White Paper Series on mHealth and Aging

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mHEALTH SOLUTIONS FOR IMPROVING MENTAL HEALTH AND ILLNESSES IN THE AGING PROCESS

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Ada Kwan, mHealth Alliance, United Nations Foundation

ABSTRACT

THIS WHITE PAPER, WHICH HAS EVOLVED FROM PRIOR RESEARCH[1], IS ONE PART OF A THREE-PART SERIES DEVOTED TO EXPLORING THE USE OF MOBILE AND WIRELESS TECHNOLOGIES IN HEALTH (MHEALTH) and the opportunities for impacting and advancing healthy aging in low- and middle-income countries (LMICs). This specific paper focuses on the use of mHealth for mental health among older adults.

In the year 2012, 11.5% of the world population of seven billion was aged 60 or older, and by 2050, this proportion is expected to grow to 22%[2]. The largest growth will occur in LMICs, which is an encouraging reflection of many achievements in public health. However, mental health disorders are increasingly recognized as major contributors to the global disease burden, and over the next 20 years these conditions are estimated to cost US $16.1 trillion in terms of global economic loss [3]. Through targeted investment, much more can be done to turn these costly consequences into gains. Unfortunately, individuals who are affected by mental illnesses often cannot overcome structural barriers to receive care and treatment. These barriers include poor awareness of their conditions, as well as stigma and discrimination in their communities. Many of these individuals go without any care at all, to say nothing of appropriate and high quality care. For the elderly, who are already prone to cognitive decline as part of the natural process of aging, getting appropriate care is particularly challenging. The situation is further exacerbated by the human resource crisis in mental health services and the lack of funding and prioritization of mental health and aging in policies.

The need for more awareness, human resources, capacity building efforts, and stronger advocacy in mental health and aging will take time. For the mental health situation for elderly people in LMICs, immediate solutions that have sustainable potential and can leverage existing resources must be implemented now to mitigate the significant challenges ahead. The near ubiquity and increasing penetration rates of mobile phones and wireless technologies, even in the most remote regions of the world, mean that such technologies may offer feasible solutions. Some mHealth efforts are already being implemented to address mental health education and awareness in communities, enhance mental health care professionals' training and extend therapy and treatment options to individuals with mental illnesses. This paper describes mHealth interventions for mental health in general and, more specifically, for depression, epilepsy and schizophrenia. Suggestions are then made for how to properly leverage mobile technologies so their full potential can be reached to improve mental health conditions among the elderly. This paper ends with a call to action to bring together stakeholders from a variety of sectors to achieve this potential.

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INTRODUCTION

THE WORLD'S SOCIETIES ARE QUICKLY AGING. The proportion of elderly in the world population is growing three times faster than the world population itself, and by 2050, one out of four people will be older than 60 years of age [4, 5]. An aging society offers many benefits, as older adults possess a wealth of knowledge and experience that can be an invaluable asset to economic development.

However, as people age, they are prone to experience physical and cognitive impairments during the natural process of growing older, and getting appropriate care can become challenging. Older adults are also more vulnerable to social isolation, loss of autonomy, loss of privacy, economic barriers and depression, which has been linked to further disability and is associated with loneliness and poverty [2, 6]. In countries around the world, individuals with poor mental health may not have strong support systems that can help, and the individuals who are affected by mental illnesses often do not receive the care and treatment they require to get better [7-9]. Poor awareness of mental health conditions and disorders (e.g., dementia, epilepsy, schizophrenia, and depression), combined with financial barriers or stigma and discrimination in the community against mental disorders, prevent access to services and trained professionals [8, 10]. The situation is further exacerbated by the human resource crisis in mental health care delivery and the lack of funding and prioritization of mental health and aging in policy. Mental health issues are particularly a growing concern in LMICs, where most of the aging population growth is expected to occur, and existing health systems and caregiver support are not prepared to respond properly to either of these growing issues [3]. If strategic preparation and action is not taken now, the growing disease burden for mental disorders among an expanding aging population will be costly to the elderly, their families and governments [3].

Another global trend could be part of the urgently needed solution. With the number of mobile phone subscriptions predicted to surpass the world population of over seven billion in 2014, mobile offers a way to reach individuals in almost all corners of the world [11, 12]. By providing new and easier ways to send information and communicate with others, mobile and wireless technologies are being used to support health interventions for healthier aging in the field of mental health. *The objectives of this white paper are twofold:*

The proportion of elderly in the world population is growing three times faster than the world population itself, and By 2050, one out of four people will be older than 60 years of age [4, 5].

(i) to understand the context and conditions related to mental health and mental illnesses among older adults in LMICs and (ii) to identify mHealth solutions that are enabling or could enable improved mental health or early detection and support for mental illnesses, as well as provide psychosocial support to older adults and their caregivers. The focus of this paper will be on LMICs while drawing on relevant information from high-income countries (HICs).

Mobile and wireless technologies are being used to support health interventions for healthier aging in the field of mental health.

BACKGROUND

"NO HEALTH WITHOUT MENTAL HEALTH," IS A PHRASE ENDORSED BY THE WORLD HEALTH ORGANIZATION (WHO) [13] and reflects the increased recognition that "mental health and well-being are essential components of a healthy society" [8]. However, the world's societies are growing and aging, which has stark implications on the disease burden of mental disorders. By 2050, the number of individuals 60 years of age and older will make up nearly 22% (two billion individuals) of the world population – a dramatic increase from 11% (760 million individuals) in 2011 [14]. The largest growth of the elderly population will occur in LMICs, where health systems are inadequately prepared to respond to mental, neurological, and substance abuse disorders [2].

Mental health conditions[1], defined as "a set of medical conditions that affect a person's thinking, feeling, mood, ability to relate to others and daily functioning" [3], affect approximately 450 million people around the world [9]. When the WHO conducted the most recent World Mental Health Survey in 14 countries, prevalence rates for mental health disorders ranged from 4.3% to 24.4% [15]. However, interpreting these rates by country cannot be done without further understanding other factors, such as family structures, prevalence of war and other sources of stress, urbanization of the population and belief systems [15]. Regardless, mental health conditions, which include schizophrenia, bipolar disorder, unipolar disorder, alcohol and substance abuse and dependence, phobias and depression, are particularly threatening because they are associated with high levels of disability, risk factors for non-communicable diseases (NCDs) and consequently, premature mortality [8, 16, 17].

Among older people, depression and dementia are the most common mental illnesses [13]. For depression, prevalence estimates in LMICs are difficult to establish for older adults; however, in HICs, prevalence for major depressive episodes among older adults have been estimated to be 6-10% in primary care settings and 30% in inpatient medical and long-term care settings [18]. In these settings, incidence rates for depressive episodes are estimated to be around half these values [19]. For dementia, the number of cases among older

[1] Mental health conditions can also be referred to as mental disorders, mental illnesses or neuropsychiatric disorders [3].

[2] However, some studies on dementia prevalence in LMICs have reported "strikingly low" rates [8].

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adults are expected to increase from 25 million in 2000 to 63 million by 2030, with the majority of affected elderly persons living in LMICs[2] [20]. In the context of aging, depression and dementia symptoms have been attributed to abuse, neglect, tension, family conflict, housing, financial insecurities and feelings of isolation, especially if older adults do not receive strong care support from family members such as their children [8,21]. Positive solutions include moral support, in addition to demonstrated love and affection, which would require families to be better educated about age-related conditions and ways to provide enhanced support to elderly members of their families. However, many older people turn to alcohol to help cope with feelings of loss or loneliness in an attempt to alleviate depression [22].

Evidence from various countries has shown that public knowledge is minimal in terms of how to treat mental illnesses, the ability to recognize when an illness is developing, knowledge of help-seeking options and treatments, knowledge of effective strategies for milder issues, and first aid skills to support individuals with mental health issues [23]. Stigma and discrimination surrounding mental health issues not only complicate education and awareness strategies, but also make providing adequate care to those affected difficult. These factors prohibit people from understanding care exists and from seeking adequate attention for individuals with mental illnesses. Among elderly individuals, these conditions, combined with frailty, contribute to poor access to health care and delayed diagnosis that complicates treatment and the ability to receive other types of necessary care. There is a need for improved awareness of mental health issues, stronger social support and better medication management.

Despite the challenges in reducing the disease burden attributed to mental disorders, the time to act is now. Without action, mental illnesses will account for US$16.1 trillion in economic and productivity losses over the course of the next 20 years [3]. Developing solutions to mitigate the growing burden of mental disorders among the elderly will require investment, prioritization, and resources. However, not investing and failing to prioritize mental health will have costly consequences that will be harder to reverse in the future.

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SOLUTIONS: mHealth for Mental Health and Illnesses in Aging

MITIGATING THE CHALLENGES AHEAD IN MENTAL HEALTH FOR OLDER ADULTS WILL REQUIRE STRATEGIC INVESTMENT IN: generating awareness for mental health issues among the general population; developing capacity for mental health service delivery; providing training for mental health workers and shifting certain tasks to less skilled workers to reduce the work burden on the low numbers who are trained[3]; and implementing immediate health management and treatment solutions. For each of these investment needs, the near ubiquity of mobile phone subscriptions and increasing mobile network penetration rates around the world offer exciting opportunities to leverage existing resources while having strong potential for scale-up. This section will detail the uses of mobile and wireless technologies for mental health among older adults in LMICs. However, the implementation of mobile applications for mental health with a specific focus on aging or older adult populations is fairly new and seldom discussed in the existing literature. Therefore, additional examples are drawn from mHealth solutions implemented for other aspects of health, other target populations, and from HICs, where relevant.

The application of mHealth to mental health and illnesses is a fairly new topic, but some reviews of potential uses and existing efforts have been published [(6, 25-27)]. These reviews describe existing mobile applications designed to collect information related to moods, anxiety levels, sleep patterns, and treatment compliance, among other strategies to improve mental health. Described in Table 1, these strategies are listed within a framework adapted from approaches identified by HelpAge International and public health priorities in mental health identified by WHO[4] [(8, 22)].

[3] Studies in India, Chile, Pakistan and Uganda have demonstrated that depression, anxiety and schizophrenia interventions can be successfully delivered with nonmedical mental health workers [(24)].

[4] The approaches by HelpAge International and by WHO were combined for the purpose of this paper because of their significant overlap and their additive ability to provide a comprehensive framework to describe relevant mHealth solutions for mental health in aging [(8)].

For the emotional, financial, and instrumental support needs of informal caregivers, mobile options are plentiful...

MENTAL HEALTH PRIORITIES	APPROACHES	RELEVANT mHEALTH STRATEGIES
Public education	• Promoting active aging – regular exercise, planning for lifestyle changes such as retirement, seeking support following bereavement, pursuing a range of interests [22] • Promoting public and media awareness of aging and mental health issues [22] and educating the public [8] • Challenging discrimination [22]	• Text messages, games or quizzes to send information on better dietary habits and encouraging exercise • Text messages or quizzes to eliminate falsehoods surrounding mental disorders and break down stigma associated with mental health and aging • Accessing information on the Internet or through hotlines • Connecting other adults or caregivers in applications or social networks to reduce social isolation and impacts of loss or to encourage active participation in communities
Security promotion	• Improving economic opportunities, including opportunities for older people [22] • Providing social protection, including basic pensions for older people [22] • Developing mechanisms to resolve conflict and reduce levels of violence [22]	• Providing patients or caregivers mobile health tips to integrate individuals with mental illnesses into society • In-between psychotherapy sessions transferred through voice calls or text messaging • Mobile options to facilitate or connect individuals with work options and job support

MENTAL HEALTH PRIORITIES	APPROACHES	RELEVANT mHEALTH STRATEGIES
Community-based mental health programs	• Giving care in the community [8] and developing community-based outreach counseling services for older people [22] • Developing human resources (8) and training health workers, community workers and health facility staff in residential settings to diagnose and treat mental health problems [22] • Establishing multi-disciplinary teams to promote mental health and provide effective care [22] • Providing practical and emotional support for people with mental health problems and their families – information, support groups, telephone helplines [22] • Developing services for trauma counseling [22]	• eLearning and mobile training options for community-based health workers to be aware of or be able to spot signs of mental illnesses in households with elderly people • Point-of-care tools or protocols accessible on mobile phones for community-based health workers • Person tracking options with mobile and GPS • Mobile communication among the elderly, family members and healthcare professionals • Remote counseling support or automated reminders or self-managing exercises for coping strategies learned in therapy • Voice or text messages to share information on or encourage treatment adherence and good dietary habits specific to improving mental health • Remote monitoring of moods, vital signs, and other health data through wireless monitoring options • Links to hotlines, support groups or trained health professionals
Security promotion	• Providing treatment in primary care [8] • Making psychotropic medications available [8] • Establishing national policies and legislation and involving communities, families and consumers [8] • Linking with other sectors [8] and other community agents (e.g., faith and traditional healers) • Supporting more research [8]	• Cognitive fitness technologies, including thinking games, with assessment and tracking components [28] • Mobile-based supply tracking monitoring for medicine • Automated and wireless detection for monitoring treatment adherence, such as mHealth solutions that can monitor the frequency of medicine intake through pill dispenser detectors [29] • Mobile accessibility to social networks or other groups that can encourage community participation or link to peer support (e.g., although there is no specific focus on older adults, the South African Depression and Anxiety Group holds Facebook online chats where individuals can converse with experts about certain topics related to mental health) [30].

TABLE 1. Adapted from HelpAge International and from WHO [8, 22], this table includes positive approaches to enhance mental health in the context of aging alongside relevant mHealth opportunities.

Other examples of mHealth solutions in mental health to emphasize include: mobile phone games to promote healthier behaviors [31]; assessments developed for mobile phones, such as mobile assessments for alcohol and substance use [32, 33]; and psychosocial interventions developed for mobile phone delivery and aimed at reducing feelings of isolation or managing severe mental illnesses. Strategies for these solutions involve mobile phone prompts that allow real-time monitoring of personalized self-management behavior change, "between-session" engagement with therapists over the mobile phone, and text messaging to facilitate case management [26]. Normally conducted with pen and paper, a psychological measurement tool called ecological momentary assessment (EMA), which "samples attitudes, behaviors, and experiences in real time in subjects' natural environments", can now be conducted with mobile technologies [34-36]. Evidence-based therapy sessions have also been adapted for ease of access on mobile phone applications, and even "virtual coaches" to help in relaxation techniques are downloadable [37]. Additionally, text messages or wireless monitoring options that can check on the moods of older adults can be designed to improve wellbeing, dietary habits and physical health or to reduce feelings of social isolation or loneliness, which do not necessarily result in mental illness – or the onset of other NCDs, since poor mental health and mental illnesses are risk factors – but can take a toll on mental wellbeing [38]. The flexibility of mobile and wireless technologies allow therapy sessions to also be conducted through voice or video[5] [27]. Furthermore, interventions delivered on the Internet, which is increasingly accessible on mobile phones, are already being implemented and will become more feasible over time. One example of this is Ilajnafsy, an Internet site that offers scientifically tested treatment of post-traumatic stress disorder in Arabic [39]. Different elements of treatment are tailored for each of the clients, who can access the therapy online in the comfort of their own home.

Specific examples of mHealth projects for mental health are displayed in Table 2. Only two examples are described from LMICs, as mHealth is less commonly applied in LMIC contexts when compared to HICs. During the research for this paper, very few mHealth efforts specifically targeting older adults were identified; however, many of the projects described below provide coverage to seniors or the elderly, in addition to adolescents and adults.

Different elements of treatment are tailored for each of the clients, who can access the therapy online in the comfort of their own home.

[5] This is further discussed in a recently published book on using technologies to improve mental health [27].

mHealth Interventions for Mental Health

RELATED MENTAL ILLNESS	APPLICATION OR IMPLEMENTING ORGANIZATIONS, LOCATION	PROJECT DESCRIPTION
Depression (Mild to Moderate)	Companion-SMS project, United States	For use by individuals with mild to moderate depression, Companion-SMS is a software system that sends text messages to monitor the emotional state of individuals [41]. This information, such as feelings of sadness or loneliness, decreased energy, difficulty concentrating, and disinterest in activities, gets sent to clinicians who are able to respond. The model behind this intervention is based on how genuine and immediate support through the mobile phone can improve the way someone feels and can encourage that individual to interact with trained clinicians.
Epilepsy	M-Kifafa, Kenya	M-Kifafa is an mHealth program that uses text messages to exchange information with health workers, caregivers, and epilepsy patients [42]. In addition to receiving text message reminders and information, caregivers and patients log and transmit seizure diaries and condition updates on their phones, and these data inform the supply of anti-epilepsy drugs. Additionally, health workers are trained through mobile phones, which also assist workers in registering patients and collecting relevant patient information [43]. Supported by Safaricom Foundation, M-Kifafa is implemented by the Kenya Association for the Welfare of People with Epilepsy (KAWE), the Ministry of Public Health, Sanofi Access to Medicines Program and Shujaa Solutions.
Schizophrenia	Mobile Assessment and Treatment of Schizophrenia (MATS), United States	The MATS intervention incorporates remote monitoring with cognitive behavioral therapy interventions to assist individuals with schizophrenia [44]. The program sends a different set of four text messages daily for each of the following: medication adherence, socialization or auditory hallucinations[6]. An evaluation of the intervention found that text messages significantly improved medication adherence among independently living patients, increased the number of social interactions and reduced the severity of auditory hallucinations [44].

[6] The sets of text messages were developed based on cognitive behavior therapy. In their article, Granholm et al. (2011) describe the content of the messages:

> Thoughts about medications, socializing and voices were elicited (e.g., "Do you think your voices are powerful?"), and the next messages encouraged participants to question unhelpful beliefs (e.g., "Maybe your voices can't really do what they say") and try a behavioral experiment (e.g., "Try ignoring them and see what happens"). Evidence used to challenge unhelpful beliefs included personalized information provided by the participant. [44]\

RELATED MENTAL ILLNESS	APPLICATION OR IMPLEMENTING ORGANIZATIONS, LOCATION	PROJECT DESCRIPTION
All Mental Illnesses	MINDS Foundation, India	A project being implemented by the MINDS Foundation injects capacity for mental health services in rural India [45] The project consists of three phases: (1) education and awareness to inform people that mental illnesses can be supported through health services; (2) free transportation for mental health patients to the hospital with mental health services to eliminate prohibitive barriers from transportation costs; and (3) a mobile-based data collection tool for trained community health workers to check on mental health patients in the community. Patients, who are often adolescents or adults in these communities, are able to improve their mental health because of access to consistent care. The project provides these individuals with additional skills training, such as job assistance, to help them reintegrate into their communities.
	Schizophrenia Research Foundation (SCARF), India	As a feasible option for filling a service delivery gap, SCARF, a non-governmental organization (NGO) and a Collaborating Centre of the WHO for Mental Health Research and Training, implemented a telemedicine service in different areas in India (7, 46). As an extension of community outreach, the telemedicine services began when SCARF delivered free psychosocial and counseling support to victims of a tsunami in 2004. The model used drew a telemedicine network across its outreach programs, which included clinical examinations and delivery of drugs to patients [7]. The program found many individuals who went "untreated or irregularly treated" due to lack of access to affordable care, to NGOs and fieldworkers who could identify cases or to existing mental health services [7].

TABLE 2. mHealth interventions for mental health and specific mental illnesses.

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Other examples of mHealth applications have shown that mobile solutions can take a central role in already existing evidence-based therapies. For example, one mHealth strategy that may be relevant for older adults is an adaptable game called PlayWrite [47]. PlayWrite consists of 10 therapeutic games that can be adapted by mental health professionals, and currently it is being implemented to support adolescent mental health. In the game, the player interacts with dialogue generated by the mental health professional. Additionally, Price et al. (2013) describe additional strategies: an application that uses geolocation information to send substance abusers "warning" messages when they enter geographical areas that have been categorized as more at risk; mobile games and exercises that are sent during emotional crises to patients with borderline personality disorder in order to divert their emotions away from intense situations; and other mHealth applications that give patients access to essential coping mechanisms learned through recovery processes [48, 49].

In locations where mental illnesses are highly stigmatized, mHealth offers a channel to educate and increase awareness within communities on the facts surrounding mental illnesses. Increasing education and awareness is often most relevant for caregivers and mental health patients since most individuals who begin treatment possess little knowledge of the treatment process and are poorly prepared to receive care. These factors have both been associated with poorer response to therapy [48, 50-52].

Other examples of mHealth applications have shown that mobile solutions can take a central role in already existing evidence-based therapies.

Focusing on a more positive approach in advance can absorb the shock of sudden transitions in emergency situations and reverse the vicious cycle that is driven by the loss of confidence and worry during old age.

mHEALTH CONSIDERATIONS RELEVANT FOR MENTAL HEALTH AND ILLNESSES IN AGING

DESIGNING AND IMPLEMENTING mHEALTH SOLUTIONS FOR MENTAL HEALTH AND ILLNESSES FOR OLDER ADULTS POSES MANY CHALLENGES and, to help advance the field, the following considerations have been identified to take into account.

Knowledge gaps of the mental health context in LMICs can be improved by building upon information from existing efforts in mental health and sharing learned lessons in the future. In general, much less is known about mental illnesses and sustainable mental health care delivery options in LMICs, especially for older adults [8]. To address this, evidence must be generated in the proper context and given thorough examination, and lessons should be transparently shared for mental health outcomes to improve. A current debate of global mental health criticizes the way in which global health concepts and "realities" are driven predominantly by western scientific perspectives, which may have limited relevance to LMICs [53-55].

Lack of mHealth evidence related to elderly populations can benefit from implementers focusing on the aging population beginning with project design and continuing through implementation. To improve mHealth evidence related to elderly populations, involving elderly populations in design, tapping their knowledge and expertise as older adults and engaging them to participate in decision-making will become increasingly important. Previous mHealth projects have found formative research through semi-structured interviews and focus groups to be helpful in informing project design, and older adults or their perspectives should be taken into account [56, 57].

The vicious cycle associated with aging can become the virtuous cycle by changing perspectives. Positive approaches to leverage when applying mHealth include: tapping the knowledge and expertise of older adults and engaging them to participate in decision-making around the household and in their trade; providing ways for them to stay independent (if possible given the stage of illness) or adopt new hobbies; and offering strategies that can help families,

caregivers, and older adults to plan finances – all of which can contribute to a more positive, virtuous cycle for healthier aging. Focusing on a more positive approach in advance can absorb the shock of sudden transitions in emergency situations and reverse the vicious cycle that is driven by the loss of confidence and worry during old age.

Treatment gaps and health system gaps can be filled with a good understanding of how older adults interact with existing health systems and informal providers, such as faith and traditional healers. Tor individuals who require treatment, there are several challenges in maintaining proper compliance. First, poor or inconsistent supplies of essential medicines in the health system can prevent individuals from receiving the adequate treatment they need. Second, in some countries, there is a lack of trust in the formal health system's ability to provide medicine, and patients seek consultations from other community agents, such as traditional healers and chemical sellers, who can sometimes cause more harm because they are unregulated and can create "avoidable complications" (e.g., by advising patients to terminate their current treatment) [(58)]. Third, there is often a tendency to terminate treatment regimens when individuals begin feeling better. For mental health issues in aging, all of these challenges are further compounded by cognitive decline, weak caregiving support, and the fact that medications are often confusing for the elderly [(24)]. mHealth solutions must aim to tackle these challenges to be effective.

Customization on the individual level for mHealth will be key. Monitoring or sending treatment adherence interventions should be customized or tailored to individuals in order to maximize effectiveness. Although the elderly are perceived to be technology-averse, some studies have reported how individuals from older age segments of the population welcomed, and in some cases were excited about, the use of mobile technologies. As populations age, more individuals will enter the elderly age segment, and these individuals will have more exposure to technology, particularly with the Internet, computers and mobile phones.

mHealth should complement traditional mental health system strengthening efforts. From the health systems perspective, one way to strengthen mental health service capacity is to develop mobile platforms that can be accessed anywhere and anytime mental health workers conduct their daily responsibilities and activities. In this case, existing guides and protocols should be adapted to mobile technologies and, if possible, face-to-face trainings on how to access digitized versions should be integrated into existing training sessions to reduce any initial discomfort, enhance familiarity and increase confidence in using technology. Korste describes the strong value of digitizing WHO's Mental Health Gap Action Programme (mhGAP) Intervention Guide for non-specialist health workers for eLearning materials, smartphone applications, text messaging, and voice platforms [(59)]. For child health, international guidelines have been successfully implemented on mobile phones[7].

More mHealth does not mean better mHealth. In a review of mobile phone applications on the BlackBerry App World site, Luxton et al. (2011) found over 200 different applications related to anxiety, depression, smoking, alcohol use, psychosis, diet, exercise, weight loss, nutrition, parenting, cognitive performance, relationships, relaxation, sleep, spirituality, and general wellbeing [(37)]. But the sheer number of mobile phone applications does not determine the effectiveness of mHealth use. Rather than quantity, coordination and strong partnerships will be necessary to make sure that the field evolves towards higher quality and more useful solutions that can be incorporated into formal health systems.

[7] This refers to the case of e-IMCI (electronic Integrated Management of Childhood Illnesses), an electronic version of IMCI protocols first deployed in Tanzania [(60)].

CALL TO ACTION: WAYS FORWARD FOR BETTER MENTAL HEALTH WITH mHEALTH

EFFECTIVE mHEALTH STRATEGIES ALONE WILL NOT OVERCOME THE CHALLENGES IN DELIVERING APPROPRIATE AND ACCESSIBLE MENTAL HEALTH SERVICES TO THOSE WHO NEED IT. Moving forward in the field will require participatory action from stakeholders across sectors to coordinate and work together towards achieving reduced morbidity and mortality attributed to mental health and aging. For this, developers and implementers, mental health workers, researchers, governments, and donors are all called to action

Developers and Implementers – Identify and pursue technologies and models that have been deployed and scaled, and build off of existing systems and knowledge while looking towards collaborations and partners who can add value for mental health in aging. Using mobile technologies also requires training or formal informational sessions, which can remove initial discomfort from technologies among end users.

Mental health workers – Participate in the design of mobile solutions implemented by developers and local NGOs and advocate for tools that can improve working conditions, motivation, training and services for elderly people with mental illnesses. When integrating mobile solutions for mental health services, these solutions should never replace, but instead supplement existing standards and guidelines [61].

Researchers – Conduct research on mHealth implementations in mental health while being sure to address the elderly and their social, financial and family situations. It will also be important to share lessons learned from mHealth projects because the field is rapidly evolving and successful development will rely on the ability to grow and adapt quickly.

Governments – Support comprehensive policies and implementation of mental health services, especially those tailored for the aging population, and consider the integration of technologies where they can be most effective. These policies and interventions must fit well within the larger health system and consider relevant modes of health service delivery (e.g., community- or facility-based), as well as work towards reducing stigma and discrimination and improving capacity for mental health human resources.

Donors and development agencies – Direct funds towards proven models for mHealth that are working and have established results, as well as those in mental health, and encourage integration of services across health systems through sustainable strategies and sustainable models of financing. Existing funding should not be shifted to mental health, but should incorporate mental health. Much is already known about delivering community-based services; however, more investment is needed to support strategies over time. Developing incremental funding for existing efforts and earmarking funding for building capacity and supporting partnerships to scale effective projects can encourage sustainability and encourage the mHealth field to develop higher quality, more useful solutions that can scale.

CONCLUSION

mHealth can help avert risk factors associated with mental illnesses and improve mental and cognitive health. For older adults confronting mental illnesses or cognitive decline, mHealth interventions can help monitor moods, promote healthier behaviors associated with better mental health, develop awareness about what to expect during mental health care and treatment, and provide access to interventions without traveling to trained professionals. For individuals and their caregivers who are dealing with mental illnesses during old age, mobile options allow for mobile-based self-assessments, check-ins between visits to facilities, reminders about certain components of therapies, and monitoring of activities for acute events made available within an individuals' environment. On the health provider side, mobile technologies can offer accessible and portable reference guides and protocol support for health workers, mobile-based assessment and monitoring options, follow-up for treatment with patients and – put simply – a conduit to communicate with patients and their caregivers. As mobile phones continue to become the preferred mode of communication among communities around the world, the ubiquitous nature of mobile technologies and connectivity will drive mHealth development towards continuous monitoring and more enhanced mobile-assisted strategies for mental health. Now is the best time to coordinate across stakeholders to strategically realize the full potential of mobile solutions to promote active aging and good mental health, as well as reduce the quickly growing disease burden associated with mental disorders.

Although an aging population will bring a wealth of knowledge and experience to societies, health systems are not prepared to respond to the progressively increasing burden of age-related health conditions, such as mental disorders. This paper describes the imminent challenges in scaling up mental health resources across the world in the near future as the world's elderly population and mental health disease burden grow quickly. This paper, however, also suggests potential solutions to confront these challenges, taking into account existing resources. Although implementing mHealth successfully will require an unprecedented shift in the way public health strategies are implemented for meeting the mental health care needs for aging populations, mobile technologies can spread awareness of mental health facts to reduce barriers related to stigma, improve awareness on mental health issues for families and aging adults, create new ways to screen for mental illnesses and to detect cognitive impairment without traditional resources or training.

The use of mHealth for caregivers of older adults is at an early stage; however, the potential impact of mHealth is being considered.

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