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Level Up

Leveraging mHealth Tools in Mental Health Management

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Abstract

Over the last decade, mobile health (mHealth) technology has changed the landscape of many areas of healthcare, and stands to offer elegant solutions to many issues common to mental health management. Mobile technology, now readily globally accessible, is a constant companion to many mental health service users. The use of such technology can offer means for information reception and dissemination via active and passive ambient monitoring, interactive engagement with self-initiated psychoeducation, and access to social support. This review of the current literature explores research regarding the efficacy and reception of various types of individual and collaborative mHealth intervention systems. With such diversity in the interventions available and the outcomes measured in this field, this review does not support a claim regarding global efficacy. Rather, the intention of this exploration is to inform mental health providers of the trajectory of current research, provide a summary of current professional recommendations, discuss potential ethical concerns and review the related implications for practice, policy and future research.
Level Up: Leveraging mHealth Tools in Mental Health Management

In healthcare, change is the only constant. In the last decade, eHealth, and more recently mHealth interventions, have served as instruments fueling more rapid change to practice modalities than ever before. These technologies are now utilized by providers to facilitate tele-consulting, as educational references and as dictation devices. In the hands of clients, they can encourage exercise, schedule appointments, fill prescriptions, provide reminders and monitor health metrics such as weight change, blood-pressure, dysthymias and blood sugar levels. As applied to mental health concerns, eHealth arguably began in the 1960s with ELIZA program which simulated therapeutic reflection as a type of pseudo-psychotherapy (Colby et al., 1966). Considering this simplistic application, it is understandable why many react with revulsion to the idea of software being applied to the care and management of mental health concerns, especially among those frequently vulnerable persons diagnosed with chronic and debilitating psychiatric diagnoses. However, there is no denying that, much like in other areas of medicine, the need for care is ever-present and growing.

Significance

The global burden of mental health and related disorders is now receiving increased scrutiny as we begin to understand the relative impact of these issues on individual and societal functioning. Those with a mental illness are more likely to experience issues such as comorbid cardiovascular disease or diabetes, homelessness or poverty and have a decrease in life expectancy (Center for Behavioral, 2016). It is estimated that one-in-five Americans are effected by a mental health disorder, and these conditions are considered the greatest contributors to years of disability, effecting the national economy (Center for Behavioral, 2016). To further compound this issue, the rising need for mental health services has been met with an increasing decline in
services available. Over the last decade, there has been a 10.2% decline in psychiatrists per-capita in America, and nearly one-hundred million Americans live in areas with a mental health provider shortage (Bishop, Seiptup, Pincus, & Ross, 2015).

With this shortage contributing to such a devastating issue, it is important to consider the optimal use of resources which demonstrate a potential to improve mental health outcomes. In primary care, evidence shows that increasing a patient’s engagement with their treatment promotes better outcomes and significant cost reduction (Germack, 2016). The shortage of providers necessitates shorter and more infrequent appointments to justly distribute care resources, making it increasingly more difficult to offer sessions providing extended direct contact. Even if there were adequate services available to cover the population, there would remain any number of barriers to care including transportation, disability, financial constraints on time, as well as illness and symptomology preventing certain clients from attending more frequent appointments in a provider’s office. It is therefore imperative for mental health providers to find avenues which increase patient engagement and address barriers without increasing the need for provider man-hours. As is often the case, rapidly evolving technology may present answers to meet this need.

**Purpose**

The influence of technology creeping into nearly every aspect of life can elicit an array of reactions, from optimistic thoughts of the potential for an interconnected and transparent utopia in some, to fear of an ethereal dystopia filled with disembodied algorithms offering only synthetic compassion, in others. As of yet, neither is the case. Therefore, as trusted experts in the lives of so many, it is critical for mental health service providers to understand advances relevant to their practice, so they might advise on, and incorporate interventions that hold the most
promise of enhancing care. The answer for mental health treatment, however, is not likely to be the expensive 3D imaging or robotics technology popular in other specialties, but rather, the utilization of devices most patients will already own.

With most Americans using smartphones, it is irresponsible for providers to neglect the potential opportunity these devices provide. Programs such as Apple Health Kit already aim to deliver a comprehensive view for primary care providers, tracking and consolidating health metrics into data compatible with the technology infrastructure of most healthcare systems (Apple Inc., 2017). The ever-growing market of mobile applications is now flooded with products that seem in-line with mental health treatment goals, offering education, medication and appointment reminders, the monitoring of behaviors, and immediate access to interventions like guided imagery.

This is not to imply that interventions provided by mobile technology can or should replace any type of professional service. Rather, in addition to making traditional tools more convenient or expedient, mHealth may offer entirely new types of assessment data to and interventions to supplement professional care. This information can help inform providers of individualized treatment needs, allow researchers to track data in more meaningful ways, and, if used to aggregate health metrics at a population level, potentially inform public health related legislation. This review of literature seeks to explore the current state of research and professional recommendations regarding the availability and efficacy of mHealth technology in the treatment of mental health, and concludes with a discussion of the implications of mHealth interventions in mental health treatment.
Theoretical Framework

Research regarding the efficacy of mobile applications in the management of mental health consists currently at lower levels of evidence, including mostly preliminary trials and feasibility proposals, with content well outpaced by the slew of mobile applications available to consumers. In review of eighty-two smartphone applications currently marketed for bipolar disorder education or symptom management, researchers found that the average application aimed toward psychoeducation covered only a third of the standard core principles, and a similar percentage of applications referenced source materials (Nicholas, Larson, Proudfoot, & Christensen, 2015). More than half of the mobile applications aimed toward symptom monitoring were frequently missing key assessment features for sleep or medication adherence, and less than half of those marketed to facilitate self-assessment of symptoms were seen to use empirically validated screening tools (Nicholas et al., 2015).

Thinking of the integration of mHealth technology into a comprehensive holistic care plan necessitates that clinicians consider not only the evidence-based content or features of the applications, but how the addition of the interventions supports or might harm the individual. For this reason, the APA (2017) released a conceptual model for the evaluation of mobile applications intended to be utilized in support of mental health treatment. This model suggests clinicians focus on four major considerations in their analysis divided into steps (APA, 2017).

Step one is the gathering of background information, including the history and business model of the developer, and determining if the developer makes their profit through upfront costs, hidden or recurring costs, or advertising (APA, 2017). Additionally reviewers must determine on which mobile operating systems the application is available (e.g. Andriod or iOS), and also when the software was last updated and why.
The second step is to determine if use of the application poses any potential risk of harm to the user, including potential legal complications or a negative financial impact (APA, 2017). Also, the potential risk for possible defamation, physical or psychological harm should be considered. These risks are frequently related to the security measures utilized to ensure privacy and should be presented in a policy by the developer.

The third step involves gathering any available evidence, reviewing findings, and determining the quality of the research complete (APA, 2017). As the clear majority of mobile applications are not tested through rigorous peer-reviewed research, clinicians may instead download the mobile application and determine the reasonability of the claims made regarding its efficacy based on judgement and research utilizing similar features (APA, 2017).

The final step is to determine if the design of the application facilitates ease of use, taking into consideration the individual needs of your client, including cognitive or sensory impairments, cultural considerations, and the individual’s level of technology literacy (APA, 2017).

For each measure, the clinician must determine a score from one to three (APA, 2017). A score of one indicating that the application fails to meet standards for use, and the clinician should therefore advise against its use. A score of two indicating that there are some concerns regarding the adequacy of the application in this area, and that clients should be advised of the concerns so they might understand the risks. Finally, a score of three should be given if the application appears to meet reasonable standards for quality in this area. A clinician may then consider recommendation of the application to their client and should offer education necessary to facilitate its use.
Methods

In order to ensure an adequate overview of current literature, the present review made use of multiple search engines available through the University of North Dakota’s digital library. The initial search utilized PsychInfo using all combinations of the subject terms ‘mHealth,’ ‘mobile,’ ‘internet’ and ‘SMS’ paired with the subject terms ‘mental health’ and ‘mental illness.’ Advanced search options available in these databases were utilized to reduce redundancy, including the ‘and,’ ‘or,’ and ‘not’ features.

To focus the review appropriately, results featuring outcomes primarily interested in symptom management of other medical diagnoses, or those which involved the utilization of propriety devices or other non-mobile technologies, were excluded. As mobile devices become a more popular means of internet access, with one-in-five impoverished persons reliant on mobile devices for this purpose, web-based interventions were included (Pew Research Center, 2017). The potential for mobile applications in monitoring behavior has been studied in many areas of health that are relevant, but not specific to mental health, including sleep, diet and fitness monitoring applications. Research primarily focused on the monitoring of these factors was not included in this review. Though pertinent to mental health care, interventions focused exclusively on substance abuse management, including smoking cessation, or organic neurocognitive dysfunction, were excluded from the current review for brevity. Due to the fast progression of the subject area, results were limited to articles published in the last five years. Only articles published in the English language and those with functional links to full-text were considered.

Similar processes were completed using the CINAHL, Cochrane and PubMed search engines. Summaries of the content including the title, subject terms and objective of the study
were manually filtered, excluding articles without apparent focus on mental illness and mobile health interventions, and those involving the above identified exclusionary criteria. The abstracts of articles were then reviewed for potential pertinence to the current review. Of the articles selected, the ancestry method was utilized, and articles found by this method were accessed individually by title in the University of North Dakota digital library.

The contents of this review will be condensed and presented in PowerPoint format (see Appendix A) and made available online for University of North Dakota faculty and students to view to broaden the dissemination of the findings. Furthermore, the presentation will be made available to medical staff at Sanford Medical Center in Fargo and undergraduate nursing students attending the North Dakota State University. In this way, the goals of the review, to inform current and future medical professionals of the state of literature and potential future applications for mHealth in mental health treatment, will be addressed.

Results

The goal of the current review was to collect a comprehensive, but not exhaustive, representation of the current state of literature included within the above-mentioned parameters. In order to accomplish this goal, selection for inclusion considered level of quality of evidence. Theoretical analyses and expert commentaries, including proposals for feasibility without accompanying original data, were not included. There was one relevant meta-analysis selected for inclusion and eight reviews of literature. Those reviews of literature which primarily held a synthesis of articles which would have been excluded from the present review, based on exclusionary criteria, were not selected for inclusion. However, utilization of the ancestry method ensured that relevant original research discussed in said reviews were considered. Fourteen controlled trials were selected, including ten randomized controlled trials (RCT), and
three studies utilizing double blind design features. One study with naturalistic observation and one with cross-over design were selected. Three questionnaire-based quantitative studies were included for better analysis of specific populations, and four studies with qualitative survey designs were selected for review.

**Definitions**

**Passive Ambient Monitoring (PAM):** The collecting of information about the immediate surroundings of the monitor. Generally referring to a passive or unobtrusive monitoring not necessitating manual data input.

**Bibliotherapy:** A method referring to the use of books and other educational materials to manage mental health concerns.

**Clinical Feedback Loop:** A monitoring and response system in which collected data, filtered through a set algorithm, and monitored for results exceeding a predetermined threshold necessitating clinical action, thus triggering an alert to the care provider of this change.

**eHealth:** An umbrella term encompassing several fields concerned with health information, including health informatics and mHealth.

**eMental Health:** A term typically referring to interventions found online that provide support for, or information regarding, the management of mental health diagnoses and concerns.

**Early Adopter:** A measurable personality characteristic indicating a tendency to embrace novel innovation prior to general acceptance.

**Geospatial Activity:** Distance measured via GPS tracking that is generally more sensitive to the traveling of longer distances.
mHealth- The agreed abbreviation for the term mobile health, referring to the use of mobile devices to distribute health-related information or capture, synthesize and interpret health data.

Multiaxial Accelerometer: A motion sensor included in many electronics to capture motion input data, including changes position and velocity of the device. The data is utilized in mobile devices in such features as tilt, determining screen orientation, photo image stabilization, gesture recognition, and the monitoring of the users’ kinetic activity.

Technology Literacy: The knowledge and ability to competently use technology in its intended purpose to collect, organize, create, synthesize and/or disseminate information.

Review of Literature

Since the launch of the first mobile application in 2008, more than one-million mobile applications have been marketed, more than 13,000 of which advertising to target health maintenance (Donker et al., 2013). In relation to this expansive development of mobile applications available to the public, research to determine efficacy has progressed from simple automated phone call reminders, to the ambient monitoring of behavioral patterns in order to detect exacerbation of symptoms (Kannisto, Koivunen, & Välimäki, 2014; Ben-Zeev, 2015b). In a meta-analysis of 33 different studies using mHealth interventions in supplement to mental health treatment, there was a significant improvement in treatment outcomes noted when compared to those receiving treatment alone (Lindheim, Bennet, Rosen & Silk, 2015). Given the broad range of intervention content and study design in this meta-analysis, generalizability to all mHealth interventions may not be possible.
Types of Interventions

To synthesize findings in this review, interventions were separated into categories including monitoring, motivation, education, social connection and relapse prevention. Some studies pertinent to multiple intervention categories are discussed in multiple sections.

Monitoring. Effective use of professional interventions in mental health frequently rely on the early detection of symptom exacerbation. Unfortunately, the symptoms themselves may effect clients’ cognition, motivation and trust, which can present a barrier to help-seeking behavior. Mobile devices are generally carried on your person at all times, making them ideal options for real-time monitoring both passively and actively. Passive ambient monitoring (PAM), may present a solution for the future of prodromal symptom detection in both bipolar disorder and schizophrenia.

PAM utilizes a battery of sensors native to modern smartphones, including GPS to track geospacial activity, and microphones connected to algorithms designed to recognize speech and determine time spent speaking with others as a measure of socialization. Smartphones are able to track global phone activity to recognize utilization patterns, and also host multi-axial accelerometers which can monitor activity, as well as sleep duration and quality (Ben-Zeev et al., 2015b; Grünerbl et al., 2012; 2014; Prociow et al., 2012). Preliminary feasibility trials (n=10-47) concluded that these smartphone tracking measures could have a feasible use in accurately monitoring behaviors associated with bipolar symptoms, but required additional research to determine their predictive value in terms of actual clinical efficacy (Grünerbl et al., 2012; 2014; Ben-Zeev et al., 2015b; Faurholt-Jepson, 2014).

Researchers also linked the tracked data with daily manual responses from participants on assessment tools, including response ratings of mood, stress level, and loneliness (Ben-Zeev et
al., 2015b). Ben-Zeev et al. (2015b) found that data collected via PAM showed a significant positive correlation between depression, rated via PHQ-9, and measured geospatial activity, socialization and sleep duration. Likert scale ratings of stress level were also correlated with geospatial activity and sleep; and higher scores on the UCLA Loneliness Scale were associated with decreased kinetic activity level. Faurholt-Jepson et al. (2015) found that phone activity patterns, including increased incoming and outgoing text messages and phone calls, were correlated positively to ratings provided on the Young Mania Rating Scale (YMRS). This is in line with findings that self-reported mania symptoms are incongruent with clinician assessment ratings (Faurholt-Jepson, 2016). This potentially indicates that PAM may provide not only an unobtrusive method for prodromal symptom detection, but could prove uniquely efficacious as a more objective tool in the detection of mania.

Active monitoring, or self-monitoring, involves the direct engagement of clients self-reporting their mood, stress levels or completing behavioral health screeners. Most of the self-report assessment tools delivered via mobile device, except for self-reported symptoms of mania, are in line with clinician assessment ratings, including measures of depression, socialization quality, hopelessness and delusions (Faurholdt-Jepson et al., 2014; 2016; Palmier-Claus et al, 2014). Additionally, screening measures delivered via mobile application, such as the PHQ-9, were comparable in assessment validity and were better received than screening administered in print form (Bush et al., 2013; Depp et al., 2012). However, the delivery method of these screening tools on a mobile device had an impact on preference and adherence to completion of questions. Ainsworth et al. (2013) found that individuals with schizophrenia (n=24) preferred, and more reliably completed, behavioral health assessments delivered via mobile application, when compared to those administered over SMS text messaging. However, Beebe, Smith, &
Phillips (2014) found no significant difference in medication adherence levels in participants with schizophrenia (n=30) who received either text messages and/or phone calls, and only an insignificant trend toward symptom reduction, so penetration at a behavioral level is questionable.

The use of active monitoring via mobile device in a study of outpatient clients diagnosed with schizophrenia (n=75) found that suicidal ideation was linked to increased reports of negative affect when alone, and feelings of anticipation related to being alone, rather than the quantity of social interaction (Depp et al., 2016). With similar monitoring over a seven-day trial among inpatient clients diagnosed with major depression (n=31), including 74% reporting suicidal ideation, participant ratings of boredom, sadness, current suicidal ideation and tension, were predictive of suicidal ideation manifesting in subsequent hours (Ben-Zeev, Young, & Depp, 2012). Compared against weekly-forecasted predictions of affect, real-time monitoring of affect ratings several times per day via mobile device, demonstrated participants’ (n=24) tendency to over-estimate the number of weeks predicted to be emotionally charged or overwhelming (Brenner & Ben-Zeev, 2014). Another trial showed this tendency also applies to retrospective self-analysis, as participants in a similarly designed trial, who instead estimated periods of heightened emotions over the previous week, displayed tendencies to over-estimate the number of these experiences as well (Ben-Zeev et al., 2012). In synthesis, these results point to the potential benefit mobile monitoring may offer to clients engaging in DBT, or similar therapies, by providing concrete measurable feedback to aid the cognitive restructuring goals of reducing catastrophizing and recognition of realistic expectations.

**Motivation.** The ubiquitous nature of smartphones makes them well-suited in the task of providing timely motivation throughout the course of the day. This can be accomplished using
personal or prerecorded calls or text messages, facilitated by mobile applications customized to improve medication or care plan adherence, or by utilizing native software, such as alarm, calendar and email applications, with intention of motivating specific behaviors in mind. Even use of relatively simple mobile interventions, such as automated text message reminders, have shown significant improvements in medication and appointment adherence and achievement of daily goals (Dekoeckkoek et al., 2015; Jones et al., 2014; Montes, Medina, Gomez-Beneyto, & Maurino, 2012; Sims et al., 2012). Ben-Zeev, Kaiser and Krzos (2014) developed an intervention which involved a daily text message inquiring about the day’s current mood rating and adherence to medication administration. This was followed by a subsequent exchange of no more than three additional text messages in a day or the prompting of a wellness phone call triggered by multiple consecutive days without participant response. They found participants in the intervention arm gave higher ratings for therapeutic alliance with their text-message support person than those in the control group gave for their traditional community support team (Ben-Zeev, Kaiser, & Krzos, 2014).

**Education.** Multiple module-based psychoeducation program studies, targeted at bipolar symptom management, reported positive responses from participants, including decreases in depressive and anxious symptoms, and improved perception of control over their illness (Alvarez-Jimenez et al., 2013; Proudfoot et al., 2012). The addition of a peer support group also found a small improvement in depressive symptoms, and significantly higher rates of treatment adherence, than those not connected to the peer support group (Proudfoot et al., 2012). Another study provided an in-person psychoeducational course and, on completion, participants in the intervention arm engaged with a mobile application intended to extend the benefits of the educational intervention (Depp et al., 2015). The application prompted mood ratings and
delivered personalized techniques for self-management. There was a brief reduction in depressive symptoms among those provided with the mobile application, but the change was not detectable at the six-month follow-up evaluation (Depp et al., 2015).

Mothers with bipolar disorder and chronic psychiatric diagnoses have shown high levels of interest and utilization of online educational materials aimed to improve coping parenting skills, and offer peer support (Jones et al., 2014; Kaplan, Solomon, Salzer, & Brusilovskiy, 2014). The mothers who engaged most often with the interactive instructive program reported greater improvement in the behavior of their children, reduced levels of stress, and enhanced confidence in their coping skills and parenting capabilities (Jones et al., 2014, Kaplan et al., 2014).

**Social connection.** Traditional peer support interventions in mental health have shown to be effective in supporting recovery goal attainment and reducing hospitalization rates (Chinman et al., 2014). However, the relative benefits of peer support via mobile application are inconsistent. The results of questionnaires from individuals (n=232) with a wide range of psychiatric diagnoses found that one-third were active on some type of social media and those respondents were more likely to be civically engaged, measured by voting rates, but there was no significant difference in their reported ratings of quality of life, loneliness or experience of psychiatric symptoms (Brusilovskiy, Townley, Snetthen, & Salzer, 2016). So, clinical benefit for individuals who are simply active on social media, is questionable.

Ben-Zeev et al. (2015a) questioned the use of social support from peers facilitated in the relatively artificial environment of researcher-created platforms for interaction. They argued that groups which were part of the greater online community, such as popular social media websites like Facebook, would provide enhanced benefit for individuals with mental illness. In a qualitative survey, Ben-Zeev (2015a) found participants made part of a private Facebook-based
social support group, connected to their community-based healthy lifestyle intervention group, appreciated the opportunity to interact with, support and share resources with peers using the familiar media (Ben-Zeev, 2015a). In a naturalistic observation of public online environments, including written and video posts to YouTube, Twitter and Facebook, researchers found openness from posters detailing their experience of severe mental illness (Naslund et al., 2014). Comments elicited by such posts were found to be mostly supportive to the poster, including expressions of solidarity, support, hope and encouragement as well as information on coping skills and navigating the healthcare system (Naslund et al., 2014; 2016). So, though users must be aware of the harmful potential from willfully malicious responders in online comments sections, there may be some benefit to the use of public domain websites in fostering community. It may also serve to empower posters as contributors toward stigma reduction as they share their experiences with the general population.

**Relapse Prevention.** At a pragmatic level, the studies and reviews discussed above address smaller components of tools, or targeted interventions, which aim to contribute toward goals related to relapse prevention. Several mHealth interventions aim to combine the most efficacious interventions into comprehensive tools, or utilize data collected by such tools to inform professional intervention, and, in so doing, better target effect on clinical outcome measures.

Targeting socialization, hallucination management and medication adherence, Ganholm et al. (2012) utilized cognitive behavioral intervention techniques in their interactive text-messaging program MATS. Several daily text messages engaged participants to respond with their thoughts regarding perceived benefit of medications, socialization or coping skills, and providing simple reality orientation or delusion challenging. They found that there was a
significant reduction in reported auditory hallucinations, and an increase in socialization quality, but no significant change in medication adherence (Ganholm et al., 2012).

Ben-Zeev et al. (2014) developed a more comprehensive automated real-time mobile program called FOCUS, designed to assist in the monitoring and immediate management and support of individuals diagnosed with schizophrenia. The design of the smartphone application accommodates common features of psychotic disorders, such as slowed and impaired thought processes, necessitating lower-level and concrete content, and combines automated and user-initiated interventions to assist with medications, sleep enhancement, auditory hallucinations, mood dysregulation and cognitive restructuring skill reinforcement (Ben-Zeev et al., 2014). Results from preliminary measures (n=33) indicate a trend toward improvement in the regulation of mood, though the sample lacked sufficient power to detect significance. Most users (87%) reported that they could effectively navigate the application, locating and understanding the content of the psychoeducational information, and engage with the suggested automated therapeutic interventions. Most reported finding the interventions useful in symptom management, and appreciated the ready availability of the mobile application in coping with periods of stress (Ben-Zeev et al., 2014). Individuals would be able to utilize this type of relapse prevention system without connection to a mental health professional.

Other projects are focused on connecting clients to mental health professionals as an intrinsic part of their care plan. Combining active and passive monitoring with the CrossCheck mobile application, participants were asked to complete a ten-item screener, sensitive to symptoms of psychosis, three times per week and allow ambient monitoring via mobile device over a 12-month period. Ben-Zeev et al. (2017) specifically focused on data collected from the five individuals hospitalized for advanced psychosis. They found that these individuals displayed
similar unique patterns in PAM data compared to others in the trial, and saw self-report data was inconsistent, with no correlated response pattern (Ben-Zeev, 2017). This indicates potentially significant and actionable predictive value in a clinical setting for the ambient monitoring of behavior by the CrossCheck system. However, Ben-Zeev et al. (2017) reported high levels of attrition in the study, which limited their analysis, and posed the risk for potential confounds specific to the population, e.g. difference in content or severity of psychotic symptoms compelling drop out from the study.

Faurholdt-Jepson et al. (2015) trialed the connection of smartphone-delivered, self-monitoring tools to mental health professionals in a blind RCT of individuals (n=78) diagnosed with bipolar disorder. The MONARCA mobile application facilitated responses to self-monitoring instruments, which in-turn was connected to a clinical feedback loop, with protocol to place a wellness-check phone call when results fell outside of individualized expected parameters. They found that this did not significantly lessen the severity of the depressive or manic symptoms experienced when compared to a control group receiving services with a traditional two-week follow-up phone call (Faurholdt-Jepson et al., 2015).

The ITAREPS program was tailored more to enhance the monitoring capabilities of mental health prescribers, to detect worsening symptoms of schizophrenia at earlier stages, and initiate proactive preventative care. In three small-scale subject-blinded RCTs (n=45-71) researchers found that the ITAREPS significantly reduced hospital readmission rates among those in the intervention arm (Španiel et al., 2008; Španiel et al., 2012; Komatusu et al., 2013). Significant results were also seen in an independent study duplication controlling for participants’ user adherence levels (Komatusu et al., 2013). The ITAREPS system prompts responses to the evidence-based Ten-Item Early Warning Sign Questionnaire (EWSQ) via text
message on a weekly basis. Positive results trigger an alert to participants’ psychiatrists with a recommendation to prescribe an immediate increase in antipsychotic dosage by 20% for a minimum three-week period, followed by a tapering back to original dosage if participants had three weeks of consecutive negative EWSQ results (Španiel et al., 2012). The effectiveness of the program, however, relies mostly on the response of prescribers, as it does not aid with self-initiated symptom management. The most recent trial of ITAREPS demonstrated this confound. The trial’s failure to achieve significance in outcome measures was attributed to disproportionately high non-adherence rate by the psychiatrists of participants in following the recommendations for prescription change when alerted to the worsening symptoms detected (Španiel et al., 2015). Proposals for several additional mobile-delivered relapse prevention programs were excluded from review due to their lack of evidentiary support for efficacy.

**Reception of mHealth**

Most studies identified in the current review provided results for some measure of satisfaction from participants as a secondary outcome, however, these methods for determining the user’s views, lacked comprehensive assessment qualities. For that reason, the current review presents studies which provide a measurement of participants’ views as their primary outcome, or systematic reviews that collected an aggregate of several study results, to provide a more accurate portrayal of perspectives.

**General population.** A questionnaire study (n=490), delivered online, reviewed the perspectives of the general population regarding use of interventions utilized in the management of mental health, including in-person therapy, bibliotherapy, web-based psychoeducational programs, and smartphone applications on several dimensions (Musiat, Goldstone, & Terrier, 2014). As should be expected, participants rated in-person therapy highest on all markers of
acceptability, save convenience and cost. Comparing the three self-directed interventions, participants indicated equal and neutral views on convenience and likelihood of future use, except for bibliotherapy which rated as less appealing in terms of cost and social support (Musiat, Goldstone, & Terrier, 2014). On the dimensions of potential helpfulness, credibility, general appeal and ability to motivate and cater to learning style, participants rated web-based programs highest, followed by bibliotherapy and finally smartphone applications (Musiat, Goldstone, & Terrier, 2014).

Global application of the results of this study should be considered cautiously. The study was conducted in the United Kingdom, and the convenience sample had 50% of participants reporting a history of mental health concerns, but only 30% had previous experience utilizing mental health services (Musiat, Goldstone, & Terrier, 2014). Approximately 80% of responders were female and of Caucasian race, more than half were currently students, and 90% reported post-secondary education (Musiat, Goldstone, & Terrier, 2014). The premise of the study, asking participants to rate self-initiated interventions in direct comparison to attending regular therapy sessions, seems to imply that these interventions are meant to displace the use of professional mental healthcare, instead of as a supplement.

Clients with Schizophrenia. One glaring area for potential concern is the acceptance of monitoring features involved in many of the mHealth technologies, with individuals experiencing symptoms of paranoid psychosis. A small (n=24), qualitative and community-based study, with a cross-over design, had adult participants diagnosed non-affective schizophrenia trial reporting their symptoms via text message or native mobile application, and later, detail their experience and perceptions (Palmier-Claus et al., 2013). Aggregating the participants’ qualitative reports, researchers found that participants had no preference in methodology.
Participants acknowledged an appreciation for the potential benefits for clinicians in gathering data and assisting client-provider communication, and the related benefit to clinical care that may come from improved clinicians’ awareness of their mental status. However, they were not impressed by any additional potentially positive impact for themselves, and found answering the repetitive questions tedious and cumbersome to complete throughout their day (Palmier-Claus et al., 2013). They stressed a concern regarding the potential negative impact continued use of the system might have on their therapeutic relationship with their care team.

In terms of self-initiated mHealth intervention use, an online survey of individuals with schizophrenia (n=457) found that 24% of respondents reported frequent use of mHealth interventions to manage symptoms, including 42% using music to manage auditory hallucinations (42%), and 28% using phones for medication reminder alerts (Gay et al., 2016). Younger responders were more likely to report seeing technology-delivered interventions as important to their recovery process (Gay et al., 2016). The results from this study may lack generalizability as it was conducted via online polling, included few older adults, and 87% of responders reported high levels of engagement with treatment, which is above national average (Gay et al., 2016).

**Youth.** Adolescents that were interviewed in a qualitative study reported generally positive thoughts and an openness to communication via social media with mental health providers, but also pointed out several potential negatives. They saw communication via social media as relatively impersonal and noted the expectation on social media platforms for expedited response, thus creating a greater potential for increasing anxiety when waiting for a reply from providers on that platform (van Rensberg et al., 2015).
**Professionals.** It is again challenging to adequately capture a comprehensive summation of the perspectives of any group, regarding a collection of interventions with non-standard differences in complexity, accessibility, utility and efficacy; particularly among those who are professionally, and therefore socially and financially, impacted by the direction of the field’s progression. Mental health professionals, as researchers, experts and trusted advisers, hold considerable power over many areas of the field’s progression. The three trials of the ITAREPs system discussed previously, demonstrate the inconsistency of reception among professionals, and, that even when providers are connected to such a system, the beneficial effect is nullified if the professional is not committed to its consistent utilization (Spaniel et al., 2015). Perceptions of the utilization of data from mobile PAM systems in clinical practice, among mental health clinicians (n=75). were generally neutral (Barch, 2014). Concerns regarding risk to clients’ privacy were the most frequently reported in this survey (Barch, 2014). The likelihood of future utilization by these clinicians, was predicted by testability of the application, ease of use, and clinicians’ rating on a scale detecting early adopter characteristics (Barch, 2014).

Looking at responses to a specific application, Kuhn et al., (2014) found a generally favorable response to the PE coach. This application, targeted to supplement prolonged exposure therapy, had been on the market, and widely circulated, for more than a year before the survey. This may show that mental health professionals may simply be more reticent to endorse mHealth generally, but are more willing to accept interventions that are described to them in specific detail, and are currently used by peers in practice.

**Discussion**

The utopian or dystopian future of mHealth technology is yet to be written. However, the potential for either, and therefore both the implications for practice and the resulting ethical
confounds of applying certain technologies regardless of their efficacy, should be duly considered.

**Ethics**

Beyond the question of whether we can use mHealth interventions in the treatment of mental health, is the question as to whether we should. This ethical and occasionally moralistic decision cannot be answered with the results of data, but studies do help inform of the potential magnitude of effects for certain concerns.

**Beneficence and Respect for Autonomy.** This review discusses aspects of several interventions, intended to directly or indirectly benefit clinicians and clients in mental health management. Many psychoeducational tools available via mobile technology would assist in enhancing health literacy, providing information, and potentially even measuring patient understanding via teach-back with quizzing tools. As care plan adherence is improved among clients more engaged in their health (Green et al., 2015), not only would the tenets of autonomy be addressed, but outcomes could be improved, as health literate clients would be better able to engage providers during appointments. This could be further enhanced by mHealth designed to facilitate connection to social support, which is also a known motivator (Naslund, 2016).

Manic, psychotic or depressive episodes can lead to disastrous social, financial and physical outcomes, but are difficult to predict, especially when only a few follow-up appointments are covered by insurance in a year. PAM and active monitoring aimed at detecting prodromal manic, psychotic or suicidal behaviors via mobile device, showed evidence of usefulness in correctly identifying symptom progression, but did not change the symptoms experienced (Faurhault-Jepson et al., 2015; Ben-Zeev et al., 2015b). The integration of this data
into a professional comprehensive care plan may help alert clinicians of a potential impending episode, allowing for more aggressive preventative care.

Skepticism regarding the ability and willingness of those with severe mental illness involving psychosis or cognitive deficits, to engage with mHealth interventions appears to be largely unfounded. Given adequate training and intuitive design features that cater to the cognitive processing of the target population, most in this population are able the effectively utilize the programs (Depp, Mausbach, & Jeste, 2010; Granholm et al., 2012; Rotondi et al., 2015).

**Justice.** The potential concern of diminished access to mobile phone ownership has been overcome by the general community with 95% owning mobile phones and 65% smartphones ownership rates (Pew Research Center, 2017). mHealth technology provides a cost-effective means to overcome barriers of distance for rural and home-bound clients, financial restraints and directly and indirectly help to increase the availability of professional services. To support these ends, applications may facilitate communication between clinicians and clients, and offer interactive psychoeducational materials to supplement professional therapeutic interventions. Technology such as this may function to alleviate some of the burden by satisfying individuals’ needs, or automating assessment collection and documentation, thereby opening the provider to increase their patient load and therefore the pool of services available to the community.

**Non-maleficence.** Privacy concerns were rated as the least important consideration in mental health treatment selection by the general population in quantitative reports (Musiat, Goldstone, & Terrier, 2014), but one of the primary concerns among mental health professionals (Barch, 2012). Nicholas et al. (2015) found that only 22% of mobile applications targeting bipolar symptom management provided a privacy policy. This lack of available privacy policies
prevents users from giving informed consent to the way in which their information is managed and distributed. Measures of security were rated among the least important consideration for intervention selection in a survey of the general population (Musiat, Goldstone, & Terrier, 2014). As discerning professionals, typically better-versed in ascertaining risk potential as it related to protected health information, it is our ethical mandate to carefully consider applications for clients. This is especially important for those applications with features involving ongoing GPS monitoring or mobile and online activity tracking, linking to social media, which require the sharing financial information or facilitate advertising during periods of vulnerability.

Misinformation is also a major potential risk. With so many thousands of unregulated mobile applications and websites, careful consideration, including testing and review, may be necessary before clear professional recommendations of mHealth interventions are possible. A systematic review of 571 currently marketed mobile applications that focused on bipolar symptom management, found that psychoeducational applications covered only a third of the core principles, only a sixth discussed information found in best practice guidelines, and neither the comprehensiveness nor the quality were correlated to the application’s user rating (Nicholas et al., 2015).

Implications for Practice and Recommendations

The adoption of mHealth interventions into mental health treatment will be considerably more complicated than most any other traditional treatment modality for several reasons. The results from the meta-analysis showing improved clinical outcomes with the supplementation of mHealth interventions in treatment are promising (Lindheim et al., 2015). However, neither current literature, nor professional guidelines, currently provide sufficient quality evidence, or a
clear advisory stance, supporting the use of any individual mHealth interventions related to mental health. For this reason, professionals must make their own determinations, perhaps guided by the general framework for application evaluation proposed by the APA (2017), on each individual application they are considering, or are asked by clients to evaluate.

Organizations such as iMedicalApp (2017), identified by the Cochrane Collaboration (2014) as evidence-based, offers basic reviews of the evidence and testing of mHealth applications in various specialties. In a cursory review, the website offers brief and balanced descriptions of, and hyperlinks to, pertinent research in peer-reviewed journals related to hundreds of mobile applications, and claims a no-conflict policy in their content. Use of such a resource may serve as a starting point for clinicians in the identification of likely mHealth applications.

**Education and Health Policy.** As this technology becomes more commonplace, educational institutions may do well to include this assessment process into curriculum that covers research methods, due to the similarity of the application evaluation process to quality assessment in literature. Similarly, institutions managing health policy may do well to address selection of mobile applications for use in practice and recommendation to clients as ongoing education for mental health providers. The development of committees dedicated to ascertaining the merit of both individual applications, and support for the efficacy of popular tools found in different mobile applications would provide uncertain clinicians with a short list of vetted interventions, potentially encouraging the use of these supplemental tools.

**Legislation.** With the unanimous passing of first federal telehealth related legislation, the Expanding Capacity for Health Outcomes Act (2016) or ECHO Act, which requires the Department of Health and Human Services (HHS) to review and recommend technology which
facilitates improved collaborative learning, specifically intended to connect the knowledge well of specialists with general practitioners, in order to better serve rural communities. Though legislation specifically addressing mHealth in mental healthcare may be long in coming, this step requires major government oversight departments to monitor the field of eHealth for efficacy. With the rapid evolution of the technology and uncertainty in the partiality of third-party reviews, encouragement of similar legislation regarding the review by the HHS of consumer-marketed mHealth applications may be the most beneficial to current practice. In consideration of risk reduction, legislation mandating purveyors of these mobile applications to provide privacy policies to facilitate informed consent and source information to limit misinformation, would be additionally beneficial.

**Future Research.** With careful consideration and implementation, mHealth applications may present elegant solutions or improvements to care delivery in both the preventative and treatment arms of care. Future researchers interested in propriety application development may consider teaming with graphic and video design teams to create marketable programs that are not only based in evidence, but also offer esthetic design, linked with motivational rewards and social support to promote continued engagement. The government funded SPARX program, free to the Australian public and targeting depressed youth, demonstrated efficacy, but saw poor utilization, which is thought to be related to its poor interface and graphic design quality (Fleming et al., 2014). In addition to recognizing novel innovation, researchers and affiliated professional organizations must also remain diligent in consolidating reviews and meta-analyses of findings to keep practitioners abreast of changes in efficacy and utilization of various categories of interventions.
Clinicians will differ on their reception of this change in practice, with individuals and systems led by early-adopters trailblazing the most promising interventions (Barch, 2014). Many may continue to shun major changes until research better supports positive outcome changes. For this reason, future researchers would do well to focus on larger scale, high quality interventions, targeting the efficacy of specific tools found in many applications. To address these concerns, certain standards in result reporting are important, in order to provide replicability, and inform results in meta-analyses and allow that researchers might better communicate potential efficacy to clinicians familiar with more traditional research. However, though blind RCT remains the gold-standard for research design, particularly in the fields of psychology, Ben-Zeev et al. (2012) argues that alternative research design such as fractural randomization, stepped designs, or adaptive trial paradigms, might better suit the analysis and facilitate more rapid advancement in knowledge in the study of technology-based health interventions. The problematic juxtaposition of atypical research design being more efficient and effective, reconciling with the need for consistent standardization in order for reviewing groups to better determine relative efficacy, needs to be addressed by the community.

The WHO mHealth Technical Evidence Review Group proposed guidelines for general mHealth application reporting in this last year which may not have yet had time enough to be widely adopted among researchers (Agarwal et al., 2016). Their recommendations for reporting include sixteen criteria in areas such as cost, data security, interoperability within existing healthcare system, infrastructural assumptions, intervention content and study replicability (Agarwal et al., 2016). With such a wide but shallow pool of research in mHealth, particularly applied to the mental health field, future researchers must endeavor to consistently deliver content of this comprehensive quality. Reporting at this level of transparency will ensure not
only the potential for future study replication, but also enhance credibility in the results of studies at any level of rigor or style of design.

Conclusions/Summary

Given the diversity of interventions provided and outcomes measured, in addition to the relatively low level of evidence quality available in the current literature in most areas, this review is inconclusive regarding the global efficacy of mHealth interventions in the management of chronic mental health diagnoses. The exploration of the enormous potential of mHealth in this area is complicated by several factors including a lack of standardization in assessment of mobile application efficacy, minimal oversight regarding privacy of information and claims made by marketed mobile applications leading to poor quality and potentially harmful content. Additionally, the rapidity of the advancement and expansion of the field, and general distrust and defensive pushback against utilization of incorporeal programs applied to a field as subjectively assessed and sensitive as psychiatric care, effects its progression. Many of these barriers are mutable and some may change as perspectives shift. However, it is certain that change to practice is coming from these advancements and as professionals, our best course is to find how it might best serve our clients and community.
References


Appendix A

Level Up PowerPoint Presentation

Level Up: Leveraging mHealth Tools in Mental Health Management

By Susan Slocum
University of North Dakota

Purpose

- Address significance of mHealth intervention use in the treatment of mental health.
- Identify types of mHealth interventions relevant to mental health management.
- Determine efficacy and discuss potential value of mHealth interventions.
- Provide framework for independent evaluation of mHealth tools.
- Discuss ethical concerns and considerations of mHealth use in mental health.
- Discuss implications of mHealth use in practice at individual, health and education policy and legislative levels.
- Discuss areas for future research.
Definitions

- **Ambient Monitoring** – collecting information of the immediate surroundings
- **Bibliotherapy** – using books and other materials to manage mental health concerns
- **Clinical Feedback Loop** – monitoring and response system that alerts clinical team when findings are outside acceptable parameters
- **eHealth** – umbrella term including several fields of health information
- **eMental Health** – typically referring to online psychoeducational interventions

Definitions Continued

- **Early Adopter** – measurable personality characteristic indicating greater likelihood to embrace novel ideas and interventions
- **Geospatial Activity** – distance measured via GPS
- **mHealth** (mobile health) – use of mobile devices to collect, synthesize and disseminate health-related information
- **Multiaxial Accelerometer** – motion sensor in electronic device able to detect changes in position, tilt and velocity of device
- **Technology Literacy** – the knowledge and ability to competently use technology as intended
Significance

Mental Health Facts in America

Prevalence of Mental Illness by Diagnosis
- 1.1%: 1 in 100 young adults live with schizophrenia.
- 2.6%: 1 in 26 adults living with bipolar disorder.
- 6.9%: 1 in 15 adults living with major depression.
- 18.1%: 1 in 5 adults living with anxiety disorders.

Consequences
- 10.2m: Adults living with serious mental illness.
- 26%: Adults engaging in behaviors that harm themselves or others.
- 24%: Adults engaging in inappropriate sexual behavior.

Impact
- 1st: Depression is the leading cause of disability worldwide, and is a major contributor to the global burden of disease.
- -$193b: Annual societal cost due to lost work productivity and health care services.
- 90%: Adults and youth that need mental health services don’t receive them in the previous year.

Treatment in America
- 60%: Adults who need mental health services receive them.
- 50%: Adults who need inpatient mental health services receive them.

(NAMI, 2017)

Theoretical Framework & Recommendation

APA’s 2017 App Evaluation Model

<table>
<thead>
<tr>
<th>Step 1: Investigate Background Information</th>
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<tbody>
<tr>
<td>- History and business model of the developer</td>
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<tr>
<td>- Profits made by cost for access, including in-app purchases, or advertising</td>
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<tr>
<td>- Mobile operating system accessibility (Android, iOS, Google)</td>
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<td>- Updates: how often, when and why has the software been updated</td>
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<th>Step 2: Privacy &amp; Security Concerns</th>
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<tr>
<td>- Potential legal risks</td>
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<td>- Negative financial impact</td>
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<td>- Privacy &amp; security policy</td>
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<td>- Potential defamation</td>
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<td>- Potential physical or psychological harm</td>
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<th>Step 3: Evidence-Based</th>
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<tr>
<td>- Current level and quality of evidence supporting intervention</td>
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<td>- If not specifically addressed in literature, download and manually review content and determine with clinical judgement the reasonability of the claims made regarding its efficacy based on research utilizing similar features</td>
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<th>Step 4: Interoperability</th>
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<td>- Ease of use considering client’s specific needs</td>
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<td>- Cognitive or sensory impairments</td>
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<tr>
<td>- Cultural considerations</td>
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<tr>
<td>- Technology literacy level</td>
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Review and Synthesis of Literature

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Tracks</th>
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<tr>
<td>GPS</td>
<td>• Geospatial Activity: determining movement around the community</td>
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<tr>
<td>Multi-axial Accelerometer</td>
<td>• Physical Activity: generally measured in steps to track exercise</td>
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<td></td>
<td>• Sleep quality and duration</td>
</tr>
<tr>
<td>Microphone</td>
<td>• Monitors ambient sound for interpersonal conversation, measuring socialization quantity</td>
</tr>
<tr>
<td>General Phone Activity</td>
<td>• Change in phone use behaviors: e.g., phone calls or texts made more frequently or late in the night</td>
</tr>
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Passive Ambient Monitoring

Smartphone sensors are used to monitor behaviors associated with symptom exacerbation (Grunerbi et al., 2012; 2014; Ben-Zeev et al., 2015; Fairfield-Japsen, 2014; 2015; 2016).

- PHO-g Depression scores correlated positively with geospatial activity, socialization & sleep duration.
- UCLA Loneliness Scale scores correlated with decreased kinetic activity level.
- Stress level correlated with geospatial activity & sleep.
- Young Mania Rating Scale scores correlated positively with phone activity patterns including increased incoming and outgoing text messages and phone calls.

Research in this area is new in the last decade; most trials testing for feasibility with small samples (n=10-47).
Active Monitoring

Individuals directly self-reporting ratings of mood, stress levels or completing behavioral health screeners

- Ratings via mobile application of depression, socialization quality, hopelessness and delusions, but not mania, were in line with clinician assessment (Rauholt-Jepson et al., 2014; 2016; Palmer-Claude et al., 2014).
- More questions were completed with mobile applications than over text message (Annisworth, 2013).
- No difference between text and/or phone call reminder interventions in medication adherence (David, Smith, & Phillips, 2014).
- Mobile monitoring allows researchers to conveniently monitor data which is more time sensitive such as triggers of suicidal ideation (Deprez et al., 2016), or which requires response several times per day during daily activities (Ben-Zeev, Young & Lepp, 2012; Brenner & Ben-Zeev, 2014).

Motivation

Mobile devices can deliver information and reminders when and wherever. This can be facilitated by prerecorded calls or text messages, custom mobile applications, or native software such as calendar and email applications.

- Trials of automated text message reminders, have shown significant improvements in medication and appointment adherence and achievement of daily goals (Dhokia et al., 2015; Jones et al., 2014; Montes, Medina, Gomez-Beneyto & Maurillo, 2014; Simu, Songhare & Hayes, 2012).
- Providers of daily-text messages (up to 3/day) were rated higher than community support teams in ratings of therapeutic alliance (Ben-Zeev, Katz & Kocio, 2014).
Psychoeducation

eMental Health interventions involve use of online psychoeducational module based lessons with or without professional facilitation.

- Participants with bipolar disorder reported decreases in depressive and anxious symptoms, and improved perception of control over their illness (Alvarez-Jimenez et al., 2013; Prud'homme et al., 2013).
- Mothers with chronic mental health diagnoses engaging in online psychoeducation and peer support reported improved behavior in their children, reduced levels of stress, and enhanced confidence in their parenting capabilities and use of coping skills (Koenig et al., 2014, Kaplan et al., 2014).
- After a course of in-person psychoeducation, use of a mobile application designed to reinforce concepts was followed by a brief reduction in depressive symptoms, not sustained through 5 month follow-up (Chupp et al., 2015).

Social Connection

In person peer support interventions have shown to be effective in supporting recovery goal attainment and reducing hospitalization rates, but support in evidence is less consistent and lower quality with mHealth delivered peer support (Chinnan et al., 2014).

Online public domain support

- A Facebook-based social support group, connected to an in-person healthy lifestyle group, reported appreciation of the familiarity and easy accessibility to social connection and information.
- A naturalistic observation of public online environments, including written and video posts to YouTube, Twitter & Facebook and responding comments found bold openness in posters' sharing of mental illness experiences and positive, supportive and informative comment responses (Naskind et al., 2014, 2016).
Relapse Prevention

Combining and focusing different methodologies, some mHealth interventions seek to prevent symptom exacerbation.

- **MATS** uses CBT based interventions with interactive text-messages and found a reduction in reported auditory hallucinations and increase in socialization quality but no significant change in medication adherence (Granholm et al., 2012).

- **FOCUS** is specially designed for the individuals experiencing psychotic symptoms and offers user-initiated automated and user-initiated interventions to assist with medications, sleep enhancement, auditory hallucinations, mood dysregulation and cognitive restructuring skill reinforcement. (Ben-Zeev, Kasar & Krzos, 2014).

- **CrossCheck** combines active and passive ambient monitoring targeted to detect worsening psychosis. Over a year trial, researchers found unique patterns among those who required hospitalization for psychosis (Ben-Zeev et al., 2017).

Relapse Prevention continued

- The **MONARCA** system monitored self-reports targeting bipolar symptoms, triggering wellness check phone call with responses out of parameter. No difference was found in symptoms compared to traditional follow-up call (Pearlhold-Jepson et al., 2015).

- The **ITAREPS** program monitored self-reports targeting detection of psychosis, triggering an alert to the prescriber suggesting a 20% increase in dose of antipsychotic. Significant reductions in hospitalization rates were found in 3 trials (Spaniel et al., 2008, Spaniel et al., 2012, Komatsu et al., 2013). One trial failed to produce significant results attributed to disproportionately higher nonadherence to recommendation follow through by the psychiatrists of participants (Spaniel et al., 2013).

- A Meta-analysis of 33 studies using mHealth interventions (smartphone, text and web-based) to supplement treatment found significantly improved treatment outcomes (Lindheim, Benet, Rosen, & Gill, 2013). Given the broad range of intervention content and study design in this analysis, generalizability to all mHealth interventions may not be possible.
Reception

General Population
- In a survey of priorities and preferences for mental health interventions, ratings of helpfulness, credibility, general appeal, ability to cater to learning style and motivational properties were highest rated web-based programs followed by bibliotherapy and finally smartphone applications (Musici, Goldstone & Terrier, 2014).

Clients with Schizophrenia
- An online survey showed 24% of those with schizophrenia report frequent use of technology to manage symptoms, 42% of which using music for auditory hallucinations, and 28% for medication reminder alters (Gay et al., 2016).
- A qualitative study of participants self-reporting symptoms, participants appreciated a potential for improved clinical communication but no personal benefit and voiced concerns about the potential impact on therapeutic relationship with their providers (Parnier-Clas, 2013).

Youth
- Adolescents interviewed reported generally positive thoughts and an openness to communication via social media with mental health providers. Concerns reported included reduced quality in communication, and increased anxiety when responses are delayed (van Rensberg et al., 2015).

Professionals
- A small survey showed generally neutral opinions on mHealth interventions. Reported inclination toward utilization in practice was predicted by ability to test, ease of use and clinician’s rating on a scale to detect early adopters (Barch, 2014).
Discussion & Recommendations

mHealth Ethics

- **Beneficence**: Potential benefits discussed in review including improved clinical outcomes, enhanced confidence and insight, connection to social support and sigma reduction.

- **Autonomy**: Potential to increase health and technology literacy promoting enhanced engagement in care.

- **Justice**: Cost barriers may be decreasing with more owning smartphones (Ben-Zeev et al., 2015). mHealth may offer some additional support for those experiencing barriers to care access, reinforcing and enhancing the professional care they are able to receive.

- **Non-Maleficence**: Concerns exist regarding lack of evidence-based content leading to misinformation and poor outcomes, lack of security and privacy especially using ambient monitoring and potential for companies to take financial advantage of clients during periods of vulnerability. Professional recommendations entreat providers to systematically evaluate applications with a client-centered lens before use or recommendation (APA, 2017).
Implications for Practice

- With so few specific mHealth interventions supported by adequate research to meet professional standards, mental health providers must make their own determinations using clinical judgement. This process should be guided by the general framework for application evaluation proposed by the APA (2017).

- Organizations such as iMedicalApp (2017), identified by the Cochrane Collaboration (2014) as evidence-based, claim to review evidence and test mHealth applications in various specialties including mental health. Use of such a resource may serve as a starting point for clinicians in the identification of likely mHealth applications.

Policy Recommendations

- Educational Institutions: Include the APA App Evaluation process into curriculum concerning research methods, expanding the scope of expectations in clinical judgement and well of knowledge.

- Health Systems and Professional Organizations: Develop committees dedicated to the review of mHealth interventions as tools in care to provide more specific recommendations to practitioners.

- Legislation: Encourage legislators to expand HHS purview to mHealth interventions perhaps as an expansion to the recent ECHO Act (2016) which gave the HHS the obligation to review technology facilitating the interprofessional sharing of knowledge.
Future Research

- The WHO mHealth Technical Evidence Review Group proposed guidelines for general mHealth application reporting which will improve quality, replicability and synthesis of independent studies (Agarwal et al., 2016).
  - The sixteen reporting criteria include: cost, data security, interoperability within existing healthcare system, infrastructural assumptions, intervention content & study replicability.
- Alternative research design such as fractural randomization, stepped designs or adaptive trial paradigms might better suit the analysis and facilitate more rapid advancement in knowledge in the study of technology-based health interventions than the gold-standard RCT design (Ben-Zeev et al., 2012). Researchers using these designs must consider how to best report findings to add to the collective field of evidence.
- Researchers should consider teaming with graphic design teams to improve the interface and quality of products offered to the public which may improve utilization (Fleming et al., 2014).

Conclusions

- The effects of chronic mental illness remains a major burden on the global economy and devastating in its impact on individuals.
- Professionals are charged with optimizing their treatment to improve individual outcomes and expanded the reach of their services and to do this, they must provide their clients with the most cost effective, evidence-based and individualized interventions they have at their disposal.
- The field of mHealth research is in its nascent stage, struggling to keep pace with the explosive progression of the technology. In this effort, the current literature has a broad base, but lacks depth the support the efficacy of individual interventions reviewed.
- The APA (2017) provides guidelines for professionals to access mobile applications, commercial organizations like mMedicalApps, provide summaries of evidence to assist in this assessment, and the WHO entrusts researchers to follow more comprehensive reporting guidelines to improve the quality of future research.
- With these considerations, mHealth technology stands to make a significant impact on future mental health practice. This will grow as solid evidence changes the perception of professionals, and ethical concerns are addressed, allowing the general population to gain more trust in the use of mHealth interventions in mental health treatment.
References


Thank you