Review Article

Text Messaging Platforms in Mental Health Computerised-based Therapy: A Review

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ABSTRACT

Mental health comprises emotional, psychological and social well-being. Global mental health problems have shown an increase in its statistics. Some psychotherapy approaches such as Internet-based therapy and mobile therapy have been carried out in clinical settings to improve one's mental health conditions. The objective of this paper is to identify the different kinds of text messaging platforms that have been tested in mental health computerised-based therapy settings. This paper also aimed to identify the effectiveness of the text messaging platforms on different mental health problems specifically. The review considered five databases (Scopus, PubMed, ACM Digital Library, IEEE XPlore and Web of Science) for the article searching process. The retrieved articles were screened to fulfil the selection criteria including English and Malay language but exclude research protocols, proposals for a prototype application and literature reviews. The search resulted in 3656 articles but only 18 were selected for further review. It was found that web applications were the least used type of text messaging in mental health therapy, followed by mobile applications, whereas SMS was the most popular platform. Overall, the three text messaging platforms showed improvements in depression, anxiety, suicide risk, self-harm risk, mood, eating behaviour and

alcohol intake. Mental health treatment through mobile therapy has the potential to help individuals with mental health problems. Suggested future directions for research community includes comparison between two or three types of text messaging platforms used in interventions to identify which platform is the most suitable to improve a particular mental health problem.

INTRODUCTION

Mental health is an important aspect that needs to be effectively taken care of in every human's life. There are many types of mental disorders as classified in the International Classification of Diseases-11 (ICD-11) by World Health Organization (WHO, 2019a; WHO, 2019b). Various mental health problems have been identified with the number of cases statistically increasing worldwide and has long been a global crisis. It can lead to other problems such as the inability to carry out daily routine and suicide, which considered as a major disruption in one's daily life.

In 2015, 4.2 million Malaysians were diagnosed with mental health problems (Ministry of Health Malaysia, 2016). This number increased in 2018 with a total of 5.5 million individuals. National Health Morbidity Survey (NHMS) in 2011 showed the percentage of Malaysians suffering from depression was 1.8% (Ministry of Health Malaysia, 2017). The NHMS survey conducted in 2015 on adults (aged 16 and over) and children (ages 5 - 15) found 29.2% of adults and 12.1% of children with depression.

According to the National Anti-Drug Agency (2019), statistics showed there was a significant increase in drug abuse in Malaysia from 2014 to 2016 but decreased in 2017 and 2018 while repeat offenders' cases were reported to have reduced significantly since 2014 to 2018. Nevertheless, these issues need to be curbed in order to avoid the side effects that will have an impact on the mental health of the abuser. Alcohol and substance abuse have been found contributed to the increase of risk in mental health problems such as depression, schizophrenia, bipolar, suicide, paranoia, depression, delusion, and other mental health problems (Mental Health Foundation, 2006; Darvishi et al., 2015; Diraditsile & Rasesigo, 2018; National Institute on Drug Abuse, 2020).

In India, the local community had a constraint to access mental health medical facilities due to the location they lived in was a huge distance away from town where the mental health clinic was located (Alghamdi, 2019). To overcome this, various ways of text messaging therapy have been implemented using computerised approaches. Text messaging therapy for mental health treatments is a method that uses text-based communication in consulting someone with mental health problems via online chat, SMS, mobile apps and other web-based applications. Delivering mental health treatment through these platforms

allow information to be transmitted to patients simultaneously and automatically. It comes with the aim to reduce the symptoms and increase the quality level of one's mental health. This type of health therapy has no time limit, it is available as long as it is needed by anyone with mental health problem. It is worth to note that the text messaging therapy method has been proven to benefit patients in depression management (Senanayake et al., 2019). It is also an acceptable and useful alternative to face-to-face therapy when depressed patients are comfortable with the approach, feel safe to express their feelings in text and trust the existence of an anonymity relationship between patient and therapists (Dwyer et al., 2021). Other than that, text messaging was found as an effective means of communicating the content of treatment to young patients while allowing them to control as well as to protect their privacy and confidentiality (Anstiss & Davies, 2015). In addition, it can save cost by reducing staff turnover (Jiménez-Molina et al., 2019), convenient treatment time and better delivery than traditional methods (Stevens et al., 2019).

Statistics show 92% of adolescents have mobile phones, 79% of them have smartphones, 90% of them use text messaging systems and 98% were active on social media (Aschbrenner et al., 2019). This is an important finding which shows that text messaging systems have a great potential to be used in mental health therapy. Since text messages can be stored in the phone, recipients can read their text over and over again, use video and audio activities for mind therapy as well as monitor their own performance during therapy besides interacting with other patients (Boettcher et al., 2018). It was found in a study, 36 of the 44 participants still kept therapy text messages in their phones for daily reference (García et al., 2019). In addition, there are text messages that attach website addresses or phone numbers to help patients who seek help.

The potential of text messaging as psychological treatments has been proven to be effective to reduce symptoms of mental health problems, easy to reach patients and cost effective. However, the types of platforms frequently used by researchers to treat targeted mental health problems still need to be considered. A previous review did not include types of text messaging platform, instead it focused on the effectiveness of text messaging intervention and concluded text messaging can be used for three different purposes; therapeutic, motivation and supportive (Senanayake et al., 2019). Similar to this, another two reviews added either content of the messages and frequency of the messages as the subgroup analysis variables (Cox & Allida, 2020), or design features, conditions addressed and characteristics of messaging procedure (Berrouiguet et al., 2016) but did not include the type of text messaging platforms as the variable in the reviews. A systematic review (Rathbone & Prescott, 2017) showed evidence of usability, efficacy and effectiveness of SMS and mobile apps as the physical and mental health interventions. However, because only these two types of text messaging platforms were analysed on digital interventions, this review could not draw broader conclusions about the implementation of other types of

text messaging platforms. Different types of text messaging platforms come with different functionalities, purposes and cost. While patients in developed countries and low-income countries might have personal concerns on the technology's usage such as cost, privacy, and accessibility, it is important to identify which type of text messaging platform is suitable for the target user. Thus, there is a need to examine from the text messaging platforms used in the interventions to the effectiveness of each platform in different kinds of mental health problems. The main objective of this article is to examine studies in using text messaging platforms in any forms of intervention, it also highlighted the types of mental health problems involved and the impact of text messaging on mental health. Therefore, this article provides a scoping review of scientific research on text messaging interventions regardless of which platform it used. This study is part of the research on the suitable text messaging types to treat different kinds of mental health problems in the community. The computing readings focusses on text messaging technologies used to deliver the treatment, whereas the mental health readings emphasize on the types of mental health problems mostly treated using technologies and the intervention effectiveness in the psychological field. To the best authors' knowledge, there is less evidence of reviews to represent an overall picture of text messaging platforms used in treating different mental health problems. Hence, this paper is to fill this gap by conducting a scoping review. The research question is that what are the text messaging platforms used in mental health computerised-based therapy? This review has two specific contributions; first, it identifies from past research the different types of text messaging platform used in mental health digital interventions. Second, it focuses and provides clear understanding on which text messaging platform has a positive effect on a particular mental health problem. It is hoped that the findings will give guidelines to other researchers in the psychological field and technologists in the computing field to work together from identification of the suitable text messaging platform for a specific mental health problem to implementation.

METHODS

Data Sources and Search Strategies

Articles' search was done using several databases namely Scopus, ACM Digital Library, IEEE Xplore and Web of Science. The search strategies covered a combination of mental health terms and text messages, which was implemented from October 2019 to February 2020. More advanced keywords were used such as mhealth, WhatsApp, SMS, chat and mobile text messaging. Then, keywords were replaced with other types of mental health problems including depression and anxiety. Each keyword was combined using the logical operators "AND" and "OR". The combination of the terms "text messaging" and "mobile applications" was among the most commonly combined terms with various types of mental health problems in the search. Article search did not consider specific findings of

study as its objective was to obtain as much research information as possible that affect various aspects such as emotion, counselling and frequency of therapy sessions. The list of keywords used in the search is shown in Table 1. The final stage of the search strategy involved doing an abstract reading to filter out irrelevant articles. In addition, the title and abstract filtration process for each article was repeated several times to ensure no similar articles was included in the list. After the potential articles were identified, further reading was made by focusing on the methodology and findings of the study within the scopes of (i) text messaging platforms, (ii) types of mental health problem involved and (iii) the impact of text messaging on mental health. Articles that did not meet the selection criteria were removed from the reading list.

Assessment Risk of Bias

All studies included in this review were assessed for risk of biasness using Cochraen Risk of Bias Tool (Higgins et al, 2020). This review includes assessments on random sequence generation, allocation concealment, blinding, incomplete outcome data, selective reporting, and any other potential sources of bias. The assessment was conducted by one of the authors using the judgement of low, high, or unclear risk.

Table 1

List of selected articles and search terms used

ID	Author	Year	Keywords	Database
S1	Agyapong et al.	2017	text messaging for depression text messaging improves depression	Scopus
S2	Xu et al.	2019	text messaging improves depression	Scopus Web of Science PubMed
S3	Arean et al.	2016	mobile apps and depression	Scopus
S4	Kodama et al.	2016	text messaging impact on mental health	Scopus
S5	Almeida et al.	2018	mhealth SMS and depression	Scopus
S6	Aguilera et al.	2017	text messaging improves mental health	Scopus
S7	Christensen et al.	2013	Web based intervention on depression Mobile therapy intervention depression anxiety mental health	Scopus

Table 1 *(Continued)*

ID	Author	Year	Keywords	Database
S8	Islam et al.	2019	text messaging for depression text messaging improves depression	Scopus Web of Science PubMed
S9	Kraft et al.	2017	text messages improves depression	Scopus
S10	Menezes et al.	2019	mobile apps and depression	PubMed
S11	García et al.	2019	Text messaging intervention and mental health	Scopus
S12	Shingleton et al.	2016	Motivational text messages on mental health	Web of Science
S13	Anstiss and Davies	2015	text messaging on anxiety OR depression	Web of Science
S14	Bock et al.	2016	text messaging intervention on substance abuse	Web of Science
S15	Zhang et al.	2019	Mobile apps and mental health	PubMed
S16	Agyapong et al.	2018	Text messaging intervention and mental health	Scopus Web of Science
S17	Wolf et al.	2016	Mobile messaging intervention and depression	Web of Science
S18	Renfrew et al.	2020	SMS messaging intervention and mental health	PubMed

Selection Criteria

The selection was done on articles published from 2013 to 2020. The seven-year interval was chosen to obtain better and more mature research findings. Articles to be included in the reading list should meet the criteria of the main search keywords, including various types of mental health problems and types of text messaging platforms. The effects of using text messages on any types of mental health problems were considered. Table 2 explains on the article selection criteria.

Exclusion Criteria

Articles will be excluded from the reading list if they (i) used other than English or Malay languages, (ii) communication through telephone calls, video calls or face-to-face interactions, (iii) did not state the effects of text message treatment, or type of protocol or

treatment prototype, (iv) did not specify the types of text messaging platform used or (v) missed the types of mental health problems treated.

RESULTS AND DISCUSSIONS

A total of 3656 articles were recorded based on keywords included in the database search. All of these papers were displayed based on any categories that met the related keywords: Scopus (n = 1765), PubMed (n = 471), ACM Digital Library (n = 461), IEEE Xplore (n = 556) and Web of Science (n = 403). Only 213 articles were downloaded due to other articles were found came from the same source. Articles published in language other than English or Malay were removed, while all abstracts were read and evaluated for subsequent selection (n = 211). Again, similar articles were removed, leaving a balance of n = 202. Articles in the form of study protocols, suggestions for prototype applications and literature readings were excluded from the reading (n = 8). The remaining articles received for full reading (n = 194) were filtered again to ensure that they met the selection characteristics. Meanwhile, a total of 176 articles did not specify the types of intervention, platform, text message and its effects on any mental health problem. The final number of remaining articles (n = 18) was included in the discussion of this study. Figure 1 shows the flow chart of the study selection process.

Table 2

Article selection criteria and description

| Selection	Description
Type of Study	Study on the types of text messaging platforms and their impact on mental illness.
Type of Participant	Study on mental illness patients, degree of seriousness of their illness and participant selection method.
Type of Intervention	Interventions that compare mental health before and after treatment using a text messaging platform.
These involve either one or several groups.	The study needs to clarify the method of treatment delivery.
Comparison	pre and post study within a group or compare one or more intervention groups with one control group.
Findings	Contains an explanation on the effectiveness of the text messaging platform used on any types of mental illness.
Others	Message treatment is text-based, delivered through any platforms such as SMS, mobile applications or websites. The text is in various forms such as reminders, motivations, support and others that may arise from previous studies.
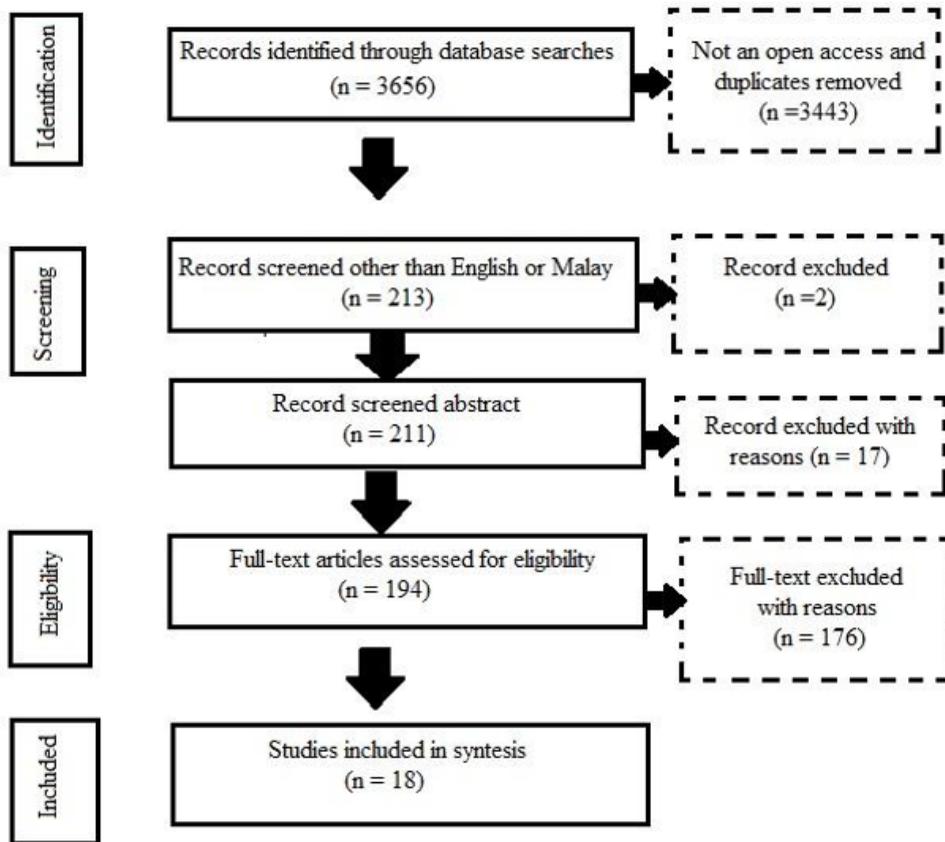
Figure 1. Flow of paper selection through phases of review

Interventions and Comparators

The selected articles came from various research information background including location, population, sample, participants age, intervention group size and intervention length. In summary, five studies were conducted in United States (Arean et al., 2016; Shingleton et al., 2016; Aguilera et al., 2017; Bock et al., 2016; Zhang et al., 2019), three in Australia (Christensen et al., 2013; Islam et al., 2019; Renfrew et al., 2020), two studies in Canada (Agyapong et al., 2017; Agyapong et al., 2018), Germany (Kraft et al., 2017; Wolf et al., 2016) and New Zealand (Anstiss & Davies, 2015; Renfrew et al., 2020) with the remaining of one study in China (Xu et al., 2019), Japan (Kodama et al., 2016), Portugal (Almeida et al., 2018), Brazil and Peru (Menezes et al., 2019) as well as Spain (Garcia et al., 2019). The intervention group target varies in some research where Spanish-speaking Latinos was focused in a study by Aguilera et al. (2017) and a specific gender group (women) by Garcia et al. (2019).

The intervention group size used in all 18 articles are ranged from 12 to 33 people. There was one study did not mention the participants' age (Almeida et al., 2018). The participants' age 18 to 35 years old categorized as young adults were found used in six studies (Agyapong et al., 2017; Arean et al., 2016; Shingleton et al., 2016; Anstiss & Davies, 2015; Bock et al., 2016), ten studies focused on middle-aged adult 36 to 55 years old (Xu et al., 2019; Kodama et al., 2016; Aguilera et al., 2017; Christensen et al., 2013; Kraft et al., 2017; Garcia et al., 2019; Zhang et al., 2019; Agyapong et al., 2018; Wolf et al., 2016; Renfrew et al., 2020), one study stated mean age of participants was 58 years old (Islam et al., 2019) whereas Menezes et al. (2019) used a sample participants with age ranged from 41 to 60 and above. The intervention period also varied between studies where most of the articles (n = 6) mentioned a period of 3 months to complete the intervention (Arean et al., 2016; Aguilera et al., 2017; Agyapong et al., 2017; Shingleton et al., 2016; Bock et al., 2016; Agyapong et al., 2018), other studies conducted within 6 weeks (Almeida et al., 2018; Menezes et al., 2019), 10 weeks (Anstiss & Davies, 2015; Renfrew et al., 2020) and 4 months (Kraft et al., 2017; Wolf et al., 2016), whereas some studies lasted for 8 week (Zhang et al., 2019) and 6 months (Xu et al., 2019; Kodama et al., 2016; Christensen et al., 2013; Islam et al., 2019). The shortest period of intervention was conducted within 30 days (Garcia et al., 2019).

Assessment Risk of Bias

Among 18 retrieved studies, there wasdifferences in terms of random sequence generation, allocation concealment, blinding, incomplete outcome data, selective reporting, and other potential sources of biasness (Appendix A).

From all the articles selected, the differences and similarities between the results of the study were analysed based on the types of text messaging platform, types of mental health problems treated and the effects of using text messaging on mental health. The summary for the selection of articles from each database is shown in Table 3.

Types of Text Messaging Platform and Mental Health

Based on the results of selected articles shown in Table 4, there were four major platforms used in the process of providing therapeutic treatment to patients with mental health problems. Twelve studies were found using basic phones to send short text messages such as SMS to treat depression and mood disorders (Islam et al., 2019; Almeida et al., 2018; Aguilera et al., 2017; García et al., 2019; Anstiss & Davies, 2015; Wolf et al., 2016; Zhang et al., 2019), train mind awareness (Kraft et al., 2017; Wolf et al., 2016), anorexia and bulimia (Shingleton et al., 2016), schizophrenia (Xu et al., 2019) and alcohol abuse (Bock et al., 2016; Agyapong et al., 2018). Of all the studies, six of them (Arean et al., 2016; Agyapong et al., 2017; Kodama et al., 2016; Menezes et al., 2019; Zhang et al.,

2019; Renfrew et al., 2020) utilised mobile text application platform as a text therapy medium for patients with depression, anxiety, mood disorders, suicidal intention, self-injury, schizophrenia, schizotypal, mental disorders and delusions. Meanwhile, findings revealed that three studies used websites to treat depression or suicide symptoms (Christensen et al., 2013; Renfrew et al., 2020; Zhang et al., 2019) and one study (Almeida et al., 2018) used online conversation method (chat) to treat depression and mood disorders.

Table 3

Article screening of four databases

Database	Scopus	PubMed	ACM Digital Library	IEEE Xplore	Web of Science
Identified	1765	471	461	556	403
Downloaded	114	15	22	28	34
English or Malay	112	15	22	28	34
Redundant articles removed	111	12	21	27	31
After excluded articles in the form of study protocols, suggestions for prototype applications and literature readings.	106	11	21	27	29
Did not specify the types of intervention, platform, text message and its effects on any mental illness	96	8	21	27	24
Total selected articles	10	3	0	0	5

Table 4

Results summary of selected articles

Article ID	Author	Text messaging platform	Mental health problem	Intervention effects
S1	Agyapong et al.	Mobile Applications	Depression, anxiety, mood	Positive change
S2	Xu et al.	SMS	Mood, schizophrenia	Positive change

Table 4 *(Continued)*

Article ID	Author	Text messaging platform	Mental health problem	Intervention effects
S3	Arean et al.	Mobile Applications	Depression, mood	Positive effects on emotions, no positive effects on depression
S4	Kodama et al.	Mobile Applications	Mood, suicide, schizophrenia, self-harm	Positive change
S5	Almeida et al	SMS, Chat	Depression	Positive change
S6	Aguilera et al.	SMS	Depression, mood	Positive change
S7	Christensen et al.	Websites	Anxiety, suicide	Positive change
S8	Islam et al.	SMS	Depression	Positive change
S9	Kraft et al.	SMS	Depression	Positive change
S10	Menezes et al.	Mobile Applications	Depression, suicide	Positive change
S11	Garcia et al.	SMS	Depression, anxiety	Positive change
S12	Shingleton et al.	SMS	Eating disorder	Positive change
S13	Anstiss and Davie	SMS	Depression, anxiety	Positive change
S14	Bock et al.	SMS	Alcohol abuse	Positive change
S15	Zhang et al.	SMS, Mobile Applications, Websites	Depression, anxiety	Positive change
S16	Agyapong et al.	SMS	Alcohol abuse	Positive change
S17	Wolf et al.	SMS	Depression	Positive change
S18	Renfrew et al.	Mobile Applications, Websites	Depression, anxiety	Positive change

As shown in Table 5, depression was the highest (n = 12) to be the variable measured (Aguilera et al., 2017; Agyapong et al., 2017; Almeida et al., 2018; Anstiss & Davies, 2015; Arean et al., 2016; Islam et al., 2019; García et al., 2019; Kraft et al., 2017; Menezes et al., 2019; Renfrew et al., 2020; Wolf et al., 2016; Zhang et al., 2019). Six studies conducted their studies on the treatment for anxiety (Agyapong et al., 2017; Anstiss & Davies, 2015; Christensen et al., 2013; García et al., 2019; Renfrew et al., 2020; Zhang et al., 2019). Whereas the number of studies that dealt with mood change was half of the total depression

studies (n = 5) (Aguilera et al., 2017; Agyapong et al., 2017; Arean et al., 2016; Kodama et al., 2016; Xu et al., 2019). Three studies focused on the effects of treatment on suicide aspect (Christensen et al., 2013; Kodama et al., 2016; Menezes et al., 2019). Two studies were conducted on Schizophrenia (Kodama et al., 2016; Xu et al., 2019), while Bock et al. (2016) and Agyapong et al. (2018) focused on patients with alcohol abuse (n = 2). One study examined the effects of treatment on the potential to self-harm (Kodama et al., 2016) and one on mindfulness (Kodama et al., 2016). Only Shingleton et al. (2016) recorded the effects of treatment on anorexia and bulimia.

Table 5

Types of mental disorders identified in each article

Mental Disorder	Frequency	Article ID
Depression	12	S1, S3, S5, S6, S8, S9, S10, S11, S13, S15, S17, S18
Anxiety	6	S1, S7, S11, S13, S15, S18
Mood	5	S1, S2, S3, S4, S6
Suicide	3	S4, S7, S10
Alcohol abuse	2	S14, S16
Schizophrenia	2	S2, S4
Self-harm	1	S4
Eating disorder	1	S12

The Effectiveness of Text Messaging Therapy

Overall, most mental health therapies have been delivered via SMS followed by mobile applications and websites. Although different types of text messaging platforms were used to deliver treatment to different types of mental health problems within each research intervention's unique time range, it is difficult to tell which text messaging platform is the most effective. For example, Xu et al. (2019) used SMS text based to delivery motivational messages and medication reminders to the patients had shown improvements in the aspect of medication adherence. Aguilera et al. (2017) showed a great improvement at 13 weeks of the study where the intervention group stayed at the treatment session longer than the control group. Other studies also have shown a significant improvement in the intervention group that used SMS text messaging to treat depression (Islam et al., 2019; García et al., 2019; Kraft et al., 2017; Anstiss & Davies, 2015; Wolf et al., 2016; Zhang et al., 2019). In addition, two studies also reported improvements in alcohol intervention groups (Agyapong et al., 2018; Bock et al., 2016). However, results from a study show negative correlation between psychiatrists and patients communication, this might be due to low number sample

size (n = 15) in the study (Almeida et al., 2018). These shows that each intervention has its own unique elements to consider before delivering the treatment. The elements could be the participants' mental health background, accessibility to text messaging, participants' commitment and treatment goal.

Nonetheless, it is undeniable that SMS and mobile applications delivery method are more efficient in reaching the patients because SMS and mobile application platforms use a push method where the therapy text is delivered to patients on a regular basis and without the effort and motivation of the participants. This is in contrast to the characteristics of the website where patients had to have high discipline and initiative to browse the web for therapy. As such, the mobile app was seen as a great and convenient choice to be used as it can be downloaded by smartphone users worldwide, without having to subscribe to phone line services such as SMS. Patients who are unable to access to urban health services, lack of time or not confidence in accessing treatment can contact mental health professionals from several countries through this smart application (Teles et al., 2019).

Depression was the most commonly found case throughout the reading process which was carried out. Patients have used various platforms, forms of text and presentations for their treatment. Anxiety falls in the second most studied, followed by mood disorders including depression. This finding is in line with the statistics provided by WHO (2019a; 2019b), which revealed 264 million people from the global population who suffered from depression while in 2017, 3.67% of the world's population suffered from anxiety, which exceeded the percentage of depression (3.44%). Statistics from a report Mental Health Foundation (2016) showed that anxiety (5.9%) was at the first place while depression (3.3%) was ranked at the second place in mental health status in the United Kingdom. Whereas in America, anxiety problem was ranked first (19.1%), personality problems in second (9.1%) and depression in third (6.7%) (National Institute of Mental Health, 2017). In Malaysia, referring to the records of patients being discharged from hospitals, depression was ranked second (12.7%) while anxiety was in the fifth place (Ministry of Health Malaysia, 2017). This raised a question of whether or not the patients in this category still need treatment since their number was not as high as schizophrenia patients, which was ranked first (37.5%). Abusive use of substances such as medicines, drugs and alcohol were also serious in Malaysia (8.3%; third place), America (drugs 8% - 12%, alcohol 19%, drugs 65.7%) (American Heart Association, 2019). Besides, the rate of substance abuse had also increased in the United Kingdom.

STUDY LIMITATIONS

According to Cronin et al. (2008), the literature search is generally done within the last five to ten years depending on the amount of information found. In the scoping review of this study, the article search process was limited to within the years of 2013 to 2020 as

it is considered the most up-to-date findings from previous studies to ensure satisfactory findings. Originally, the article search started in 2015, but not many studies have met the required breakdown of information. However, articles published prior to 2013 have been used to support the findings of other studies. Additionally, article selection in this study was done excluding open access and paid articles. This causes some articles related to the scope of this review not to be included in the discussions and some useful information could not be included in the findings.

FUTURE DIRECTIONS

Recent studies have shown that communication technology is very helpful in treating mental health problems. However, rural people have limited access to the use of this technology. Suggested future directions for the research community include available Internet of Things technologies and the accessibility of rural areas to digital therapy. Compared to today's communication development, mobile applications are the major focus of consumers as they facilitate much of the day-to-day business. Therefore, the development of therapeutic applications in smartphone for mental health problems is important as it is easy to reach, able to go across the globe and minimize the constrain in relationship between patients and nurses.

Most of the studies were found using the comparison method of achievement of intervention group (with one type of platform) and control group. Examining the effectiveness of a type of platform for a particular type of mental health problem is also important, given the characteristics differences of digital technology, user accessibility and mental health problem. The diversity of the interventions, research contexts, and digital platforms analysed in this study suggest that comparison between groups using two or three types of text messaging platforms is needed to identify which platform is the most suitable to improve a particular mental health problem.

CONCLUSION

In this era of technology, everyone owns at least a basic cell phone with a majority owning a smartphone. Previous studies have shown that all patients know how to use a cell phone. Although some may not be familiar with the therapeutic application, it is not difficult for them to learn the functionalities of the application. Mobile applications have the potential to treat mood disorders including depression and anxiety (Arean et al., 2016). In order to use this method consistently in self-treatment, initiatives for the development of better delivery methods need to be investigated. Various delivery methods in terms of frequency of text delivery, delivery time and textual content need to be continuously studied to achieve the objectives of therapy and not to burden the patients. Future therapeutic applications need to focused more on the mental health problems suffered by most of the world's

population such as depression, anxiety, substance abuse, schizophrenia and bipolar so that the therapeutic applications can be used more widely and help many people regardless of boundaries and distances. Mental health therapy through the mobile application, SMS and web-based therapy have also been found to be beneficial not only to the individual with mental health problems as a user, but also to family members or close friends as the monitors in the therapy session.

ACKNOWLEDGEMENT

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Appendix A

Table Summary of Assessment Risk of Bias

Article ID	Author	Random sequence generation	Allocation concealment	Blinding	Incomplete Outcome Data	Selective reporting	Other biases
S1	Agyapong et al.	Low risk "single-rater-blinded randomized trial involving 73 patients with Major Depressive Disorder."	Low risk "the intervention group (n = 35) and the control group (n = 38), recruited from four community mental health clinics."	High risk Participant in intervention group know they need to give feedback based on the treatment received. Assessors were blinded.	Low risk Two participants from each group withdrew. The size is similar, 31 and 32.	Low risk Mentioned protocol used. "The trial is registered with clinicaltrials.gov (NCT02327858)." All outcomes were reported.	Low risk None
S2	Xu et al.	Low risk "2-arm randomized controlled trial.'	Low risk "278 community-dwelling villagers (patient participants) were randomly selected from people with schizophrenia from 9 townships of Hunan, China, and were randomized 1:1 into 2 groups."	High risk Participant in intervention group know they need to give feedback based on the treatment received. Assessors were blinded.	Low risk "2 participants in the intervention group and 1 in the control group died." "120 intervention. 117 control. Only small number of missing data."	Low risk Mentioned protocol used. "Chinese Clinical Trial Registry (ChiCTR-ICR-15006053)." All outcomes were reported.	Low risk None

S3	Arean et al.	**Low risk** Participants were randomly assigned to interventions group using a random number generator.	**Low risk** "Participants were recruited through Web-based advertisements and social media."	**High risk** Participant in intervention group know they need to give feedback based on the treatment received. "Because all assessment was conducted using assessment software, procedures for blinding research assistants was not necessary."	**High risk** More than half of the participants enrolled in intervention groups did not download the apps. The number of participants left is not balance in each intervention group.	**Low risk** All pre-specified and expected outcomes of interest are clear and reported. "Clinicaltrials.gov NCT00540865"	**High risk** **Paid study.** **"Participants were paid US $20.00 for completing assessments at the 4-, 8-, and 12-week marks."**
S4	Kodama et al.	**High risk** Non-random	**Unclear** "Participants were recruited from a university hospital, a psychiatric hospital in Hyogo Prefecture, three medical center hospitals in Kobe City, a private psychiatric hospital, and three psychiatric clinics in Kobe City, Japan (population approximately 1.5 million)"	**High risk** Participant in intervention group know they need to give feedback based on the treatment received.	**Low risk** High follow-up rate (>96%). "All participants received all text messages, and no one refused receipt of messages. One participant did not complete the questionnaire at 3 months and another at 6 months into the intervention."	**Low risk** "The study protocol was approved by the Kobe University Research Ethics Committee, Kobe City Medical Center Hospitals and Hyogo Prefectural Psychiatric Hospital." All outcomes were reported.	**High risk** **First study of its kind.** **"This is the first study that promotes psychiatric outpatients' help-seeking and reduction of self-harm using text messaging."**

		Unclear	**Unclear**	**High risk**	**Low risk**	**High risk**	**Low risk**
S5	Almeida et al.	Not reported the choice of patients and health professionals	Allocation method was not reported	patients and health professionals know they need to give feedback based on the treatment received.	All participants completed the study.	Protocol was clearly stated but insufficient. "The study was approved by the Ethical Committee of the Hospital of Magalhães de Lemos, Porto, Portugal." All outcomes were reported.	None
		High risk	**Unclear**	**High risk**	**Low risk**	**Low risk**	**Low risk**
S6	Aguilera et al.	nonrandomized design	Allocation method was not reported. "48 were allocated to the texting condition and 43 were allocated to control group."	"Neither the therapists and patients nor research assistants were blinded since they participated in the delivery of treatment and data collection."	Number of participants in each group is acceptable, did not influence the outcomes. "39 active texting patients in the texting condition, and 40 in the control."	"All procedures and materials were approved by the University of California, San Francisco Institutional Review Board Committee." All outcomes were reported.	None

S7	Christensen et al.	Low risk / randomised	Low risk	High risk	Low risk	Low risk	High risk
			"Participants were 155 callers to Lifeline, Australia's 24 h telephone counselling service" "Allocation of participants to trial conditions was conducted independently by a research assistant not involved in the day-to-day running of the trial."	Participant in intervention group know they need to give feedback based on the treatment received.	"Although there were small effects at post-test and medium effect sizes at follow-up among the intervention conditions, there were no consistent overall effects for conditions."	All pre-specified and expected outcomes of interest are clear and reported. "Study protocol was approved by the Australian National University Human Research Ethics Committee (Protocol no. 2007/12)." All outcomes were reported.	**First of its kind** **"This was the first study to examine the effect of online interventions on suicide ideation in a helpline using an RCT design."**
S8	Islam et al.	Low risk	Low risk	High risk	High risk	Low risk	Low risk
			"The random allocation sequence was in a uniform 1:1 allocation ratio with a block size of 8 and was concealed from study personnel."	Participant in intervention group know they need to give feedback based on the treatment received.	Imbalance no. of participants in each group after exclusion of missing data. n = 333 in intervention group, n = 350 in control group	All pre-specified and expected outcomes of interest are clear and reported. "Ethics approval from Western Sydney Local Health Network Human Research Ethics Committee." All outcomes were reported.	**None**

S9	Kraft et al.	**Low risk** Two-arm randomized clinical trial	**Low risk** computer-generated random numbers.	**High risk** Participant in intervention group know they need to give feedback based on the treatment received.	**Low risk** n = 18 completed intervention while n = 17 completed control	**Low risk** "The study was approved by Ulm University's Ethics Committee." All outcomes were reported.	**High risk** **Paid study** **"All participants received €25 after returning the follow-up questionnaire. Additionally, participants in the intervention group received €10 at hospital discharge to cover their costs for sending text messages."**
S10	Menezes et al.	**Low risk** randomized controlled trial	**Unclear** Allocation method was not reported. All three groups were for intervention.	**High risk** Participant in intervention group know they need to give feedback based on the treatment received.	**High risk** Small sample size. n = 17 Sao Paolo, n = 16 Lima 1, n = 16 Lima 2.	**Low risk** "Approved by local Institutional Review Boards and the US National Institute of Mental Health Data and Safety Monitoring Board." All outcomes were reported.	**High risk** **Most participants were female.** **No controlled group to compare with intervention outcomes.**

S11	Garcia et al.	High risk	High risk	High risk	High risk	High risk	Low risk	Low risk
		non-random	Participants were given options to choose which group to join. "All women were contacted and asked to freely choose between the intervention and the control group. "	Participant in intervention group know they need to give feedback based on the treatment received.	Imbalance no. of participants between both groups. "the intervention group included a face-to-face therapy session and text messages (n = 46); and the non-equivalent control group included a face-to-face therapy session but no text messages (n = 29)."		Protocol Number: 2017–12-10597. All outcomes were reported.	None
S12	Shingleton et al.	Low risk	High risk	High risk	Unclear	High risk	Low risk	High risk
		Randomized clinical trial	Allocation method was not mentioned. "Participants were recruited via community and online postings and clinician referrals. Eligible participants were screened through phone and in-person."	Participant in intervention group know they need to give feedback based on the treatment received.	Small sample size but said to be plausible for this design. "Missing data were not imputed because GEE uses maximum likelihood estimation; therefore, there is little or no need for imputation."		"All study procedures were conducted at the CARD Eating Disorder Program and were approved by the Boston University Institutional Review Board" All outcomes were reported.	Paid study "They were compensated $100 for participating in the study and received a $50 bonus if their compliance rate with the nightly questionnaire and food logs were above 80%."

S13	Anstiss and Davies	**Low risk** Randomly assigned to intervention and controlled group.	**High risk** Allocation method was not mentioned.	**High risk** Participant in intervention group know they need to give feedback based on the treatment received.	**High risk** Small sample size with high dropout, 7 from intervention group, 11 from controlled group. "Twelve (63%) of the 19 participants who received support from a trained supporter completed the text package and evaluation. Nine (45%) of the 20 participants who did not receive support from a trained supporter, also completed the text package and evaluation."	**Low risk** "Ethical Review for the study was sought from the New Zealand Northern X Region Ethics Committee prior to study commencement" All outcomes were reported.	**Low risk** None
S14	Bock et al.	**Low risk** two-arm randomized trial	**Low risk** "Randomization was stratified by gender and by frequent heavy drinking status, which was defined as three or more heavy drinking episodes in the past two weeks."	**High risk** Participant in intervention group know they need to give feedback based on the treatment received.	**Low risk** High engagement and follow up rate. "Overall 93.3% (n = 56) of participants completed the six-week assessment and 88.3% (n=53) completed the final follow-up assessment."	**Low risk** All pre-specified and expected outcomes of interest are clear and reported. All outcomes were reported.	**High risk** **Paid study** **"Participants who completed the surveys received $30.00 for each time point."**

		Low risk		Unclear / Low risk		High risk		Low risk		Low risk		High risk / Low risk
S15	Zhang et al.	Low risk	Randomized	Unclear	Allocation method was not mentioned. "participants were recruited between July 2016 and May 2017 via social and print media advertising, research registries, and commercial recruitment firms."	High risk	Participant in intervention group know they need to give feedback based on the treatment received.	Low risk	10 out of 301 participants discontinued the treatment but this number did not influenced the results.	Low risk	Protocol under Clinicaltrials.gov NCT02801877 and approved by North western University Institutional Review Board. All outcomes were reported.	High risk	**Most participants were female.**
S16	Agyapong et al.	Low risk	Randomized	Low risk	"randomized using a series of random numbers generated using Microsoft Excel."	High risk	Participant in intervention group know they need to give feedback based on the treatment received.	Low risk	Balance no. of dropouts between both groups. "Participants with missing follow-up data were balanced between the two groups (8 in the text message group and 8 in the control group)."	Low risk	"The study protocol was approved by the Research Ethics Board of the University of Alberta and published." All outcomes were reported.	Low risk	**None**

S17	Wolf et al.	**Low risk** Randomized	**Low risk** computer-generated random numbers. "Recruitment took place at University's Clinic for Psychiatry Psychotherapy and Psychosomatics in Günzburg, Germany, which is alargepsychiatric hospital in rural Bavaria."	**High risk** Participant in intervention group know they need to give feedback based on the treatment received.	**Unclear** Outcomes were reported. However, the actual no. of participants completed the intervention were not stated clearly.	**Low risk** All outcomes were reported.	**Low risk** None
S18	Renfrew et al.	**Low risk** Randomized	**Low risk** using computer-generating software. "Participants were randomized by a person not on the research team using computer random number generation."	**High risk** Participant in intervention group know they need to give feedback based on the treatment received.	**Unclear** High number of dropouts at 12 weeks of the study. Imbalance no. of participants between one group and the other two intervention groups. "At 12 weeks, 320 out of 458 (69.9%) participants had completed both the pre- and postintervention questionnaire required for postanalysis (S=103, S+pSMS=114, and S+VCS=103)."	**Low risk** All pre-specified and expected outcomes of interest are clear and reported.	**Low risk** "Ethics approval was granted from the Avondale Human Research Ethics Committee (Approval No. 2018.09)." All outcomes were reported.	**Low risk** None