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Use of mobile assessment technologies in inpatient psychiatric settings

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ABSTRACT

Mobile electronic devices (i.e., PDAs, cellphones) have been used successfully as part of research studies of individuals with severe mental illness living in the community. More recently, efforts have been made to incorporate such technologies into outpatient treatments. However, few attempts have been made to date to employ such mobile devices among hospitalized psychiatric patients. In this article, we evaluate the potential use of such devices in inpatient psychiatric settings using 33 hospitalized patients with schizophrenia. Employing an Experience Sampling Method approach, we provide support for the feasibility of using such devices, along with examples of potentially clinically-relevant information that can be obtained using such technologies, including assessment of fluctuations in the severity of psychotic symptoms and negative mood in relation to social context, unit location, and time of day. Following these examples, we discuss issues related to the potential use of mobile electronic devices by patients hospitalized at inpatient psychiatric settings including issues related to patients' compliance, assessment schedules, questionnaire development, confidentiality issues, as well as selection of appropriate software/hardware. Finally, we delineate some issues and areas of inquiry requiring additional research and development.

1. Introduction

Technological advances over the past decade have made it feasible to incorporate electronic mobile devices (i.e., PDAs, cellphones) into psychiatric research and treatment. Specifically, mobile devices have been used to study "real world" daily functioning of individuals with severe mental illness including people with schizophrenia and acute psychosis (Kimhy et al., 2006, 2010, 2012; Granholm et al., 2008, 2012; Spaniel et al., 2008; Johnson et al., 2009; Depp et al., 2010; Swendsen et al., 2011; Ben-Zeev et al., 2011, 2012; So et al., 2013), bipolar disorder (Husky et al., 2010; Depp et al., 2010; Bopp et al., 2010; Kwapil et al., 2011), schizotypy (Kwapil et al., 2012; Barrantes-Vidal et al., 2013), as well as individuals at clinical high-risk for psychosis (Kimhy & Corcoran, 2008). While these technologies were utilized primarily to collect research data, in recent years a number of attempts have also been made to incorporate such technologies into treatments (Kimhy & Corcoran, 2008; Spaniel et al., 2008; Depp et al., 2010; Granholm et al., 2013).

Recent reports reviewing the use of mobile technologies in research and treatment of individual with severe mental illness have highlighted the feasibility and potential benefits of such practice (Kimhy et al., 2012; Ben-Zeev et al., 2013). However, these reports have concentrated, for most part, on the application of such technologies to outpatient individuals living in the community. In contrast, few reports have focused on the feasibility and utility of incorporating mobile technologies into assessment and/or treatment of hospitalized individuals. In fact, to date only few studies using mobile devices were conducted in inpatient psychiatric settings (Kimhy et al., 2006, 2010; So et al., 2013). To address this gap in the literature, we assessed the feasibility of using mobile technologies among hospitalized individuals with schizophrenia. Next, we provide examples of potential clinical information that may be obtained using mobile technologies to inform clinical decisions and treatment at inpatient psychiatric settings. Finally, we discuss issues related to the potential use of mobile electronic devices by patients at inpatient psychiatric settings including selection of software/hardware, confidentiality issues, assessment schedule, questionnaire content, and patients' compliance.

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2. Experimental/materials and methods

2.1. Participants

Participants with schizophrenia and related disorders were recruited from patients hospitalized at the New York State Psychiatric Institute (NYSPI). Forty-one individuals were approached to participate in the study of which 33 (80.5%) enrolled in the study. Decline to participate did not appear to relate to clinical status. All participants provided written informed consent, and the study was approved by the NYSPI's Institutional Review Board. Table 1 presents data on the participants' demographic and clinical information.

2.2. Procedure

On the morning of the study, participants were provided with a mobile device (Palm Tungsten T3) to carry with them throughout the day. Next, participants received a brief introduction to basic operations of the mobile device and completed two full practice sets of questions. The introduction sessions typically lasted 20 min. The mobile device was programmed to beep at random times 10 times a day between 10:00 am and 10:00 pm to elicit information about current symptoms, mood, location, and social context. Upon hearing the beep, subjects were instructed to respond to a questionnaire presented on the screen of the mobile device (i.e., "I feel depressed"; "I hear voices that other people can't hear"). For each symptom and mood question, subjects were asked to indicate on the mobile device's screen the quality of their current experience on a graphical slider similar to a visual analog scale (from "not at all" to "very much"; see Fig. 1). Responses were represented in the output as a value between 1 ("not at all"; leftmost extreme) and 100 ("very much"; rightmost extreme). Additionally, subjects were asked about their current location on the unit and their social context. This procedure was used successfully in two previous reports documenting use of mobile assessment technologies among hospitalized patients with schizophrenia (Kimhy et al., 2006, 2010).

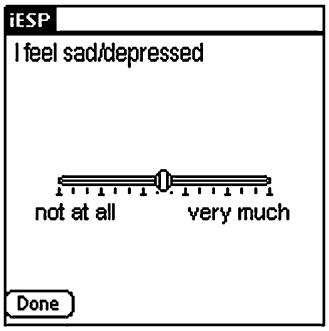

Fig. 1. Screen shot of question presented on the mobile device.

Table 1
Demographics and clinical information.

	N/Average	%/SD
Age (years)	27.8	6.3
Sex (female)	15	45%
Racial background		
Caucasian	17	52%
Black/African-American	6	18%
Asian	4	12%
More than one race	6	18%
Ethnic background (Hispanic/Latino)	10	43%
Diagnosis		
Schizophrenia	23	70%
Schizoaffective disorder	7	21%
Depression with psychotic symptoms	2	6%
Delusional disorder	1	3%
Primary language (English)	25	76%
Education (years)	13.8	2.7
Positive symptoms (SAPS Global Ratings)		
Hallucinations	3.12	1.97
Delusions	3.51	1.57
Bizarre behavior	.67	1.10
Positive formal thought disorder	1.29	1.40
Negative symptoms (SANS Global Ratings)		
Affective flattening	2.43	1.45
Alogia	1.20	1.46
Avolition-Apathy	2.41	1.65
Anhedonia-Asociality	2.61	1.62
Attention	1.89	1.31
Ease and convenience of using the mobile devices		
I had difficulties understanding the questions	1.24	.41
I had difficulties typing my responses	1.39	.92
I had difficulties operating the device	1.03	.35
The device was comfortable to carry	4.30	1.01
The beeps interfered with my activities	2.21	.90
Overall, this experience was pleasant	3.88	1.15
Overall, this experience was challenging	1.97	1.09
Overall, this experience was stressful	1.63	.55

$n = 33$; SAPS – Scale for the Assessment of Positive Symptoms; SANS – Scale for the Assessment of Negative Symptoms; Ease and Convenience – ratings on a 5-point Likert-scales (from 1 "not at all" to 5 "very much").

2.3. Data analyses

Data were first analyzed descriptively to check range and distribution of all variables. Next, patient self-reported rating of mood and symptom were analyzed by multilevel linear mixed effects model analyses controlling for correlation among repeated measurements at the day level and the subject level by including subject-specific random intercepts, and day-specific random intercepts. Association between mood and symptom outcomes and social context (being alone), unit location (different rooms in the unit) and time was examined by testing significance of these predictors included as fixed effects in the model. The mean of mood and symptom outcomes estimated from the linear mixed effects models and their standard errors were reported. All tests were two-sided and statistical significance was defined as $p < 0.05$.

3. Results

On average, the participants responded to 81% of the 20 questionnaires presented over the 2-day assessment period. Only one patient discontinued his participation due to a clinical exacerbation associated with use of the mobile device and no mobile devices were broken or damaged during the assessments. Similarly, patients' reports of comfort and ease of use of the mobile devices were similar to previous reports among hospitalized individuals with schizophrenia and comparable to rating among healthy controls (Kimhy et al., 2006; See Table 1).

3.1. Association between mood and social context

Social context, as indexed by the question "Am I alone?" (response options: Yes or No) was reported by participants as part of each questionnaire completed on the mobile device, allowing determination of potential differences in severity of mood related to social context. Patients reported being by themselves during 35% of their experience samples vs. 65% in the company of others. Depressed mood was significantly higher when alone than when in

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