reviewed in this study.

Characteristics of included papers

Table 1 shows the key features of all 15 articles, including author, year, country, study design, TTIs medium, TTIs use, diagnosis, treatment phase, sample size and result. All articles were published between 2001 and 2017: 47% ($n = 7$) were published between 2001 and 2010 and 53% ($n = 8$) published after 2011. As for countries where the study was conducted, 33% ($n = 5$) were in Germany, 33% ($n = 5$) in USA, 20% ($n = 3$) in UK, 7% ($n = 1$) in Hungary and 7% ($n = 1$) in Netherlands. Regarding the types of EDs studied, 47% ($n = 7$) of articles discussed a single subtype of EDs and the other 8 articles (53%) discussed a combination of subtypes of EDs. Thirty-three percent ($n = 5$) were randomized controlled studies (RCTs); 40% ($n = 6$) were single-arm trials; 13% ($n = 2$) were case reports; 7% ($n = 1$) descriptive studies, and 7% ($n = 1$) had a single-case alternating treatment design. Studies used four different text-based telemedicine methods: Email (40%; $n = 6$), text-messaging (33%; $n = 5$), webpage (7%; $n = 2$) and online chat (7%; $n = 2$). Nine studies (60%) used TTIs as a stand-alone intervention, whilst 6 (40%) used TTIs as an adjunct. TTIs were used to manage EDs at different stages: Nine studies (60%) occurred during treatment for EDs, and six studies (40%) were conducted during aftercare.

TTIs during treatment

During treatment period, text-based telehealth techniques included email, web-based texting, text-messaging and online chat rooms. The psychological theories underpinning these interventions were cognitive behavioral techniques (CBT) and motivational interviewing techniques (MI). CBT used in TTIs included keeping a food diary, psychoeducation, eating regular meals, as well as modifying negative automatic thoughts, emotional regulation and maladaptive behaviors were used in TTIs (Table 2). Researchers also sent motivational messages via messaging apps.

All nine studies (a total of 860 participants) showed effectiveness (for RCTs) and usefulness (for quasi-experimental studies and qualitative studies) of TTIs among individuals with EDs. Robinson and Serfaty [46] tested the effectiveness of using email to reduce ED-related symptoms among patients with BN, BED and EDNOS. This study found email-delivered intervention was effective both at the end of the intervention and at 3-month follow up. Wagner *et al.* [47] found that an online asynchronous chat on a webpage with patients with BED was effective in reducing binge-eating episodes, depression level, as well as promoting recovery. Zerwas *et al.* [48] conducted an intervention in which patients with BN received psychotherapy from therapists. This study found that the text-based telemedicine intervention was equivalent to face-to-face psychotherapies in increasing abstinence rate at follow up. The intervention also alleviated binge eating and depression and improving quality of life at both end of treatment and follow-up. Robinson and Serfaty [49] tested the effectiveness of email therapy on participants with BN, BED and EDNOS. Results indicated that email therapy was effective in reducing bulimic and relevant depressive symptoms. ter Huurne *et al.* [50] tested the effectiveness of a web-based program in which participants with BN and related EDNOS communicated with therapists via text asynchronously. Results indicated that the intervention was effective in reducing BN-relevant symptoms and improving body satisfaction, quality of life, and general mental and physical health. The improvements sustained after 6 months. Shingleton *et al.* [51] tested effectiveness of text-messaging in reducing AN and BN. This study found that the intervention was effective in improving motivation among normal weight individuals. Yager [52, 53] reported the use of email with patients diagnosed with AN was

Table 1.
Characteristics of studies included in mixed methods systematic review of text-based telehealth interventions in eating disorder management, January 2000–May 2021

Author, year	Country	Study design	OTIs type	OTIs use	Diagnosis	ED-relevant measures	Treatment phase	Sample size	Results
Robinson and Serfaty, 2001 [49]	UK	Single-arm trial	Email	Stand-alone	BN, BED, EDNOS	BITE BDI	Treatment; email therapy	23	There was a significant reduction in scores of depression, of bulimic symptoms and severity (paired <i>t</i> -test, $p < 0.05$)
Yager 2001 [52]	USA	Case report	Email	Adjunct	AN	Not mentioned	Treatment; contact, monitor	4 cases	There was reasonably good biopsychosocial recovery, including significant improvements in weight gain, eating a wider variety of food and reduction of sleepiness, sluggishness and confusion
Bauer <i>et al.</i> , 2003 [55]	Germany	Single-arm trial	Text-messaging	Stand-alone	BN	Informal short evaluation questionnaires	Aftercare; symptom report and tailored feedback	30	There was relief from BN-related symptoms. However, the body satisfaction of one patient remained low
Yager 2003 [53]	USA	Case report	Email	Adjunct	AN	Not mentioned	Treatment; food record, communication	3 cases	There was an increase in frequency and amount of contact between patients and clinicians and email assisted face-to-face sessions
Robinson <i>et al.</i> , 2006 [58]	UK	Single-arm trial	Text-messaging	Stand-alone	BN	SEED	Aftercare; symptom report and tailored feedback	21	There was no significant symptom change in terms of the bulimic symptoms
Robinson and Serfaty 2008 [46]	UK	RCT eBT, SDW v.s. waiting list control	Email	Stand-alone	BN, BED, EDNOS	QEDD BDI BITE	Treatment; email bulimia therapy, self-directed writing	97	Email was significantly superior to waiting list control on scores of QEDD ($p < 0.05$). However, depression and bulimia symptoms on scores of BDI and BITE showed no significant change
Shapiro <i>et al.</i> , 2010 [57]	USA	Single-arm trial	Text-messaging	Stand-alone	BN	SCID eating disorders Modules EDI Binge-Purge questionnaire NEQ BDI	Aftercare; symptom report and tailored feedback	31	There were significant reductions on scores of BDI, EDI and NEQ at both post-treatment (week 12; $p < 0.05$) and follow-up (week 24; $p < 0.05$)

(continued)

Author, year	Country	Study design	OTIs type	OTIs use	Diagnosis	ED-relevant measures	Treatment phase	Sample size	Results
Gulec <i>et al.</i> , 2011 [58]	Germany	Single-arm trial	Email & online chat group & online individual chat	Adjunct	BN, EDNOS	Not mentioned	Aftercare, monitor and feedback	22	n/a
Bauer <i>et al.</i> , 2012 [56]	Germany	RCT Text-messaging v.s. TAU	Text-messaging	Stand-alone	BN, EDNOS	LIFE with an extended session on eating disorders PSRs	Aftercare, symptom report and tailored feedback	165	There was a significant difference in remission rates in both the intent-to-treat analysis ($p = 0.05$) and the completer analysis ($p = 0.06$). Remission rates between the intervention and control groups were not significantly different among patients who used outpatient treatment ($p = 0.51$). For participants who utilized outpatient treatment, the intervention group had a higher remission rate as compared with the control group ($p = 0.046$). Among patients who were utilizing other forms of service, 39% indicated that they would never engage in additional care without this online counseling service. Thus, it was concluded that online service facilitated access to routine care for underserved individuals
Moessner and Bauer 2012 [54]	Germany	Descriptive study	Email	Stand-alone	EDs	A set of online questionnaires, which assessed satisfaction, acceptance and service utilization; SEED	Treatment; counseling via email	238	Eating disorder psychopathology significantly improved ($p < .001$); significant improvements in body dissatisfaction, quality of life, mental and physical health. Almost all treatment effects were sustained at the 6-week and 6-month follow-up measurements
ter Huurne <i>et al.</i> , 2013 [50]	Netherlands	Single-arm trial	Webpage	Stand-alone	EDNOS; BN purging BN nonpurging	EDE-BAT MAP-HSS DASS-21 EQ-5D VAS DSM-IV-TR	Treatment Asynchronous and intensive personalized communication between the patient and the therapist	165	

(continued)

Table 1.

Table 1.

Author, year	Country	Study design	OTIs type	OTIs use	Diagnosis	ED-relevant measures	Treatment phase	Sample size	Results
Gulec <i>et al.</i> , 2014 [60]	Hungary	RCT EDINA v.s. WLC	Online chat group & email	Adjunct	BN or related EDNOS	EDE-Q DASS-21	Aftercare; group chat sessions; symptom-monitoring; feedback	95	There was a statistically significant main effect of time on EDE-Q score ($F = 15.814, p < 0.001$). None of the time × group interactions reached significance with regard to the DASS-21 scores Text-messaging did not impact eating behaviors. Text messages had mixed effects on motivation to change dietary restraint. The effects were moderated by weight status
Singleton <i>et al.</i> , 2016 [51]	USA	Single-case alternating treatment design	Text-messaging	Adjunct	An, BN	EDE SCID-I RMQ EDE-Q Daily food records Medical Safety Questions	Treatment; daily reminder; symptom and food report; feedback	12	The treatment group had significantly reduced symptoms of all eating psychopathology outcomes relative to those on the waiting list ($p < 0.001$). This reduction was sustained one year after treatment The percentage of abstinent participants increased in both groups. At the end of treatment, CBT4BN was inferior to CBT2F. However, by the 12-month follow-up, CBT4BN was no longer inferior
Wagner <i>et al.</i> , 2016 [47]	Germany	RCT Webpage v.s. waiting list control	Webpage	Adjunct to an online self-help program	BED	EDE-Q BDI SCL-90-R; anxiety subscale	Treatment; counseling via text	139	The treatment group had significantly reduced symptoms of all eating psychopathology outcomes relative to those on the waiting list ($p < 0.001$). This reduction was sustained one year after treatment The percentage of abstinent participants increased in both groups. At the end of treatment, CBT4BN was inferior to CBT2F. However, by the 12-month follow-up, CBT4BN was no longer inferior
Zerwas <i>et al.</i> , 2017 [48]	USA	RCT OTIs v.s. face-to-face	Online chat group	Adjunct	BN	EDE SCID-IP BDI BAI EDQOL SF-6D	Treatment	179	The percentage of abstinent participants increased in both groups. At the end of treatment, CBT4BN was inferior to CBT2F. However, by the 12-month follow-up, CBT4BN was no longer inferior

Note(s): This was a feasibility and acceptability study. Hence, no effectiveness was examined; Abbreviations: AN = Anorexia Nervosa; BN = Bulimia Nervosa; BED = Binge Eating Disorder; EDs = Eating Disorders; EDNOS = Eating Disorder Not Otherwise Specified; RCT = Randomized Control Trial; OTIs = Online Text-based Interventions; BITE = Bulimia Investigatory Test Edinburgh; BDI = Beck Depression Inventory; SEED = Short Evaluation of Eating Disorders; QEDD = Diagnosis of eating disorder on the questionnaire for eating disorders; SCID = Structured Clinical Interview for DSM-IV; EDI = Eating Disorders Inventory-II; NEQ = Night Eating Questionnaire; LIFE = Longitudinal Interval Follow-Up Evaluation; PSRs = Psychiatric status ratings; EDE = Eating Disorder Examination; BAI = Body Attitude Test; MAP-HSS = Maudsley Additional Profile Health Symptom Scale; DASS-21 = Depression Anxiety Stress Scale-21; items; EQ-5D VAS = EuroQol-5 Dimension/DSM-IV-TR = Diagnostic and Statistical Manual of Mental Disorders; EDE-Q = Eating Disorder Examination Questionnaire; RMQ = Readiness and Motivation Questionnaire; SCL-90-R = Symptom Checklist-90 revised; BAI = Beck Anxiety Inventory; EDQOL = Eating Disorders Quality of Life Questionnaire; SF-6D = Short Form Health State Classification

Table 2.
Examples of Online
Text-based
Interventions (OTIs)
used in the treatment
phase and aftercare
phase for eating
disorders in mixed
methods systematic
review

Treatment	Aftercare
(1) Deliver cognitive behavioral therapies for participants	(1) Monitor eating disorder symptoms
(2) Monitor symptoms relating to eating disorders	(2) report positive or negative life events, thoughts, feelings and their progress (or lack of progress)
(3) Deliver motivational interviewing (MI)	(3) Automatic personalized feedback to educate the recipients about positive and negative changes in their status. The feedback aims to motivate participants to solve their own problems
(4) Send motivational messages to participants	(4) Send feedback about the participants' progress
(5) Participants report eating disorder-related symptoms	(5) Online counseling
(6) Clients do "homework" and send it back to the researcher	
(7) Provide feedback to participants about their progress	
(8) Set goal and/or plan	
(9) Psycho-education	
(10) Deliver self-control techniques	
(11) Deliver exposure techniques	

useful tool for communication in combination with face-to-face sessions and improved recovery among this population. Moessner and Bauer [54] reported that email as a stand-alone intervention facilitated access to routine care for underserved individuals.

TTIs during aftercare stage

Six studies (a total of 364 participants) used TTIs to provide aftercare for participants to prevent relapse. During aftercare, TTIs were used mainly for monitoring patients. In our review, we found that phones were mainly used text-messaging (in four studies) and a combination of online chat and email (in two studies). Researchers used TTIs to monitor the change of ED-related symptoms, thoughts and emotions as well as to provide feedback. When necessary, TTIs were also used to deliver online counseling (see Table 2). The results regarding the effectiveness of TTIs were mixed. Three studies [55–57] used text-messaging to monitor changes in ED-related symptoms and provide tailored feedback. Their results indicated a reduction in ED-related symptoms after intervention. In contrast, a similar intervention [58] did not find statistically significant changes. Two studies [59, 60] used an online chat group and email to provide aftercare support for ED patients. This study found that this intervention was acceptable and feasible, but not effective.

Methodological quality of included studies

For randomized controlled trials (Table 3), we found that the quality of evidence for three studies were "good" and two were "moderate." For quasi-experimental studies (Table 4), quality assessment showed that five studies were categorized into "good" quality, while two were "moderate." Because six out of seven quasi-experimental studies were single-arm trial, none of them had control group. For qualitative studies (Table 5), all three studies were of "good" quality.

Discussion

We found evidence suggesting that telemedicine is effective in treating Eds [20, 26]. For example, video-based modality (i.e. videoconferencing) produced an equivalent outcome to face-to-face conditions [17, 27]. Online CBT as well as Internet-based self-help programs

Table 3.
Critical appraisal
results of eligible
randomized controlled
trials in systematic
review of online text-
based intervention and
eating disorder
management

Citation	Wagner <i>et al.</i> (2016) [47]	Zerwas <i>et al.</i> (2017) [48]	Bauer <i>et al.</i> (2012) [56]	Robinson <i>et al.</i> (2008) [46]	Gulec <i>et al.</i> (2014) [60]
Randomization	Y	Y	U	Y	U
Allocation concealment	Y	Y	U	U	U
Groups similar at baseline	Y	Y	U	Y	U
Blinding: Participants	N	N	U	N	U
Blinding: delivery	N	N	Y	U	U
Blinding: outcome assessment	N	Y	Y	Y	Y
Groups treated identically	Y	Y	Y	Y	Y
Follow-up complete	Y	Y	Y	Y	Y
Analysis according to randomization	Y	Y	Y	Y	U
Same outcome measurement	Y	Y	Y	Y	Y
Outcome is reliable	Y	Y	Y	Y	Y
Appropriate statistical analysis	Y	Y	Y	Y	Y
Trial design is appropriate	Y	Y	Y	Y	Y
Final analysis	Good	Good	Moderate	Good	Moderate

Note(s): Abbreviations: Y = Yes; N = No; U = Unclear

reduced ED-related symptoms more effectively than the waiting list control group [61, 62]. Our current review found the evidence that TTIs have positive effects on managing EDs. Thus, this analysis adds new evidence showing effectiveness of telemedicine for Eds [63].

Among studies testing the effectiveness and usefulness in treating BN, BED and EDNOS, all studies showed that TTIs were effective in reducing bulimic symptoms and severity. We found that TTIs which were underpinned by CBT and were particularly effective in interventions. This finding is consistent with previous evidence on the effectiveness of CBT on EDs [64]. Another technique used in the included studies was motivational interviewing (MI). It was found that text-messaging underpinned by MI techniques had effect on motivation to change rather than on eating behaviors [51].

In the aftercare stage, previous studies have shown that outpatient care prevents relapse after acute care. In addition, mobile and internet-based interventions were promising and may help maintain treatment gains [65]. Our current study showed that text-based interventions were helpful during the aftercare phase because they enabled monitoring of patients' symptoms in a less disruptive way for patients. When the text-based feedback is tailored to the reported symptoms, patients may want to maintain behavior changes. However, some participants provided feedback that TTIs may not be able to provide the empathetic feedback which human therapists are able to. Therefore, future studies may explore ways to improve the patients' experience.

Current studies also found various features, as well as advantages and disadvantages of different modalities of TTIs. Interventions delivered via text messages were preprogrammed in reviewed studies. These interventions usually served a single purpose such as symptom monitoring [57]. Others focused on global health and increasing motivation to change eating behaviors [51]. Previous studies also reported that the purpose of the text messaging was to provide support and assist in self-monitoring. They distributed supportive messages and self-monitoring procedures in mental health interventions [66]. Therefore, text messaging

Citation	Robinson <i>et al.</i> (2006) [58]	Shapiro <i>et al.</i> (2010) [57]	Gulec <i>et al.</i> (2011) [59]	ter Huurne <i>et al.</i> (2013) [50]	Bauer <i>et al.</i> (2003) [55]	Robinson and Serfaty (2001) [49]	Shingleton <i>et al.</i> (2016) [51]
Clear definition of "cause" and "effect"	Y	Y	Y	Y	Y	Y	Y
Participants are similar	Y	NA	U	N	U	Y	Y
Participants receive similar treatment	NA	NA	Y	Y	Y	Y	Y
Control group	N	N	N	N	N	N	Y
Multiple measures	Y	Y	Y	Y	Y	Y	Y
Complete follow-up	Y	U	Y	Y	Y	Y	Y
Outcomes measured in a similar way	Y	Y	Y	Y	Y	Y	Y
Outcomes measured in a reliable way	Y	Y	Y	Y	Y	Y	Y
Appropriate statistical analysis	Y	Y	Y	Y	U	Y	Y
Total	Good	Moderate	Good	Good	Moderate	Good	Good

Note(s): Abbreviations: Y = Yes; N = No; NA = Not Applicable; U = Unclear

Table 4. Critical appraisal results of eligible quasi-experimental studies (non-randomized experimental studies) trials in systematic review of online text-based intervention and eating disorder management

Citation	Yager (2001) [52]	Yager (2003) [53]	Moessner <i>et al.</i> (2012) [54]
Congruity between philosophical perspective and methodology	Y	Y	Y
Congruity between methodology and question	Y	Y	Y
Congruity between methodology and data collection	Y	Y	Y
Congruity between methodology and presenting data	Y	Y	Y
Congruity between methodology and results	Y	Y	Y
Cultural and theoretical location	N	U	U
Influence of researcher	U	U	Y
Participants' voice represented	Y	Y	Y
Ethical approval	Y	Y	Y
Conclusion	Y	Y	Y
Total	Good	Good	Good

Note(s): Abbreviations: Y = Yes; N = No; U = Unclear

Table 5. Critical appraisal results of eligible qualitative studies in systematic review of online text-based intervention and eating disorder management

reducing the need for healthcare personnel manpower enabled more frequent follow-up. However, participants also criticized interventions delivered via text messages as being too standardized and impersonal [50].

In terms of the feasibility and acceptability of TTIs, the current literature generally shows that retention rate and adherence rate were high and participant feedback was positive [26, 66–68]. However, some participants and therapists in reviewed studies preferred to face-to-face consultations. In contrast to texting interventions, email or online chat (chat group, webpage-based chat) interventions involved a human therapist on the other end. Therefore, chat interventions were able to conduct more complex and complete therapeutic process. Also, the responses were more personalized and appropriate. These modalities gave participants opportunities to discuss their situations and concerns [47, 50]. But this type of intervention was less frequent than text-message interventions.

There are some limitations in our review that are worth noting. The quality of these studies varied. First, 66% ($n = 10$) of the studies were non-randomized studies (e.g. single-arm trial, case report) with small samples. Moreover, one-fourth ($n = 4$) of the studies did not use validated instruments or indicate the instrument. Also, half ($n = 7$) of the studies used TTIs as an adjunct to face-to-face treatment or bigger online treatment. For these studies, it is hard to conclude that the changes in outcome were due to TTIs, those results therefore should be interpreted cautiously.

Conclusion

Overall, our review found that TTIs generally had positive results on the management of EDs. TTIs including email, text-messaging, webpage and online chat room, are viable ways to enhance or deliver multiple levels of treatment for EDs. They help reduce ED-related symptoms, comorbid depression and anxiety, improve body satisfaction and contact between clients and therapists. However, due to variability in quality of the reviewed studies, our conclusions should be interpreted with some caution. In the future, more rigorously designed studies with larger samples are required to evaluate the effectiveness of TTIs for EDs.

Conflict of Interest: None

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Appendix 1

Search terms

Results:

PsycINFO

Abstract: telemedicine OR mHealth OR “mobile health” OR “text message” OR text-messaging OR text-messages OR text-based OR email OR e-mail OR chatroom OR “chat room” OR forum OR “discussion board” OR “message board” AND Abstract: “eating disorder” OR “eating disorders” OR bulimi* OR anorexi* OR binge eat* OR EDNOS AND Year: 2000 To 9999

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PubMed

(telemedicine[Title/Abstract] OR mHealth[Title/Abstract] OR “mobile health”[Title/Abstract] OR “text message”[Title/Abstract] OR text-messaging[Title/Abstract] OR text-messages[Title/Abstract] OR text-based[Title/Abstract] OR email[Title/Abstract] OR e-mail[Title/Abstract] OR chatroom[Title/Abstract] OR “chat room”[Title/Abstract] OR forum[Title/Abstract] OR “discussion board”[Title/Abstract] OR “message board”[Title/Abstract]) AND (“eating disorder”[Title/Abstract] OR “eating disorders”[Title/Abstract] OR bulimi*[Title/Abstract] OR anorexi*[Title/Abstract] OR binge eat*[Title/Abstract] OR EDNOS[Title/Abstract]) *Filters applied:* from 2000/1/1 - 3000/12/12.

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Embase

(“eating disorder”:ab,ti OR “eating disorders”:ab,ti OR bulimi*:ab,ti OR anorexi*:ab,ti OR “binge eat*”:ab,ti OR ednos:ab,ti) AND (telemedicine:ab,ti OR mhealth:ab,ti OR “mobile health”:ab,ti OR “text message”:ab,ti OR “text messaging”:ab,ti OR “text messages”:ab,ti OR “text based”:ab,ti OR email:ab,ti OR “e mail”:ab,ti OR chatroom:ab,ti OR “chat room”:ab,ti OR forum:ab,ti OR “discussion board”:ab,ti OR “message board”:ab,ti) AND [2000-2021]/py

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CINAHL

AB (“eating disorder” OR “eating disorders” OR bulimi* OR anorexi* OR binge eat* OR EDNOS) AND AB (telemedicine OR mHealth OR “mobile health” OR “text message” OR text-messaging OR text-

messages OR text-based OR email OR e-mail OR chatroom OR “chat room” OR forum OR “discussion board” OR “message board”) Limiters - Published Date: 20000101-20210631 Expanders - Apply equivalent subjects Search modes - Boolean/Phrase

105

Text-based
telehealth in
ED
management

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