

Mobile Technologies in the Study, Assessment, and Treatment of Schizophrenia

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Mobile technologies are developing at a phenomenal rate and hold tremendous promise for transforming schizophrenia research and treatment. Over the last decade, mobile devices including microcomputers, mobile phones, and smartphones have become ubiquitous. The United Nations' telecommunication agency recently reported that mobile phone subscriptions have reached almost 6 billion worldwide.¹ Developing countries now account for close to 3 quarters of the mobile phones in use, and in some developed countries, the number of mobile phones already exceeds the size of the population, with many individuals owning multiple mobile devices. Recent national surveys in the United States found that mobile devices are helping bridge the digital information divide between various socioeconomic groups, as several traditionally underserved populations who typically could not afford access to home computers and internet packages now often use smartphones as their primary connection to information on the Internet. Remarkably, there is emerging evidence that many chronically homeless individuals now also use mobile devices regularly. The characteristics of contemporary mobile technologies (ie, portability, self-contained power source, increasingly user-friendly design) allow for something quite revolutionary—they enable us to transport research, assessment, and treatment out of the laboratories and clinics and into the real-time/real-world context in which individuals negotiate their daily lives and contend with chronic psychiatric illnesses and functional impairment. As infrastructure for mobile telecommunication continues to develop globally, it will create opportunities for far-reaching implementation of evidence-based interventions and wide-scale dissemination of information and resources in a manner that is unprecedented.

The inherent advantages of mobile technologies are not going unnoticed by researchers, clinicians, and forward-thinking policy makers. The incorporation of

various mobile devices in support of prevention and treatment initiatives across biomedical and behavioral disciplines is growing rapidly,^{2,3} the National Institutes of Health has recently begun to offer specialized training and funding opportunities focusing specifically on Mobile Health (mHealth) research, The Center for Medicare and Medicaid Services is exploring new payment models that may allow for expanded reimbursement of technology-based services, and the US Food and Drug Administration has already released statements regarding guidelines for regulating the use of some mobile devices and applications.

While enthusiasm for utilization of mobile technology in research and clinical care is gaining momentum across a wide array of physical and mental health disciplines, many schizophrenia researchers and clinicians remain skeptical about the ability or willingness of patients with psychotic illnesses to comply with mobile research protocols or engage in mobile interventions. This apprehension is largely unfounded, and evidence suggests that given opportunity and appropriate training, many individuals with schizophrenia can and will use various mobile technologies successfully, even when they are quite symptomatic. The purpose of this special issue is to cultivate discussion about new opportunities for leveraging existing and emerging mobile technologies in the study of psychotic illnesses and to encourage investigators to think creatively about how these novel approaches can improve our understanding of the etiological risk factors, contextual influences, and possible treatments for schizophrenia.

In the first article in this collection, we have asked Kimhy et al⁴ to discuss the rationale for mobile technology research in schizophrenia and provide concrete guidelines and practical suggestions for studies with this population. Their expert insights and shared collective experiences will undoubtedly be useful to investigators who are unfamiliar with mobile technology study design, hardware and software requirements, and statistical approaches necessary to successfully analyze the rich data that are characteristic of these paradigms. In the articles that

follow, investigators demonstrate how 3 generations of mobile devices, including preprogrammed wristwatches used in conjunction with paper-and-pencil diaries, micro-computers, and mobile phones, can be effectively deployed for mobile research and treatment development. Ben-Zeev and colleagues⁵ use mobile technology to assist in the evaluation of patient clinical self-reports. They compare real-time/real-place momentary mobile assessments collected over 7 days in individuals with schizophrenia and a nonclinical comparison group to retrospective reports provided by both groups for the same period of time. Their findings indicate that study compliance in individuals with schizophrenia can be exceptionally high and that various dimensions of one's symptomological and emotional experience are not well captured by traditional reports and better captured by momentary mobile assessments. Oorschot and colleagues⁶ and Granholm and colleagues⁷ deploy mobile devices in a therapeutic context. Oorschot and associates demonstrate how mobile data can be used to elucidate idiosyncratic symptom patterns and dynamic changes within individuals longitudinally, and articulate how this approach can augment face-to-face treatments by improving the therapeutic relationship between clinician and patient, providing important information for psychoeducation and treatment personalization. Granholm and colleagues⁷ report on an innovative automated mobile assessment and intervention for schizophrenia. In their pilot study, text messages sent from a remote preprogrammed server to patients' mobile phones are used to administer cognitive-behavioral interventions in support of medication adherence, social functioning, and coping with auditory hallucinations. In the context of a growing body of evidence suggesting symptoms, affect, and functioning in schizophrenia are not nearly as static as previously believed, such paradigms may prove to be an especially powerful tool for identification of risk or preventive factors that could perhaps be targeted with real-time mobile interventions.

As mobile devices infiltrate more and more areas of life of the general population, they will undoubtedly become

more prevalent among those with schizophrenia as well. Statistically, many of those who are currently growing up with these technologies in hand will go on to develop serious mental illnesses in the future. Looking forward, now is the opportune time for innovative investigators and clinicians to examine how these emerging technologies can be harnessed as a powerful new platform for research and treatment approaches that can be made available in the years ahead.

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