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Enhancing early psychosis treatment using smartphone technology: A longitudinal feasibility and validity study

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ABSTRACT

Smartphone applications that promote symptom tracking and self-management may improve treatment of serious mental illness (SMI). Although feasibility has been established in chronic adult outpatient or inpatient SMI samples, no data exist regarding implementation of smartphone technology in adolescent and young adult populations as part of early psychosis (EP) outpatient care. We implemented a smartphone "app" plus clinician Dashboard as an add-on treatment tool in the University of California, Davis Early Psychosis Program. Participants completed daily and weekly surveys examining mood, symptoms, and treatment relevant factors via the app for up to 14 months. Clinicians discussed symptom ratings and surveys during regular treatment sessions using the Dashboard. We report methodological details of the study, feasibility metrics, and analyses of the validity of measuring symptoms via self-report using mobile health (mHealth) technology in comparison to gold-standard clinician-rated interviews based on a comprehensive longitudinal analysis of within-person data. Results demonstrate that integrating mHealth technology into EP care is feasible and self-report assessment of symptoms via smartphone provides symptom data comparable to that obtained via gold-standard clinician-rated assessments.

1. Introduction

Smartphone applications that promote symptom tracking, treatment engagement, and self-management have the potential to improve mental health outcomes and reduce cost of care (Luxton et al., 2011). This is especially important in the treatment of psychotic illness, as long-term clinical outcomes remain poor and financial costs are high (Bartels et al., 2003; Desai et al., 2013). A growing body of work is testing mobile technologies designed to enhance clinical care and self-management in psychotic and other serious mental illnesses (SMI) (Depp et al., 2016).

Research demonstrates utilization of smartphone applications and associated mobile technology in SMI is achievable. Individuals with psychosis are amenable to using a variety of technologies, even when symptomatic, and study completion rates and compliance are high (Ben-Zeev, 2012; Depp et al., 2016). Although the evidence supports feasibility (Ben-Zeev et al., 2014; Palmier-Claus et al., 2012), most studies evaluate adoption of technology independent of care providers, and have almost exclusively been conducted in chronic adult outpatient or inpatient samples (Alvarez-Jimenez et al., 2014). Given the emphasis on early intervention in psychosis (IEPA-Writing-Group, 2005), implementation in adolescent and young adult populations in the early stages of psychotic illness is critical. Similarly, successful implementation and long-term adoption of mobile technology likely requires integration into clinical care settings so that it is directly relevant and personalized to each individual's treatment plan (Palmier-Claus et al., 2013). This may be particularly important for relapse prevention, a major challenge in the treatment of early psychosis (EP), which represents the critical period for intervention within the first 2–5 years after illness onset (McGorry, 2015).

Although remission of psychotic symptoms following the initial psychotic episode is achievable (Masand et al., 2009), 50% of patients relapse within two years; 80% relapse within five (Eisner et al., 2013). Predictors of relapse amenable to treatment include symptom exacerbations (Birchwood et al., 2000), medication adherence (Masand et al., 2009), and social impairments (Corrigan and Phelan, 2004). Approximately two weeks prior to acute symptom exacerbation, patients often show an increase in "early signs," including visual/auditory

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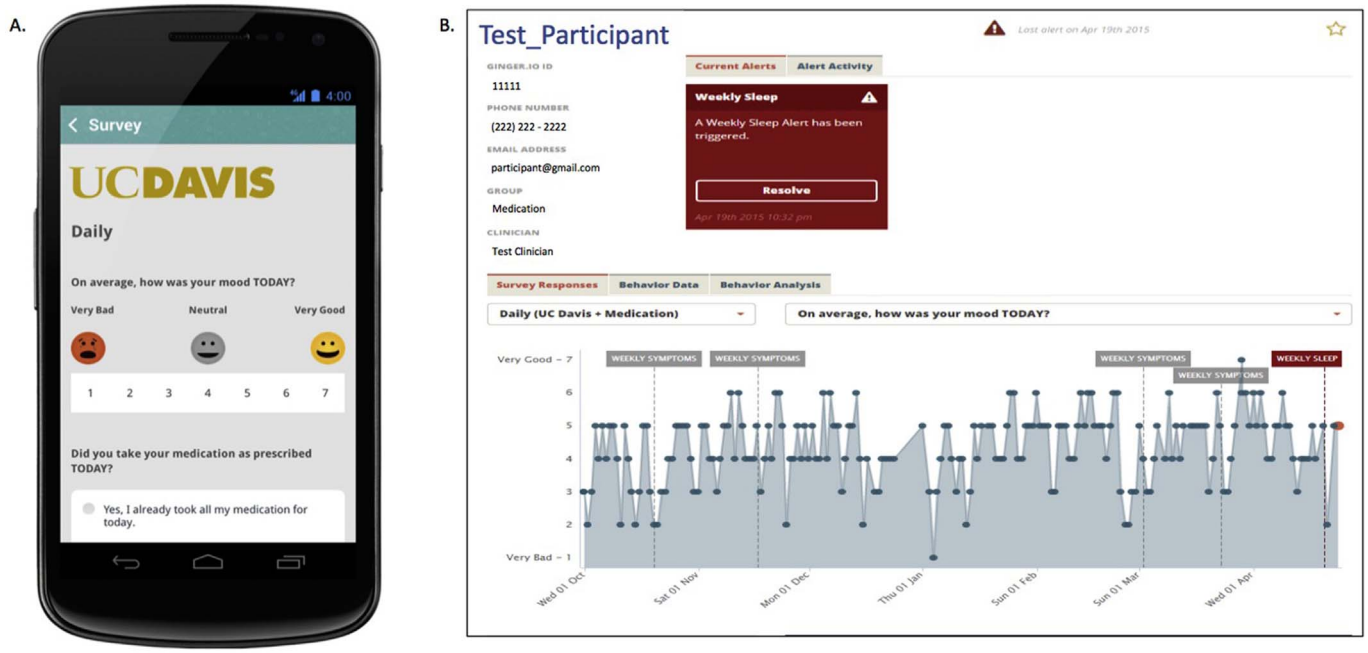

Fig. 1. A. Example App view. Participants responded to daily and weekly surveys in the app. Responses were summarized on the Dashboard and discussed with clinicians as part of regular clinic appointments. B. Example Dashboard view. Clinicians received "alerts" when responses were considered clinically significant. Alerts were resolved according to patient's need for care. Clinicians could plot symptoms over time (daily mood shown). Alerts are flagged on the plot.

perceptions, anxiety/dysphoria, insomnia, increased emotional reactivity, mild subjective cognitive problems, and difficulties tolerating normal stress (Birchwood et al., 1989; Eisner et al., 2013). Regular and close monitoring of these predictors could enable early intervention to minimize the impact of relapse, or prevent it altogether.

However, without the information necessary to identify individuals in need of such intervention, providers have limited ability to respond rapidly. In the typical outpatient clinic, weekly evaluations (at best; most clinics conduct monthly or bi-annual assessments) provide an incomplete snapshot of patient status and providers may miss early signs of relapse. Retrospective ratings may miss day-to-day fluctuations in mood and behavior (Ben-Zeev, 2012) and repeated questioning by providers may be perceived as challenging or stressful by patients, who may have difficulty recalling their previous experiences or prefer to report symptoms remotely (Palmier-Claus et al., 2013). Gathering relevant data daily via a smartphone application and making it available via a secure web-based platform could enable providers to identify patients most in need of intervention without the burden of increased appointments. However, before smartphone data can be used to predict relapse and prompt early intervention, the validity of assessing early signs of relapse via smartphone (as opposed to traditional face-to-face clinical assessment) must be established.

To test the potential utility of symptom assessment via mHealth technology, we implemented a smartphone application plus clinician Dashboard as an add-on treatment tool within the Coordinated Specialty Care (CSC) model of EP care (Heinssen et al., 2014), as executed in the University of California, Davis (UCD) Early Psychosis Program. This manuscript reports methodological details of the study and results pertaining to the first two study aims. For Aim 1, we sought to determine feasibility and acceptability of implementing a smartphone application as an add-on tool in EP care. Although feasibility has been established in individuals with chronic schizophrenia-spectrum diagnoses (Ben-Zeev et al., 2014, 2016a, 2016b; Palmier-Claus et al., 2012), first episode psychosis (Alvarez-Jimenez et al., 2013), and recent-onset schizophrenia (Schlosser et al., 2016), all these studies have been conducted independent of traditional outpatient care settings. To date, there are no data supporting feasibility as part of outpatient clinic care. For Aim 2, we sought to evaluate the validity of self-report symptom data collected via a smartphone application in EP. We have developed a self-report survey examining positive, negative, depressive/anxious, and cognitive symptoms based on our previous work implementing daily surveys in schizophrenia (Tully et al., 2014) that will be used to assess "early signs" of relapse in the current study.

We evaluated these aims using a longitudinal within-person design. Participants completed daily and weekly surveys examining mood, symptoms, medication adherence, and social behavior via a smartphone application for up to 14 months. Participants also completed monthly in–person psychosocial assessments using clinician-rated gold-standard measures. We hypothesized: 1) participants will show low dropout from smartphone-based assessment and high compliance with smartphone surveys; 2) self-report symptom data collected via smartphone will be highly correlated with gold-standard symptom measures.

2. Methods

2.1. Participants

To make results broadly applicable to individuals across the spectrum of psychosis, 76 EP individuals, comprising 64 individuals with Recent Onset Psychosis (ROP) and 12 Clinical High Risk (CHR) individuals receiving care at the UCD Early Psychosis Program, were included in the study. The UCD Early Psychosis Program comprises two clinics that provide services for both CHR and ROP individuals: EDAPT, a self-pay and/or insurance based clinic for individuals ages 12–40 regardless of county of residence, and SacEDAPT, a county contracted clinic supported by federal and state funds that provides care to Sacramento County residents ages 12–30 regardless of insurance status. Study inclusion criteria: age 13–30 years, English fluency, WASI (Wechsler, 1999) IQ above 70, no neurological disorders or current substance abuse/dependence per DSM-IV criteria. ROP participants are within three years of illness onset and have diagnoses of non-affective (i.e., schizophrenia, schizoaffective, schizophreniform, psychosis not otherwise specified) or affective psychosis (i.e., bipolar disorder with psychotic features; major depressive disorder with psychotic features) per the Structured Clinical Interview for DSM-IV Disorders (SCID) (First et al., 2002). CHR participants have no history of psychotic diagnoses