Can Texting Improve Therapy?

A Scoping Review of Behavioral Change Methods in Text-Messaging to Support Psychological Treatment

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201300102, Master thesis Positive Clinical Psychology and Technology

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24th of January 2021

Abstract

Background: Psychological treatment often comes with long waiting times that can exacerbate psychological symptoms. Text-messages might increase the efficiency of treatment, by reaching several people with little effort and enabling contact with therapists apart from scheduled sessions. Various researches were done in which text-messaging was used as adjunct to psychological treatment. Extracting the mechanisms that make text-messages effective, enables to apply useful features to more advanced technologies, such as eHealth apps. **Method**: This literature review assessed 16 articles that added text-messaging to psychological treatment. The objectives of text-messages were explored, and behavioral change methods (BCMs) were identified. **Results**: Three message objectives were found: supportive messages, appointment reminder and self-monitoring. Supportive text-messages were effective to reduce psychopathological symptoms or at least appreciated by participants. Appointment reminders might increase treatment attendance, however, impulsive and anxious participants did not benefit from reminders. Conclusions about the effectivity of monitoring messages could not be drawn, because of insufficient controlled studies. The following eight BCMs were identified: facilitation, tailoring, counterconditioning, persuasive communication, reinforcement, self-monitoring of behavior, individualization and belief selection. While the number of integrated BCMs did not influence the effectivity and acceptability of text-messages, the absence of BCMs might be linked to a higher dropout of participants. **Conclusion**: The findings implicate that text-messages may be an effective adjunct to psychological treatment. The importance of applying BCMs to text-messages and possibility to interact with text-messages for a high acceptance are emphasized.

Keywords: text-messaging, blended digital treatment, behavioral change method, BCM

Contents

Can Texting Improve Therapy? - A Literature Review of Behavioral Change Methods in Mobile Phone Messaging Supported Mental Health Treatment

Text-messaging might reduce long waiting lists, by making psychological treatment more efficient. In several countries of the Western world, there is a shortcoming of therapy places for people with psychopathological symptoms, such as in the Netherlands, Germany, and the USA (Bundespsychotherapeutenkammer, 2018; National Council for Behavioral Mental Health, 2018; Vleugels, 2018). These limited treatment capacities can have detrimental consequences. Research with psychotic patients indicates that after waiting longer than three months for a treatment to begin, therapy outcomes are poorer (Reichert & Jacobs, 2018). Apart from that, qualitative research demonstrates that waiting for therapy is associated with suffering and feelings of helplessness, while some people even give up seeking for help when waiting lists are too long (Mental Health Foundation, 2018). In sum, there is a need to explore how to make therapy more efficient.

Technology offers the possibility to increase efficiency. Treatment without technology limits clinicians to interact with clients only within scheduled sessions. In contrast, text-messages, for example by means of SMS or messaging apps, offer a range of possibilities to extend the contact outside the therapy room. By receiving for instance prompts for homework, advices for coping strategies or other healthy behaviors in time, clients might be more inclined to implement treatment practices in their real lives (Substance Abuse and Mental Health Services Administration [SAMHSA], 2015). Studies suggest that the practice of psychotherapeutic activities in the immediate environment of the client may increase outcomes (Carroll et al., 2008; Carroll, Nich & Ball, 2005). Moreover, text-messaging enables sending automatized messages and to reaching many clients with little effort, which can increase time-efficiency and reduce treatment costs (Aguilera, & Muñoz, 2011). Various ways of how text-messages can support treatment were assessed in mental health research (Granholm, Ben-Zeev, Link, Bradshaw & Holden, 2011). Therefore, it might be beneficial to provide a summary of ways how text-messages can be used additional to treatment.

The simplistic design of text-messages makes them suitable to analyze the underlying mechanisms which contribute to effects. To gather more information about the effective mechanisms that contribute desired outcomes, it might be of interest to assess the application of behavioral change methods (BCMs) within text-messages. BCMs are theoretical methods that can be used to change determinants of people's behavior (Kok et al., 2016). Information about effective mechanisms may contribute to the design of technological adjuncts for

treatment, based on scientific evidence. The aim of this study is to examine different ways in which text-messages were applied to treatment and to compile different BCMs that were used in text messages, as well as to provide an overview about the evidence for their benefits and downsides, and to emphasize research gaps.

1.1 Primary Treatment

Primary treatment describes the main treatment of a disease, which can be added by other means for more support (National Cancer Institute, n.d.). In the context of psychological treatment, primary treatment typically consists of sessions in which people with psychopathological symptoms have contact with professionals, but apart from these sessions no further therapeutically interactions occur. Those primary treatment sessions do not necessarily have to be face-to-face. They can be via telephone or video call as well (Fairburn & Patel, 2018). Studies that compared psychological treatment via telephone, videoconferencing and face-to-face sessions concluded that these three forms of treatment can be equally effective (Day & Schneider, 2002; O'Reilly, Bishop, Maddox, Hutchinson, Fisman, & Takhar, 2007). Primary treatment in the mental health sector describes sessions of clients and professionals either face-to-face or digitally.

Several factors indicate that despite its' effectivity for some clients, other clients benefit little from primary treatment alone. Treatment effectivity may be influenced by low engagement factors, client drop-out, non-appearance to appointments, relapses, and low adherence to homework practices (Boschen, 2009; Detweiler-Bedell & Whisman, 2005; Melville, Casey & Kavanagh, 2007). This noncompliance might indicate that some needs of clients are not met by primary treatment. Adjuncts might support primary treatment to heighten engagement.

1.2 Blended Digital Treatment

Primary treatment that is supported by technology is called blended digital treatment. People with psychological symptoms who seek for help at practitioners, nowadays still seem to expect human support (Fairburn & Patel, 2017). Blended care can provide this social support for people. Additionally, blended care reduces the risk of low adherence that digital treatment often has to face (Mohr, Cuijpers & Lehman, 2011). Blended digital treatment combines the advantages and reduces the downsides of primary treatment and digital treatment.

However, nowadays in many countries blended care still is not implemented. In the Netherlands blended digital treatment is already adopted and commonly used by practitioners (ICT & Health, 2019). Nonetheless, other Western countries such as the UK, Austria and Germany are hesitant to integrate blended care (Asthana, Jones & Sheaff, 2019). In a qualitative study German therapists enumerated several barriers to implement technology, such as uncertainties how the technology can be embedded in the healthcare systems, technical problems, and concerns about clients expecting therapist availability at all times (Titzler, Saruhanjan, Berking, Riper & Ebert, 2018). Implementing a simple and easy to use feature like text-messaging can be a first step to become acquainted with technological adjuncts to treatment.

1.3 Text-Messaging as Adjunct to Psychological Treatment

Mobile phones may be a suitable medium to extend contact to clients outside the therapy rooms. Mobile phones nowadays are increasingly widespread. In 2020 6.95 billion people in the world were using a mobile phone (Statista, 2020). In the Netherlands and Germany about 125 mobile phones per 100 inhabitants were counted (Statista, 2019a; Statista, 2019b). Although that does not imply that every person has a mobile phone, it indicates that mobile phones are widespread. Additionally, studies revealed that mobile phone usage is also widespread in low socioeconomic populations (Fjeldsoe, Marshall & Miller, 2009). All in all, mobile phones seem to be tool that is available for many people in Western countries.

One mobile phone feature that can be used for interaction is text messaging. Text-messages can be sent as SMS via mobile phone or via smartphone apps (Lent, 2017; Wagoner & Myrick, 2020). Text-messages have several advantages above other communication features. In contrast to phone calls, messages are less intrusive and because of its' asynchrony can be dealt with more time flexible (Välimäki, Kannisto, Vahlberg, Hätönen & Adams, 2017). Compared to voice mail, text-messages are more often checked (McVeigh, 2012). Reasons for that might be that reading a message is faster than listening to voice-mails and that messages can be read in noisy environments, as well as in environments in which silence is required. Due to the flexible handling, messages appear to be a convenient way to communicate with clients outside the therapy room.

Integrating messages to support psychological treatment might have several advantages. One benefit of messaging is in-vivo contact, which means that contact can take place while clients are in everyday situations. Thereby the practice of therapeutically activities in real life scenarios can be stimulated, which is associated with increased treatment

effectivity (Granholm, Ben-Zeev, Link, Bradshaw & Holden, 2011). Additionally, transmitting content via text-messages that would otherwise be covered in sessions can increase valuable treatment time. Text-messages can be time-efficient as well, because they can be distributed to many clients at once (SAMHSA, 2015). Moreover, real time data referral can help to deliver interventions tailored to the individual needs of clients in a particular moment (Granholm, Ben-Zeev, Link,Bradshaw, & Holden, 2012). Due to its' versatility and availability text-messaging might be a suitable medium to interact with clients in between therapy sessions. Nonetheless, it is important to find out what aspects of text-messages contribute to the desired effects.

1.4 Behavioral Change Methods (BCMs)

In text-messages, different methods can be incorporated, which ultimately aim at behavioral change. Behavior change is one of the major foci of cognitive behavior therapy (Longmore & Worrell, 2007). Although, even when only cognitive problems are tackled in therapy, behavior change is still necessary, because treatment sessions have to be attended and at times homework has to be practiced. There are different BCMs that can be used to change behavior, that were enumerated by Kok et al. (2016). For instance, one method to change behavior is modeling. Modeling describes a process in which seeing a behavior exerted by others can convince people to follow this behavior and act similarly (Kelder, S., Hoelscher, & Perry, 2015). BCMs are commonly based on social-scientific and psychological theories that describe the underlying mechanisms of actions (Bartholomew, Parcel & Kok, 1998). In many cases the mechanisms work indirectly, by changing variables that moderate behavioral change, such as attitude or efficacy beliefs (Kok et al. (2016). Some online mental health platforms used BCMs to construct their interventions (Filler, Kowatsch, Haug, Wahle, Staake & Fleisch, 2015; Minddistrict, n.d.) although, no research was found that assessed BCMs in technology for mental health practice. Therefore, it might be beneficial to analyze text-messages in the light of BCMs.

1.5 State of the Art Reviews on Messaging in Psychological treatment

To date, no published review focuses on text-messaging as adjunct for treatment. Nonetheless, there are several reviews about mobile phones in psychological treatment, of which the majority of articles comprise apps with more functions than just text-messaging and only few studies with text-messaging and as such fail to provide an extensive overview about text-messaging in treatment (Alvarez-Jimenez, Alcazar-Corcoles, González-Blanch, Bendall,

McGorry & Gleeson, 2014; Boschen, 2009; Lindhiem, Bennett, Rosen & Silk, 2015). Reviews that focus on text-messaging only, also included whole interventions, messaging as aftercare, neglected recent studies, or focused only on psychotic patients (Berrouiguet, Baca-García, Brandt, Walter & Courtet, 2016; D'Arcey, Collaton, Kozloff, Voineskos, Kidd, & Foussias, 2019). It is still unclear what possibilities text-messaging offers to support mental health treatment and what aspects of text-messages are effective and accepted by psychiatric populations.

1.6 Current study

This scoping review answers what the current state of evidence is for text-messaging as support for primary mental health treatment by means of two research questions (RQs):
RQ1: What message objectives can be identified and are text-messages effective for those objectives?
RQ2: Which BCMs were applied in text-messages as adjunct to mental health treatment?

2. Method

To be replicable and efficient the review was conducted and documented in line with the guidelines for preferred reporting items for systematic reviews and meta-analyses (PRISMA, 2015). The selected studies were analyzed on different criteria such as their quality and the content of text-messages that were used to support treatment.

2.1 Search Strategy

The databases PsycINFO, Scopus, Web of Science, Cochrane, and Wiley Online Library were thoroughly screened in October 2020. Synonyms of the domains “text-message” and “mental health treatment” were used as search terms. Out of those keywords a search command was constructed, using the Boolean operators “OR” and “AND” (see Figure 1). Titles of scientific articles in the online databases were screened by the command and an equivalent in German language. Mental health related filters were selected for databases that do not focus exclusively on psychological research. To find additional publications, suitable papers were screened for more eligible studies, which is also known as the snowballing technique.

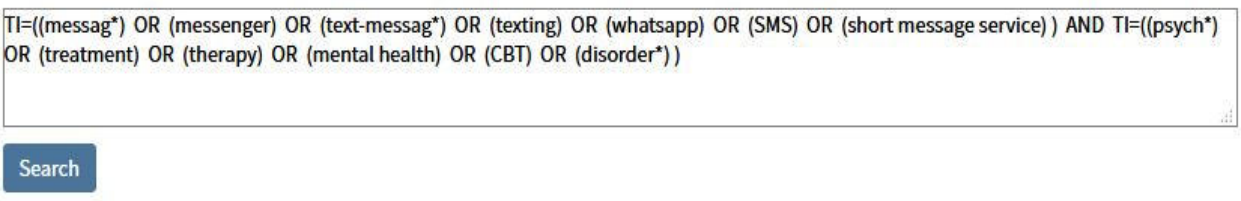

Figure 1. Search command that was entered exemplary on the online database Web of Science.

To determine whether the yielded papers contribute to answering the research question, first the titles were screened for suitability, then, the abstracts were studied for relevance, and ultimately the remaining full texts were checked for eligibility. Articles that met the inclusion and exclusion criteria, as outlined under paragraph 2.3, encompass the final selection. A flowchart demonstrates the selection process (See Figure 2).

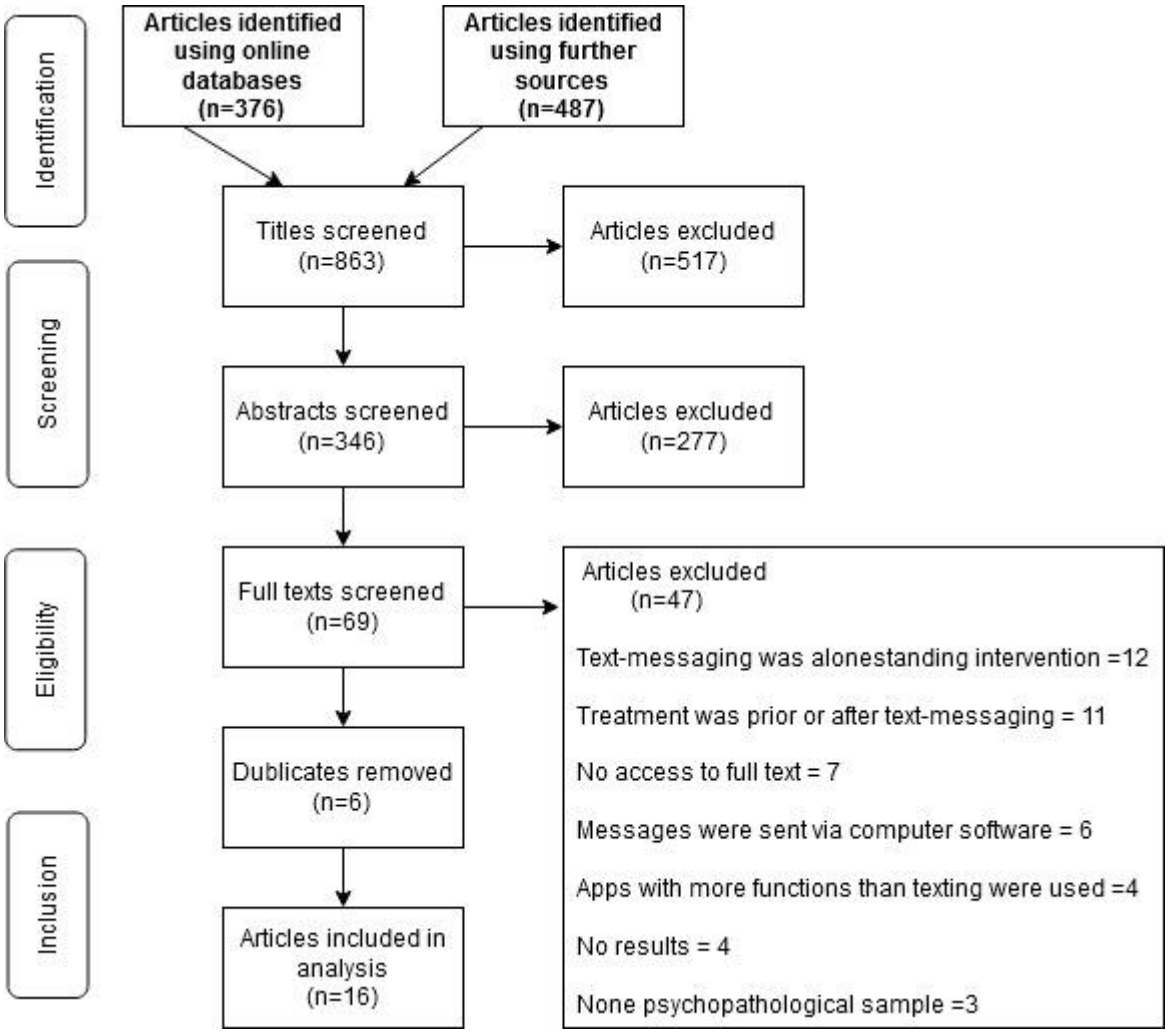

Figure 2. Flowchart of the selection process.

2.2 Selection Criteria

Several inclusion criteria for papers were determined. Due to the fact, that the first text-message was sent in the end of 1992, only publications from 1993-2020 were included. Additionally, only English and German studies were included, due to the researcher's limited

proficiency in other languages. Text-messaging must have been a supportive mean at the time of treatment and not being used to replace therapy. The primary treatment sessions could be done face-to-face, via video chat or telephone. Studies were included if they used SMS or apps that were primarily designed for texting like Whatsapp, Telegram or Threema. Researches with participants of all age groups and every psychopathological symptom were included.

Furthermore, exclusion criteria for papers that did not qualify for this review were established. Papers that used text-messaging as intervention in advance of mental health treatment or as aftercare of terminated treatment were excluded. Further, studies were excluded if they used text-messaging as an independent intervention and not as a supportive mean to primary treatment. Moreover, studies were excluded if they used mental health apps, because other functions of the app might confound the outcome which would not allow drawing conclusions about the effectivity of the text-messages. Additionally, qualitative studies were excluded, because they fail to indicate the usability or effectiveness of text-messaging.

2.3 EPHPP Quality Assessment

To rate the quality of the study the Quality Assessment Tool for Quantitative Studies of the Effective Public Healthcare Panacea Project (EPHPP) was used. The tool provides a method how to test articles of diverse health-related topics. Therefore, six categories that are assumed to be universally relevant in scientific research are rated (Effective Public Healthcare Panacea Project, 2019). The categories are sample selection, study design, treatment of confounding variables, blinding of interventionists and participants, data collection methods, and withdrawal and drop-outs. The grading of “weak”, “moderate,” or “strong” for each category were done according to the tool and dictionary (Effective Public Health Practice Project, 2009; Effective Practice Public Health Practice Project, 2010). Ultimately, the ratings of six different categories were synthesized into one global rating (see Appendix). The rating was executed by one rater.

3. Results

3.1 Study Characteristics

From 863 screened records, 16 studies were included in the review. The articles were published between 2011 and 2020 (see Table 1). Primary outcomes of the included papers were quantitative. The studies were conducted on four different continents: six in Europe

(Agyapong Milnes, McLoughlin & Farren, 2013; Cheli, Cavalletti & Petrocchi, 2020; Kunigiri, Gajebasia, & Sallah, 2014; Kunigiri et al., 2014; Moran, O'Loughlin & Kelly, 2017; Sims et al., 2012), five in the United States (Aguilera & Muñoz, 2011; Beebe, Smith, & Phillips, 2014; Ben-Zeev, Kaiser & Krzos, 2014; Bruehlman-Senecal, Aguilera & Schueller, 2017; Shapiro et al., 2010), four in Australia (Clough & Casey, 2014; Clough & Casey, 2018; Furber, Jones, Healey & Bidargaddi, 2014; Gullo, Irvine, Feeney & Connor, 2018) and one in Africa (Thomas, Lawani & James, 2017). Out of 16 studies, 15 used SMS, with the exception of Cheli et al. (2020) who used an unspecified text-messaging app.

3.2 Participant Characteristics

Some articles did not include information about the age range, but no paper mentioned that younger participants than 17 year olds were included (see Table 1). Populations of diverse psychiatric diagnoses were covered in the studies, including five with psychotic participants (Beebe et al, 2014; Ben-Zeev et al., 2014; Cheli et al., 2020; Kravariti et al., 2018; Thomas et al., 2017), two related to affective disorders (Aguilera & Muñoz, 2011; Bruehlman-Senecal et al., 2017), two included anxiety disorders (Clough & Casey,2014; Clough & Casey, 2018), two papers had substance abuse disorder patients (Agyapong et al., 2013; Gullo et al., 2018), one with bulimic patients (Shapiro et al., 2010), one included miscellaneous disorders (Sims et al., 2012), and three without information on psychiatric diagnoses (Furber et al., 2014; Kunigiri et al., 2014; Moran et al., 2017).

In the majority of studies studies that provided information on phone coverage, more than 84% of the participants possessed an own phone. The only exception was the study of Sims et al. (2012) in which only 70% of the treatment appointments were offered to patients that had a valid phone number in the sampling country England. Nevertheless, only 63% of the studies provided information about the availability of phones. Four studies included only people that owned a mobile phone (Ben-Zeev et al., 2014; Clough & Casey, 2014; Thomas et al., 2017; Kravariti et al. 2018).

Table 1

Sociodemographic characteristics of participants

Study no.	Source	Nationality	Age	Gender F = Female M = Male	Psychiatric diagnose	Additional characteristics	Phone availability
1	Aguilera & Muñoz (2011)	Latino, European Americans, African American, Sampling location: United States	M = 52.30 *SD* = 8.13	F = 40% M = 60%	Depression	Low-income	84.2%
2	Agyapong, Milnes, McLoughlin & Farren (2013)	Sampling location: Ireland	38,5% <45 61,5% >46	F = 53.8% M = 46.2%	Alcohol use disorder and comorbid depression	/	100%
3	Beebe, Smith, & Phillips (2014)	Caucasian and African American, Sampling	M = 48.7 *SD* = 11.6 Range = 23–64	F = 63% M = 37%	Schizophrenia or schizoaffective disorder	/	8.1% did not participate due to lack of confidence in

		location: United States					phone usage
4	Ben-Zeev, Kaiser & Krzos (2014)	53% African-American, 35% White, 6% Asian, 6% more than one race Sampling location: United States	M = 40.47 *SD* = 11.56	F = 41% M = 59%	schizophrenia or schizoaffective disorder and past or present substance abuse	Unemployed 94.1%	n.a.
5	Bruehlman-Senecal, Aguilera & Schueller (2017)	Latino/a Sampling location: United States	M = 50.92 *SD* = 10.90 Range = 28-68	F = 82% M = 18%	Elevated depressive symptoms	Low income	98%, 68.2% knew how to text
6	Cheli, Cavalletti & Petrocchi (2020)	Sampling location: Italy	Range: 19- 27	F = 40% M = 60%	Psychotic disorder	/	n.a.
7	Clough & Casey (2014)	Research department location: Australia	M = 39.45 *SD* = 16.60 Range: 18-74	F = 62% M = 38%	Anxiety disorders	/	n.a.

8	Clough & Casey (2018)	Research department location: Australia	M = 39.45 *SD* = 16.60 Range: 18-74	F = 61% M = 39%	Anxiety or related disorder	/	n.a.
9	Furber, Jones, Healey & Bidargaddi (2014)	Australia	IG: M = 34.1 *SD* = 14.5 CG: M = 37 *SD* = 15.8	IG: F = 67% M = 33% CG: F = 57% M = 43%	n.a.	/	94,6% had a phone and knew how to use it
10	Gullo, Irvine, Feeney & Connor (2018)	Australian	IG: M = 45.67 *SD* = 9.60 CG: M = 43.47 *SD* = 10.75	IG: F = 23% M = 77% CG: F = 32% M = 68%	Alcohol use disorder	/	n.a.
11	Kravariti et al. (2018)	Sampling location: United Kingdom	IG: M = 42.50 *SD* = 8.964 CG: M = 41.77 *SD*= 9.30	IG: F = 50% M = 50% CG: F = 37% M = 63%	Psychosis	/	n.a.
12	Kunigiri, Gajebasia, & Sallah (2014)	Sampling location: United Kingdom	Range: 18–65	n.a.	n.a.	/	n.a.
13	Moran,	Sampling	n.a.	n.a.	n.a.	/	n.a.

	O'Loughlin & Kelly (2017)	location: Ireland					
14	Shapiro et al. (2010)	Caucasian, African American, Asian, Sampling location: United States	M = 26.3 *SD* = 8.6 Range: 17–49	F = 100%	Bulimia nervosa	/	n.a.
15	Sims et al. (2012)	Sampling location: England	M = 42,64 *SD* = 11,86 Range: 19-79	n.a.	Mood or affective disorders, neurotic, stress-related, or somatoform disorders, schizophrenia or a schizotypal or delusional disorders, personality disorders and substance use disorders	/	70% of appointments were for patients who had a valid mobile phone number in the United Kingdom
16	Thomas, Lawani & James (2017)	Sampling location: Nigeria	M = 33.7 *SD* = 11.9 Range: 18-64	F = 54% Male = 46%	Psychosis	/	n.a.

Note. N.a. = no information was found in the paper. IG = intervention group, CG = control group.

3.3 Message Objectives

The first research question was to identify the objectives of text-messages and to assess whether text-messages are effective to realize those objectives. Three overarching message objectives were extracted inductively from the articles. To do so, articles that used text-messages for similar purposes were grouped. After that an overarching theme was established that summarizes the underlying common ground of text-messages in one category. Those themes were supportive messages (38%), appointment reminders (44%), and monitoring (19%) (See table 2). Apart from that it got visible that 68,75% of the articles assessed the effectivity of messages on the variables treatment attendance, symptom reduction, or medication adherence. All appointment-reminder studies investigated the effectivity of text-messages on therapy attendance. 25% of the studies measured the attitude of participants on their experience with the text-messages. One study assessed the relationship between mood and clinical attendance (Bruehlman-Senecal et al., 2017). The following subparagraphs elaborate on the three different purposes for which text-messages were used.

Table 2

Study characteristics

Overarching message objective	Concrete message usage	No., Reference	Methodology, duration, sample size (n), Service (SMS or App)	Principal outcome	Result	Global rating according to EPHPP
Supportive message	Automatized supporting and health behavior promoting messages	2, Agyapong, Milnes, McLoughlin & Farren (2013)	Cross sectional semi-structured survey, 3 months, n = 26, SMS	Perceived usefulness of text-messages	83% experienced the messages as beneficial for their mental health; 75% were reminded by the messages to stay abstinent; 8% felt annoyed	Weak
	Automatized messages covering different topics with multiple choice answers	3, Beebe, Smith, & Phillips (2014)	Randomized three arm interrupted time series study without control group, 3 months, n=30, SMS	Comparison of phone call only, text messaging only and phone call plus text messaging on psychotic symptoms and medication adherence	Telephone and message more effective than telephone or message alone in symptom reduction; no difference in medication adherence between the three groups	Moderate
	Messaging used	4, Ben-Zeev,	Cohort study,	Assessment of	Participants response-rate	Moderate

	to monitor and communicate with patients	Kaiser & Krzos (2014)	12 weeks, n = 17, SMS	acceptability and satisfaction with text messages	on average 87%, 90% participants stated that the intervention helped them in their lives and 87% stated that they needed the intervention.	
	Possibility to contact therapists if necessary	6, Cheli, Cavalletti & Petrocchi (2020)	Cohort study, 28 days, n = 6, App (open messenger service, not further specified)	Effect of intervention on general symptoms and secondary outcomes (depression, anxiety and stress symptoms).	Significant difference in primary and secondary outcome for the participants, all participants had a stable working alliance	Weak
	Therapists sent supporting messages on different topics	8, Clough & Casey (2018)	Cohort study, n = 32, SMS	Satisfaction and acceptability of text messages in adjunct to therapy.	Patients were not bothered by messages and considered them helpful Patient satisfaction (M = 27.4) was high and about the same as the reported	Weak

					norm score of M = 27.8 for mental health settings. Symptom reduction was as expected for psychological treatment.	
	Prompts and psychoeducation messages via SMS	9, Furber, Jones, Healey & Bidargaddi (2014)	Comparison study, 4 months, IG: n = 68 CG: n = 157, SMS	Effects of messaging in adjunct to psychotherapy on attendance and clinical outcomes (depression, anxiety, eating disorders, alcohol abuse, somatoform disorders functional impairment)	No significant differences in clinical outcomes between IG and CG. There was a trend for IG to attend fewer sessions than CG; 66% of the consumers accepted the intervention	Weak
Appointment Reminder	Clients received reminder ahead of appointment	7, Clough & Casey (2014); n=139	Randomized controlled trial (RCT), SMS	Effect of SMS reminders on clinical attendance and treatment dropout	No difference in attendance, significantly higher dropout in IG than CG	Weak

	Clients received reminder ahead of appointment	10, Gullo, Irvine, Feeney & Connor (2018)	Nonrandomized comparison, 12 weeks, n = 193, SMS	Effect of SMS reminders on treatment attendance	7% increased attendance, impulsive patient benefited less	Moderate
	Clients received reminder ahead of appointment	11, Kravariti et al. (2018)	RCT, 7 months; n=95; SMS	Effect of SMS on treatment attendance	Significant higher attendance of IG (+16%)	Moderate
	Clients received reminder ahead of appointment	12, Kunigiri, Gajebasia, & Sallah (2014)	Comparison of three different reminder mediums after each other (nonrandomized), three phases: telephone calls (2 months), letters (2 months), messages (7 months), n= 248 (Text messaging group), SMS	Effect of letters, telephone prompts and SMS reminders on clinical attendance	Text messages (+8%) and reminder letters (+23%) increased attendance significantly	Weak
	Clients received reminder ahead of	13, Moran, O'Loughlin &	Interrupted time series, 3 years	Effect of SMS reminders on	Attendance-rate increased by 8% within	Moderate

	appointment	Kelly (2017)	including 6 month control, 81% of appointments in the clinic received reminder, n= n.a., SMS	attendance	the first 6 months, but after 3 years the effect declined to 2.9%	
	Clients received reminder ahead of appointment	15, Sims et al. (2012)	Interrupted time series, three years, number of appointments Year 1 (control): (n=648), Year 2: (n=1,081)Year 3: (n=1,088), SMS	Effect of SMS reminder on attendance	Attendance rates were significantly higher for both intervention years (Year 1 = 10%; Year 2 = 9%) compared to control year, but did not differ between intervention years	Moderate
	Clients received reminder ahead of appointment	16, Thomas, Lawani & James (2017)	RCT, six months and one week; n= 192, SMS	Effect of SMS reminder on attendance	Reminders increased attendance significantly (+15%),	Moderate
Monitoring	Self-monitoring messages covering different topics	1, Aguilera & Muñoz (2011)	Cross-sectional pilot study, 2 months, n=10, SMS	Usability and feasibility of text-messaging as adjunct to therapy	65% of the messages received a response; 90% of the clients reported positive experience;	Weak

				clients reported experience of heightened self-awareness	
Monitoring symptoms with feedback	14, Shapiro et al. (2010)	Cross-sectional study, 24 weeks, n=31, SMS	Effect of self-monitoring and feedback on eating disorder symptoms and depression (BDI)	Significant decrease in BDI, eating disorder (EDI), and night eating (NS), 87% of patient adherence to intervention	Weak
Mood-monitoring	5, Bruehlman-Senecal, Aguilera & Schueller (2017)	Correlational study, n= 56, SMS	Relation between mood rating and clinical attendance	Positive relationship between mood and clinical attendance; between 20% asked to stop receiving text message before the end of psychotherapy; 13% additional patients did not respond	Weak

3.3.1 Supportive message

The objective of supportive messages was applied to research, in which messages of more than one topic related to mental health and well-being were transferred, such as psychoeducation, prompts for homework or medication-intake, messages relating to therapy content or client symptoms. An example of a supportive message is: "If you are having a good day, share your joy with others. If you are having a bad day, share it with others and accept their help." Out of six studies that used supportive messages three studied the acceptability (Agyapong et al., 2013; Ben-Zeev, et al., 2014; Clough and Casey, 2018) and three measured the effectivity on different outcome variables, such as clinical symptoms (Beebe et al., 2014; Furber et al., 2014; Cheli et al, 2020).

In the studies that focused on user attitudes, between 83-90% of the participants stated to experience the text-messages as beneficial for their mental health and well-being. In the paper of Ben-Zeev et al. (2014) 90% of the participants considered the text-messages as helpful and 87% stated that they needed the text-messages. For example, participants indicated that the messages helped them to be more productive in their lives. In the study of Agyapong et al. (2013) 75% of the participants stated that the text-messages helped them to stay abstinent from alcohol. The participants of Clough and Casey (2018) regarded the text-messages as helpful with a mean of 5.67 on a rating scale rating (from 1 to 7). The patient satisfaction score of M = 27.43 (*SD* = 3.23) for the text-messages is comparable to the norm score of 27.80 for other psychological treatment. However, occasionally, clients stated to experience difficulties, like one client suffering from anxiety disorder that was worried when receiving messages while driving, because he could not check whether something bad happened to his family or whether it was just a therapy message (Clough & Casey, 2018). Moreover, in the study of Agyapong et al. (2013) 8% of the participants felt annoyed by the text-messages, although, they did not drop out. Overall, despite some criticism the majority of participants considered the text-messages as beneficial.

The effectivity of supportive messages targeting psychiatric symptoms, medication adherence and treatment attendance was studied in three articles. One study compared telephone therapy alone, messages alone and telephone therapy combined with additional messages and indicated that the addition of messages to treatment sessions with a psychiatrist via telephone had a positive effect on psychosis symptom reduction, but no difference on medication adherence (Beebe et al., 2014). Another study recognized a significant difference in general symptoms measured by the Symptom Check List 90-R and the total score of the Depression Anxiety Stress Scale 21 of participants that received video-chat based treatment

supported with messaging; however, there was no comparison group (Cheli et al, 2020). The third study investigated the effects of messaging with a therapist in adjunct to telephone-based psychotherapy on attendance and several clinical outcomes but did not find a significant difference compared to control groups (Furber et al., 2014). Thus, based on the limited and contradicting study outcomes no conclusion about the effectiveness of supportive text-messages can be drawn.

3.3.2 Appointment Reminder

Seven articles studied text-message appointment reminders and measured their effect on treatment attendance. One example phrasing of a reminder text-message is: "This is a reminder that you have a hospital appointment on … (date) at (time) with Dr. at … (venue). If unable to attend please contact …" (Kunigiri et al., 2014). Six of seven studies indicated a significant increase of attendance rates from 2.5% up to 16% for groups that received a reminder, compared to control groups (Sims et al., 2012; Kunigiri et al., 2014; Moran et al., 2017; Thomas et al., 2017; Gullo et al., 2018; Kravariti et al., 2018).

Thomas, Lawani & James (2017) assessed the effectiveness of text-message reminders in Africa. The reminders increased attendance rates significantly by 15%. The increase is comparable to other research in Western countries, such as the research of Kravariti et al. (2018) who observed an increase of attendance rates of 16% in the United Kingdom.

Clough and Casey (2014) found no effect of reminders on attendance and even an increase in dropouts of the intervention group. Compared to the previous mentioned studies that found positive effects, no differences in the message content were found and the quality according to the EPHPP was comparable. Nevertheless, the study of Clough and Casey (2014) was the only research in which appointment reminders where used in a population of participants with anxiety disorders.

Impulsiveness. One research that studied reminders with alcoholic participants indicates a difference in effectivity for impulsive participants. Impulsive patients had lower attendance rates in the intervention and the control condition. However, there was no significant effect of SMS reminders on the group of participants that scored high on impulsivity. The attendance probability of impulsive participants was 0.78, compared to a probability 0.96 of participants low in impulsivity (Gullo et al., 2018). Impulsive people seemed to benefit less from text-message reminders in one research.

Long-term effects. The outcome of the study of Moran et al. (2017) suggests that the positive effects of reminders decline on the long term. The longitudinal research found a decline of the

positive effects of text-message reminders on clinical attendance from 8% to 2.5% after three years. In contrast to that, Sims et al. (2012), who studied the effect of text-messaging over two years found no significant decline. However, in the study of Sims et al. (2012) the design changed after one year. They sent two messages in advance of appointments and changed the timing of the second messages by sending it three days in advance of the appointment instead of five days. Due to the change in design after one year the researches are difficult to compare.

Sims et al. (2012) investigated whether a different timing of reminder transmission makes a difference. They sent reminders seven and five days before each appointment first and after that sent reminders seven and three days before each appointment. However, the variation did not yield any significant difference in attendance rates. Nonetheless, the timing differed only by two days. Furthermore, other reminder studies sent reminders at different times, ranging from one reminder 24 hours prior to the appointment to two times with seven and five days prior to the appointment (Sims et al., 2012; Gullo, Irvine, Feeney & Connor, 2018). The only study that found no positive effect of reminders on attendance rates sent the reminders one day before the appointment (Clough & Casey, 2014). In contrast to that, a study that also sent reminders one day before the appointment found a significant effect (Gullo et al., 2018). Further, no relation between the timing and the percentage of attendance-rate increase got visible. In sum, a difference in timing on which appointment reminder are sent, does not seem to impair the effectivity of the reminder.

3.3.3 Monitoring

Three articles examined text-messages that were used to monitor clients' mood or behavior. An example message for self-monitoring is: "How many positive thoughts have you noticed today?" Shapiro et al. (2010) studied the effect of text-message based monitoring on eating disorder symptoms and depression. The intervention led to a significant reduction of both, eating disorder symptoms and depression. However, they did not use a control group, which prohibits drawing conclusions about the effect of text-messages in this case. The research of Aguilera and Muñoz (2011) examined the acceptability of self-monitoring via text-message and reported appreciation for the text-messages from 90% of the participants. Bruehlman-Senecal et al. (2017) used text-messaging to monitor their clients moods on a scale from zero to nine (9 = the best) daily. They found evidence for the correlation of their interest, which was clients' mood and clinical attendance. Nonetheless, there was a dropout of 33% of the participants. This is in sharp contrast to the acceptability of 90% that was found in

the study of Aguilera and Muñoz (2011). In both publications participants had primarily depressive symptoms and were of low income populations.

3.4 BCMs

The second research aim was to examine which BCMs were applied in the text-messages. In total eight different BCMs by Kok et al. (2016) were identified. Out of all papers, nine studies integrated the method facilitation (Sims et al., 2012; Clough & Casey, 2014; Furber et al., 2014; Kunigiri et al., 2014; Moran et al., 2017; Thomas et al., 2017; Clough & Casey, 2018; Gullo et al., 2018; Kravariti et al., 2018); six studies used tailoring (Shapiro et al., 2010; Ben-Zeev et al., 2014; Clough & Casey, 2014; Furber et al., 2014; Clough & Casey, 2018; Cheli et al., 2020), five used counterconditioning (Shapiro et al., 2010; Agyapong et al., 2013; Ben-Zeev et al., 2014; Furber et al., 2014; Clough & Casey 2018), four studies used persuasive communication (Agyapong et al., 2013; Ben-Zeev et al., 2014; Clough & Casey 2018), four used reinforcement (Shapiro et al., 2010; Beebe et al., 2014; Ben-Zeev et al., 2014; Clough & Casey, 2018), another four integrated self-monitoring of behavior (Shapiro et al., 2010; Aguilera & Muñoz, 2011; Beebe et al, 2014; Ben-Zeev et al., 2014), three studies used individualization (Beebe et al., 2014; Ben-Zeev et al., 2014; Cheli et al., 2020), and one time belief selection was integrated (Agyapong et al., 2013).

3.4.1 Facilitation

The concept facilitation is derived from the social learning theory of Bandura (1986). Facilitation describes the process of reducing barriers, or the simplification an action, to increase the likelihood of people to engage in the action (Kok et al., 2016). Nine studies used facilitation (Sims et al., 2012; Clough & Casey, 2014; Clough & Casey, 2018; Furber et al., 2014; Moran et al., 2017; Thomas et al., 2017; Gullo et al., 2018; Kravariti et al., 2018). Eight of nine studies that used facilitation, used the method to increase the attendance of treatment appointments. Therefore, appointments reminders were sent, which included information about the location, the date and time of the appointment. The only exception is the study of Furber et al. (2014) in which text-messages were used to remind participants of their homework practices. Overall, facilitation was applied into text-messages to counteract the action barrier forgetting.

3.4.2 Tailoring

Tailoring refers to the process of adapting an intervention to the individual characteristics of a person (Kok et al. 2016). For text-messages this means that not every client receives the same standardized messages. Instead, they entail some form of personalization. In the selected studies the personalization ranged from only inserting the name of the receiver in an otherwise standardized message (Clough & Casey 2014; Clough & Casey, 2018), to writing completely free answers in response to clients' messages (Ben-Zeev et al. 2014; Cheli et al., 2020). In the study of Shapiro et al. (2010) participants reported their binge-eating behavior and received individual feedback based on their input, such as appraisal on days at which they did not purge. Some text-messages were only slightly tailored by inserting client's names, while other messages were completely tailored answers to clients' input.

3.4.3. Counterconditioning

Counterconditioning is a method to change behavior by suggesting alternative behaviors for an undesired behavior Kok et al. (2016). Shapiro et al. (2010) aimed to reduce binging and purging episodes by sending tips for alternative behaviors directly linked to the text-messages of participants. When clients wrote that they experienced binges, they responded , as one example: "Try harder not to give into the binge eating tomorrow. Call a friend instead." In the paper of Clough & Casey (2018) behavior recommendations were sent, which wrapped up the content of the past treatment session, such as: "Remember motivation can change over time. Sometimes it's helpful to reconsider your reasons for change and set goals for how you will achieve this.". Agyapong et al. (2013) did not provide insights into every text message. However, one text-message illustrates that they recommended practicing strategies for relapse prevention: "Make a list of 5 people you can call if you are craving. Make sure you carry their numbers with you all the time.". All in all, the choice of targeted behavior was differently in the studies, some focused on predetermined desired behavior, and others targeted more behaviors that were problematic for clients at that moment.

3.4.4 Persuasive Communication

Persuasive communication is used when arguments or other means are used to guide individuals to an attitude or action (Kok et al., 2016). Agyapong et al. (2013) used psychoeducation to convince clients to stay abstinent by writing for instance: "The alcohol that you just got away from will return to test you. Remember to never give up in the face of temptation.". In contrast to that, Furber et al. (2014) gave arguments why clients benefit from

adopting alternative behaviors by mentioning the benefit of the behavior, such as that slow breathing or self-reassurance reduces anxiety. Similarly, Ben-Zeev et al. (2014) sent explanations about the rationale of healthy behaviors. They explained for instance that putting medicine in a pill-box can prevent forgetting (Ben-Zeev et al., 2014). Overall, persuasive communication was used in form of information and arguments to convince clients to adopt a healthier behavior.

3.4.5 Reinforcement

Reinforcement is a concept related to social learning theories, such as operant conditioning by Skinner (1990). Reinforcement means that a desired behavior is followed by a consequence that increases the likelihood of the behavior to occur again (Kok et al., 2016). Two studies sent standardized reinforcing messages to their participants. For example in the study of Beebe et al. (2014) the following reinforcing message was sent every 6 days: “Thank you for being a part of the texting study. We appreciate you!” Another way in which reinforcement has been applied in messages was to compliment reported positive behavior with messages like: “"Good job with resisting your strong urge to purge today" (Shapiro et al., 2010). In sum, in the studies reinforcement was used to motivate participants to continue treatment or to facilitate healthy behaviors.

3.4.6 Self-Monitoring of Behavior

The BCM self-monitoring of behavior refers to prompts that encourage people to record their behavior (Kok et al. 2016). Ben-Zeev et al. (2014) induced self-monitoring of behavior, by asking participants to report their medication adherence and gave tips based on participants’ responses. In contrast to that, in the study of Aguilera & Muñoz (2011) participants received messages that encouraged them to track thoughts, pleasant activities and their social contacts for instance with the message: "How many positive thoughts have you noticed today?”. In this case monitoring was used to increase self-awareness. Participants received no answers. Overall, self-monitoring was used to record a range of behaviors such as medication adherence, thoughts and social activities, either to present tips for participants or to increase self-awareness.

3.4.7 Individualization

The BCM individualization is applied when individual questions are answered or other forms of communication that are adapted to the individual learning process are provided (Kok

et al., 2016). In the study of Beebe et al. (2014) one of the seven message topics that repeated every week was “questions”. On these days, participants received the following text-message: "Hello from the texting study. Today's topic is anything you have questions about." In the study of Ben-Zeev et al. (2014) participants were free to ask the interventionists questions any time. Comparably, Cheli et al. (2020) answered any concerns and questions that clients had. In the publications that included individualization, participants were allowed to ask questions, either freely or after receiving the invitation to do so.

3.4.8 Belief Selection

The BCM belief selection refers to the use of messages that intend to strengthen positive beliefs, weaken negative beliefs or introduce new beliefs (Kok et al., 2016). Belief selection was integrated in the study of Agyapong et al. (2013) in which messages were sent in an affirmative manner to evoke positive beliefs such as “I will take charge of my life today” or “remain positive”. Moreover, messages were sent to reduce negative beliefs, for instance the negative evaluation of craving by the following message: “Do not be afraid of cravings, when it is hurting, it is healing.”. Belief selection was used to introduce positive beliefs, as well as reduce negative beliefs.

3.5 Amount of BCMs

In the researches one to five different BCMs were applied to the text-messages. On average 2.2 BCMs were integrated. Eight studies used one BCM (Aguilera & Muñoz, 2011; Sims et al., 2012; Kunigiri et al., 2014; Moran et al., 2017; Thomas et al., 2017; Gullo et al., 2018; Kravariti et al., 2018). Although, seven out of eight studies that used only one BCM used facilitation in form of text-messages as appointment reminders. The exception was the study of Aguilera and Muñoz (2011) that used only one BCM, which was self-monitoring of behavior. One study used two different BCMs (Clough & Casey, 2014). Two studies used three different BCMs (Agyapong et al., 2013; Beebe et al., 2014; Furber et al., 2014), two study used four different methods (Shapiro et al., 2010) and two studies integrated five different BCMs (Ben-Zeev et al., 2014; Clough & Casey (2018). The papers of Cheli et al. (2020) and Bruehlman-Senecal et al. (2017) were not taken into account, because they did not offer insights into every kind of message that was sent, thus not all BCMs they used could be identified.

3.6 Effectivity of BCMs per Message Objective

3.6.1 Supportive Message

There were some differences in the outcomes of studies that used text-messages for supportive messages. While Beebe et al. (2014) and Cheli et al. (2020) recognized a significant symptom reduction in their participants, Furber et al. (2014), found no significant difference in clinical outcomes between the intervention and control group. There are some differences in the incorporated BCMs between the studies with contradicting results. Both studies that found a significant effect made use of the BCM individualization which means that participants received replies to their messages (Beebe et al., 2014; Cheli et al., 2020). In contrast to that, the participants of Furber et al. (2014), received individually tailored messages based on the events in therapy sessions, but they did not receive replies. Furthermore, one of the studies that found an effect of text-messaging used the BCM self-monitoring of behavior like medication adherence, social contacts and reinforcement of clients' participation (Beebe et al., 2014). The second study that found an effect of supportive messages did not provide concrete information about further possible BCMS (Cheli, Cavalletti & Petrocchi 2020). In the paper that found no effect of text-messaging, facilitation was used in form of prompts for homework practices, and counterconditioning reminded participants to practice desired behavior that was learned during therapy session content for instance to breathe slow in case of anxiety. Nonetheless, given the limited amount of articles, there is not enough evidence to draw conclusions on the influence of the choice of BCMs on the effectivity of supporting messages.

3.6.2 Appointment Reminder

All studies of appointment-reminders used the BCM facilitation to reduce the barrier of forgetting appointments. Clough and Casey (2014) were the only researchers who used tailoring additionally, by incorporating clients' names into the messages. The other studies solely used the method facilitation by reminding participants about the appointment. The research of Clough and Casey (2014) was the only research that did not found a positive effect of the reminders.

3.6.3. Monitoring

Three studies used text-messages for self-monitoring. Shapiro et al. (2010) found a positive effect of text-message based monitoring on eating disorder symptoms and depression. They incorporated several BCMs. Apart from self-monitoring of behavior, tailoring,

counterconditioning, and reinforcement were used. Bruehlman-Senecal et al. (2017) used text-messaging as a medium to monitor their clients moods. Despite that they found evidence for the correlation of their interest of clients' mood and clinical attendance, there was a dropout of 33% of the participants. This is in contrast to the study of Aguilera and Muñoz (2011) that was done in a similar population of depressive clients with low income. In the latter study, 90% of the participants reported a positive experience with the text-messages. The participants further stated that they experienced a heightened self-awareness due to the text-messages. However, Aguilera and Muñoz (2011) integrated the BCM self-monitoring of behavior. In Bruehlman-Senecal et al. (2017) no BCMs of Kok et al. (2016) were integrated. The participants were only asked to monitor their mood, not their behavior.

Table 3.

Content analysis

Overarching method objective	No., Reference	Method	Level of interaction, personalization	Text message Content/ example	BCM (Kok et al., 2016)
Supportive message	2, Agyapong, Milnes, McLoughlin & Farren (2013)	Messages twice daily at 10.00 and 19.00 o'clock; no message was sent twice	One-way, automatized	Topics: Stress management, well-being, promoting abstinence, e.g.: " If you are having a good day, share your joy with others. If you are having a bad day, share it with others and accept their help."	Belief selection, Persuasive communication, Counterconditioning, eventually more
	3, Beebe, Smith, & Phillips (2014)	Daily text-messages with multiple choice answers	Two-way; automatized, messages that repeated every week	Six topics: 1. Medication 2. Appointments 3. Symptoms 4. Drug craving 5. Social life 6. Questions 7. Reinforcement and reassurance e.g. topic 2: "Hello from the texting study. Today's topic is symptoms. Have	Individualization, Self-monitoring of behavior, Reinforcement

			you been bothered by any [specific symptom here]? You can say Not at all, A little, or A lot.”	
4, Ben-Zeev, Kaiser & Krzos (2014)	Assessment of medication adherence and medical status and provision of feedback and support. Interventionists responded maximum 3 times per day	Two-way, individually tailored	Unless counselors received a message from clients, they routinely started to assess medication adherence. Interventionists offered coping strategies or tips for illness management, e.g.: “One way you can remember is to put the pill box next to your toothbrush. Would that help?“. In the last two weeks messages focused on self-management e.g.: “You’re doing a great job. It’s important to keep that up after we finish in 2 weeks”	Tailoring, Individualization, Self-monitoring of behavior, Reinforcement, Persuasive communication,
6, Cheli, Cavalletti & Petrocchi (2020)	Clients could individually contact	Two-way, individually	n.a.	Tailoring, Individualization,

	their therapist	tailored		eventually more
8, Clough & Casey (2018)	Daily text message of 4 different topics : Reinforcing treatment attendance, prompting homework and giving tips, appointment reminders and messages relating to therapy content	One way, semi-standardized messages (tailored to client name)	e.g.: "Hi [insert name]. Remember motivation can change over time. Sometimes it's helpful to reconsider your reasons for change and set goals for how you will achieve this." Or: "Hi [insert name]. Congratulations on completing session one. Starting a new treatment can be difficult, but it is a strong decision. We hope you enjoy the program."	Tailoring, Reinforcement, Persuasive communication, Facilitation, Counterconditioning, eventually more
9, Furber, Jones, Healey & Bidargaddi (2014)	Clients could choose after each session whether they wanted to receive messages or not	One-way, standardized messages but process of sending was tailored to the choice of participant	Two main message types: 1) Prompts for homework practices 2) Psychoeducation Both linked to the therapy sessions e.g.: consumers were reminded of	Tailoring, Facilitation, Counterconditioning, Persuasive communication, eventually more

				recommended methods for managing feelings of anxiety such as slow breathing or reassurance that feelings of anxiety will pass naturally	
Appointment Reminder	7, Clough & Casey (2014); n=139	Reminders sent via SMS at 8.30–9.00 a.m. one day prior to appointment	One-way, semi-standardized (tailored to client name)	Client's name, Appointment day and time, and contact details for the clinic	Facilitation, Tailoring
	10, Gullo, Irvine, Feeney & Connor (2018)	Reminders sent 24 h prior to appointment	One-way, standardized	"Reminder: PAH Alcohol & Drug Unit, Wednesday, 03/ 02/2016 at 09:00. Phone 3176 5191 if unable to attend. DO NOT REPLY"	Facilitation
	11, Kravariti et al. (2018)	Seven days and one day before appointments	One-way, standardized	"You have an appointment with Lambeth South at [TIME] on[DATE]. Please call XXXXXXXXXXX if you cannot come"	Facilitation
	12, Kunigiri, Gajebasia, & Sallah	Text message sent 14 days and two	One-way, standardized	"This is a reminder that you have a hospital appointment on …	Facilitation

	(2014)	days prior to appointment		(date) at (time) with Dr. at … (venue). If unable to attend please contact …"	
	13, Moran, O'Loughlin & Kelly (2017)	n.a.	One-way, standardized	n.a.	Facilitation
	15, Sims et al. (2012)	In first intervention year SMS were sent seven and five days before appointment, in second year seven and three days before appointment, at 6p.m.	n.a., standardized	"You have an appointment on TESTDAY at TESTTIME at Ferryview. Please call TESTNUMBER if you cannot come."	Facilitation
	16, Thomas, Lawani & James (2017)	The SMS was sent five days and three days before appointment	n.a.; standardized	Date and time of patients' first clinic appointment.	Facilitation
Monitoring	1, Aguilera & Muñoz (2011)	Daily mood monitoring messages were sent; 1-2	Two-way, however clients got no response after they	Thought tracking (both positive and negative), (2) tracking of pleasant activities, (3) tracking of	Self-monitoring of behavior

		additional messages to different topics at a random time per day	entered their rating Automatized	positive and negative contacts, and (4) tracking of physical well-being e.g.: "What is your mood right now on a scale of 1 to 10?"; "How many positive thoughts have you noticed today?"	
	14, Shapiro et al. (2010)	Clients sent message every night and got feedback, additional reminders in case of nonadherence	Two-way (one reply per message from client) Semi-standardized; automatic tailored feedback relative to symptoms	Feedback e.g. "Good job with resisting your strong urge to purge today. Try harder not to give into the binge eating tomorrow. Call a friend instead."	Tailoring, Self-monitoring of behavior, Reinforcement, Counterconditioning
	5, Bruehlman-Senecal, Aguilera & Schueller (2017)	Clients received prompting SMS daily, at a random time between 8 a.m. and 9 p.m.	Two-way, however clients got no response after they entered their rating, automatized	"What is your mood right now on a scale of 1–9? (9 = the best)"	n.a.

Note. IG = intervention group, CG = control group.

4. Discussion

4.1 Answers to RQs

This thesis answers two research questions. First, it answers what message objectives can be identified in text-messages as addition to mental health treatment and whether text-messages are effective for those objectives. Results illustrate that the following three message objectives were entailed in text-messages: supportive messages, appointment reminder and monitoring. The evidence for the effectivity of supportive text-messages was mixed. However, the majority of individuals that received text-messages described positive attitudes towards the text-messages and felt supported by it. Overall, appointment reminders seem to be an effective mean to heighten attendance-rates of psychological treatment. The timing of message transmission does not seem to impact the effectiveness. Nonetheless, in one study appointment reminders did not change attendance rates and more people that received text-message reminders left the study. Symptom-monitoring via text-messages might be effective to reduce clinical symptoms in one study. Nonetheless, the attitudes towards text-messages for monitoring were contradicting.

The second research question was 'which BCMs were applied in text-messages as adjunct to mental health treatment?' In total eight different BCMs were integrated in the text-messages. Those are facilitation, tailoring, counterconditioning, persuasive communication, reinforcement, self-monitoring of behavior, individualization and belief selection. The outcomes suggest that the number of integrated BCMs is not related to the effectivity of text-messages. Nonetheless, a reduced acceptability is visible in a study that did not incorporate BCMs compared to studies that used BCMs. These findings suggest that the integration of BCMs in text-messages might be important in terms of acceptability.

The following subsections elaborate on the effectivity of text-messages relative to the three identified message objectives.

4.1.1 Supportive messages

Supportive messages primarily reduced psychopathological symptoms or at least received high acceptance and appreciation from participants. The messages reminded clients of healthy alternative behaviors for their problem behavior throughout the day. Some messages also stimulated self-monitoring and reinforcement to motivate participants. It can be assumed that the integrated BCMs facilitated clients in the adoption of healthy behavior. All

in all, psychiatric populations might benefit from, or at least appreciate supportive messages from therapists in addition to primary treatment.

4.1.2 Appointment Reminder

The publications suggest that text-message reminders can increase attendance rates from 2.5% to 15%. One explanation for why appointment reminders are effective can be found in the social learning theory by Bandura (1986). The social learning theory states that one way to increase the likelihood of a behavior to happen is for instance the reduction of action barriers. Thus, appointment reminders may increase attendance rates, because they remembered participants of their appointments and thereby decrease the likelihood of forgetting.

4.1.3 Monitoring

Due to a lack of controlled studies, it is still unclear whether text-messages are effective for self-monitoring. Nonetheless, it can be assumed that thinking about the own behavior stimulates a reflecting process. Participants recognize to which extent they engaged in healthy or unhealthy behaviors. The dual process model purports that decisions based on undeliberate processes can differ from our intentions at times. To act in line with our intentions, it is more effective to decide for actions with a state of awareness (Neys, 2017). Moreover, by increasing awareness about the own engagement in undesired behavior, the attitude towards the undesired behavior might become more negative (Maas, Hietbrink, Rinck & Keijsers, 2013). According to the theory of planned behavior (Ajzen, 1991) the attitude towards a behavior is one of three contributing factors for behavioral change. Overall, it can be assumed that self-monitoring might stimulate behavioral change.

4.2 Deviating results

4.2.1 Supportive message

The results on supportive messages oppose each other to some extent. Two studies found a reduction of clinical symptoms by supportive text-messages. While Furber et al. (2014) found no significant difference between the intervention and control group. One factor that might have caused the deviating outcome is that the study was statistically underpowered, which means that differences between groups might have remained undiscovered. Despite statistical weaknesses, it may be possible that a different use of BCMs accounted for the non-effectiveness. Both effective studies used individualization, which means that participants

received replies to their messages. In the study of Furber et al. (2014) participants did not receive replies, which mean that no interaction was possible. Studies demonstrate that interactivity is important to engage people with technology. For instance, the revisit rate of highly interactive website is higher than the revisit rate of websites that allow less interaction (Dholakia, Miao, Dholakia & Fortin, 2001). Furthermore, a survey on apps yielded that interactive apps increase user's feeling of autonomy, which is positively correlated to their attitude towards the app (Bellur & DeVoss, 2018). Thus, it can be suggested that the effect of text-messages might be increased by enabling people to interact with text-messages.

4.2.2. Appointment Reminder

Appointment reminder increased the attendance rate effectively in all studies except in Clough and Casey (2014). The content of the message and quality of the studies is comparable. Looking at the BCMs, the studies included only the BCM facilitation, while Clough and Casey (2014) additionally inserted participants' names in the text-message, which refers to the BCM 'tailoring'. However, it might be assumed that incorporating BCMs induces behavioral change, instead of inhibiting it. Other studies that included tailoring turned out to be effective as well (Shapiro et al., 2010; Clough & Casey 2018). Therefore, it seems unlikely that the addition of client's names in the reminder messages diminished the positive effect of the reminder. Instead, it might be possible that participant characteristics influenced this outcome. The research of Clough and Casey (2014) was the only appointment reminder study in a sample population of patients with anxiety disorders. It is possible that anxious participants have different needs to supportive adjuncts to treatment, compared to other psychiatric populations.

The research of Gullo et al. (2018) revealed that a difference in participant characteristics indeed influences the effectivity of text-message reminders. The higher participants scored in impulsivity, the less their treatment attendance rate benefited from appointment reminder. Previous research even suggests that there is a link between impulsivity and anxiety (Del Carlo et al., 2012). An explanation for the increased dropout might be that the reminder increased the negative affect in anxious participants by reminding them of the appointment which caused additional apprehension and consequently increased their dropout rate. The finding implicates that different clinical populations might have different needs regarding adjuncts for therapy.

Two studies researched the effectiveness of appointment reminder over years. The findings of Moran et al. (2017) suggest that the positive effects of reminder decline within

three years. In contrast to that, Sims et al. (2012) found no significant decline after two years. Nonetheless, in the latter study, the timing was changed after one year from seven and five days, to seven and three days in advance of the appointment. It is conceivable that this variation caused an experience of variability, which might have decreased a habituation effect. The findings indicate that there might be a decline in effect over years when participants become used to reminder; nonetheless, there is only one study that provides evidence for this finding.

4.2.3 Monitoring

Self-monitoring was faced with contrary acceptability in two studies. While Aguilera and Muñoz (2011) received positive feedback from 90% of the participants, Bruehlman-Senecal et al. (2017) experienced a dropout of 33%, which was the highest dropout of all studies. Both studies included participants with comparable characteristics. Nonetheless, a difference in usage of BCMs can be recognized. While Aguilera and Muñoz (2011) used self-monitoring of behavior, Bruehlman-Senecal et al. (2017) only monitored the mood of clients and thereby did not use any BCMs. Text-messaging in this case was only used as a tool for practitioners to gather information from participants. Nonetheless, in other behavioral change taxonomies, such as the taxonomy by Abraham and Michie (2008) self-monitoring of emotions is considered a behavioral change method. Nonetheless, it may be assumed that the participants did not experience a direct benefit from the text-messages, because mood-monitoring alone does not lead to perceivable change. A qualitative study about mood monitoring of depressive participants supports this assumption. Participants mentioned that the intervention heightened their self-awareness, but that it did not help them to improve their illness management. Additionally, some participants stated that documenting their mood even decreased their mood (Incecik et al., 2020). Other mood-monitoring studies of mainly depressive participants' reported completion rates from 45.9% -76% (Ross, TenHave, Eakin, Difilippo & Oslin, 2008; Lauritsen et al., 2017; Van der Watt, Suryapranata & Seedat, 2018). These findings support the assumption that mood-monitoring on its own is related to high dropout rates. However, the positive feedback for monitoring in the study of Aguilera and Muñoz (2011) suggests that the acceptability of mood-monitoring interventions might be heightened by the addition of BCMs. Thus, the integration of BCMs to monitoring might heighten acceptability, because a feeling of benefit through behavioral change can be experienced.

4.3 Taxonomy of BCMs

The taxonomy of Kok et al. (2016) that was used in this review has one major advantage. Other behavioral change taxonomies, like the taxonomy of behavioral change techniques (BCTs) by Abraham and Michie (2008) provide an overview of different behavioral change techniques and their definitions. Nonetheless, Kok et al (2016) added parameters for each BCM to the taxonomy. The parameters indicate requirements that need to be met to ensure the effectiveness of a BCM. For instance, the parameter for the BCM tailoring indicates that tailored variables or factors should be related to behavior change or relevance. Thus, behavioral change might not be achieved when random components are tailored. The relevance of parameters is indicated by our finding that the BCT self-monitoring of emotions was not effective in changing behavior in the study of Bruehlman-Senecal et al. (2017). Additional parameters to the taxonomy might provide an explanation by additional requirements that need to be met in order for self-monitoring of emotions to be effective. The parameters of Kok et al. (2016) might be beneficial to explain why BCMs in some research might not lead to desired results. Moreover, the parameters might enhance the effectivity of BCMs and consequently may support a successful implementation of BCMs in practice.

4.4 Practical Implications for Psychological Treatment

In this review it was demonstrated that in several cases participants could benefit from blended treatment in form of additional support to treatment sessions. While living their everyday lives, participants were asked to reflect on different situations such as their social life or medication. These messages might help clients to stimulate reflection, which is beneficial, because patients are able to change their behavior immediately. Participants primarily reported positive experiences and explained that reflecting on their activities throughout the day helped to be more productive in their lives and that additional contact facilitated their treatment goals. Further, to increase treatment attendance rates, appointment reminder seemed to be useful. Due to their efficiency text-message reminders can be recommended for regular clinical settings. However, it has to be noted that reminders might be dysfunctional for impulsive and anxious client groups.

Nonetheless, the usage of SMS as a medium for treatment extensions is associated with limited possibilities. Nowadays, the usage of apps becomes more and more widespread (Clement, 2020a; Clement, 2020b). Compared to SMS, messenger apps have improved possibilities to protect data and enable more complex features (McLean, 2018). Moreover, the e-mental health platform Minddistrict is a tool designed to reduce the workload of

psychotherapists, by offering modules of psychoeducation and cognitive behavioral therapy exercises such as thought records. First research suggests that people with mild to moderate depressive symptoms may benefit from a web-based intervention with automated support equally compared to web-based platforms with human support (Kelders, Bohlmeijer, Pots & Van Gemert-Pijnen, 2015; Mira, Bretón-López, García-Palacios, Quero, Baños & Botella, 2017). Nonetheless, research with strong designs about the requirements and suitable populations for non-human-supported technological treatment are still scarce and the evidence for automated support is contradicting (Mira et al., 2017; Shim, Mahaffey, Bleidistel & Gonzalez, 2017). Therefore, it can be recommended to use secure apps or websites as an extension of treatment.

4.5 Implication of EPHPP-Rating

Looking at the rating of single criteria, overall, the included studies are of average quality (see Appendix). Nonetheless, there are some outliers in terms of strong and weak points. For instance, looking at the assessment component blinding, all except one study were rated weak. Research suggests that non-blinded participants tend to exaggerate intervention effects (Hróbjartsson, Emanuelsson, Thomsen, Hilden & Brorson, 2014). This implicates that if participants were aware about the study, they might have rated the text-messages more favorable. However, the weak score in the category blinding might also have been caused by the requirements of the rating. The majority of articles did not provide information about blinding. This also explains why according to the quality assessment of the EPHPP, there were no strong articles included in the review. In order to be globally rated as strong, a study is not allowed to be rated weak in any component. Some studies may have been rated weak due to a lack of information in one component, but they still might have a strong design in other components.

4.6 Strengths and Limitations

Overall, the review provides a thorough overview how text-messages with different objectives are applied as an extension of psychological treatment. Moreover, no other study was found that investigated the use of BCMs in text-messages. This is probably because BCMs are more common in the context of behavioral change interventions than in psychotherapeutic context. However, this research provides evidence that it may be useful for treatment methods, such as mood monitoring, to apply BCMs. Additionally, this review provides further support for the finding that the effectiveness of appointment reminders might

be influenced by characteristics of the sample population, by Gullo et al. (2018). This suggests that individuals with different psychiatric diagnoses have different needs to be regarded when implementing adjuncts to treatment.

The review has some limitations. First, various types of study designs were integrated in the review, which was necessary to achieve a broad overview about research in this field. However, the review includes only few studies with a strong study design, which all assessed appointment reminder. Furthermore, several researches have no control group. Additionally, two researches had small sample sizes of ten and less participants, one being a pilot study. The lack of strong study designs for the text-message objectives monitoring and supportive messages prohibits conclusions about the effectiveness of additional text-messages. Secondly, it has to be noted that the identification of BCMs was done by one researcher. Other researchers might have interpreted the description of BCMs by Kok et al. (2016) differently, which might have biased the extraction of BCMs. Another barrier to the analysis of BCMs was that not every study enabled BCM identification, as a clear description on the content was missing (i.e. in Agyapong et al., 2013; Furber et al., 2014; Clough & Casey, 2018). In addition, the quality rating of the studies was done by one researcher. Nonetheless, according to a comparison of quality assessment tools, the interrater reliability for the EPHPP seems fair (Armijo-Olivo, Stiles, Hagen, Biondo & Cummings, 2010). This suggests that no major differences between several raters are expected.

4.7 Future Research

The review reveals several research gaps. First of all, there are not sufficient controlled studies that examine the effectiveness of monitoring text-messages as extension of psychological treatment. Further, this research indicates that mood-monitoring of depressive populations comes with high dropout rates. It might be investigated whether adding BCMs to mood-monitoring can increase the acceptability of participants. Nevertheless, it should be mentioned that this review focuses on text-messaging based support for psychological treatment. The rise of apps and websites which enable more diverse and interactive features provides even more possibilities for measures that can be used in clinical practice. Practitioners hesitate to integrate apps in clinical practice, because there is an oversupply of mental health apps without scientific evidence with strong research designs. However, this review suggests that technological extensions to primary treatment can be beneficial for clients.

4.8 Conclusion

This review suggests that the addition of text-messaging to psychological treatment can be beneficial, while stressing the different possibilities that text-messaging enables. Treatment effectivity, patient satisfaction and treatment attendance might be heightened. However, text-message reminders seemed to have negative effects for an anxious population. Further, the importance of integrating BCMs into text-messages as extension to therapy is emphasized. Lastyl, it is assumed that the ability to interact with text-messages or the possibility to receive replies heightens the acceptance of participants.

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Appendix

EPHPP Quality Assessment

The global rating is synthesized based on the rating on six different components. The global rating strong is indicated when no weak rating and at least four strong components are given. A global rating is moderate when there is one weak rating and less than four strong ratings. A weak global rating is considered for articles with more than two weak component ratings (Thomas, Ciliska, Dobbins & Micucci, 2004).

Nr, Reference	Rating	Global rating
Aguilera & Muñoz (2011)	Selection bias: 2 Study design: 3 Confounders: 3 Blinding: 3 Data collection methods: 2 Withdrawals and drop-outs: 2	Weak
Agyapong, Milnes, McLoughlin & Farren (2013)	Selection bias: 1 Study design: 3 Confounders: 2 Blinding: 3 Data collection methods: 2 Withdrawals and drop-outs: 1	Weak
Beebe, Smith, & Phillips (2014)	Selection bias: 1 Study design: 2 Confounders: 1 Blinding: 3 Data collection methods: 1	Moderate

	Withdrawals and drop-outs: 1	
Ben-Zeev, Kaiser & Krzos (2014)	Selection bias: 2 Study design: 2 Confounders: 2 Blinding: 3 Data collection methods: 2 Withdrawals and drop-outs: 1	Moderate
Bruehlman-Senecal, Aguilera & Schueller (2017)	Selection bias: 2 Study design: 3 Confounders: 2 Blinding: 3 Data collection methods: 3 Withdrawals and drop-outs: 1	Weak
Cheli, Cavalletti & Petrocchi (2020)	Selection bias: 3 Study design: 2 Confounders: 3 Blinding: 3 Data collection methods: 1 Withdrawals and drop-outs: 1	Weak
Clough & Casey (2014); n=139	Selection bias: 3 Study design: 1 Confounders: 2 Blinding:2 Data collection methods: 1 Withdrawals and drop-outs: 3	Weak
Clough & Casey (2018)	Selection bias: 3 Study design: 2	Weak

	Confounders: 2 Blinding: 3 Data collection methods: 1 Withdrawals and drop-outs: 2	
Furber, Jones, Healey & Bidargaddi (2014)	Selection bias: 3 Study design: 2 Confounders: 1 Blinding: 1 Data collection methods: 1 Withdrawals and drop-outs: 3	Weak
Gullo, Irvine, Feeney & Connor (2018)	Selection bias: 1 Study design: 2 Confounders: 3 Blinding:2 Data collection methods: 1 Withdrawals and drop-outs: 1	Moderate
Kravariti et al. (2018)	Selection bias: 3 Study design: 1 Confounders: 1 Blinding:2 Data collection methods: 1 Withdrawals and drop-outs: 1	Moderate
Kunigiri, Gajebasia, & Sallah (2014)	Selection bias: 3 Study design: 2 Confounders: 3 Blinding: 2 Data collection methods: 1	Weak

	Withdrawals and drop-outs: 3	
Moran, O'Loughlin & Kelly (2017)	Selection bias: 2 Study design: 2 Confounders: 2 Blinding: 2 Data collection methods: 1 Withdrawals and drop-outs: 1	Moderate
Shapiro et al. (2010)	Selection bias: 2 Study design: 3 Confounders: 2 Blinding: 3 Data collection methods: 1 Withdrawals and drop-outs: 3	Weak
Sims et al. (2012)	Selection bias: 2 Study design: 2 Confounders: 1 Blinding: 2 Data collection methods: 1 Withdrawals and drop-outs: 3	Moderate
Thomas, Lawani & James (2017)	Selection bias: 2 Study design: 1 Confounders: 2 Blinding: 3 Data collection methods: 1 Withdrawals and drop-outs: 1	Moderate

Note. 1=strong, 2=moderate, 3=weak.