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Identifying preferences for mobile health applications for self-monitoring and self-management: Focus group findings from HIV-positive persons and young mothers

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ABSTRACT

Objective: Self-management of risk behaviors is a cornerstone of future population health interventions. Using mobile phones for routine self-monitoring and feedback is a cost-efficient strategy for self-management and ecological momentary interventions (EMI). However, mobile health applications need to be designed to be highly attractive and acceptable to a broad range of user groups. To inform the design of an adaptable mobile health application we aimed to identify the dimensions and range of user preferences for application features by different user groups.

Methods: Five focus group interviews were conducted: two ($n=9$; $n=20$) with people living with HIV (PLH) and three with young mothers ($n=6$; $n=8$; $n=10$). Thematic analyses were conducted on the focus group sessions' notes and transcripts.

Results: Both groups considered customization of reminders and prompts as necessary, and goal setting, motivational messaging, problem solving, and feedback as attractive. For PLH, automated and location-based reminders for medication adherence and sharing data with healthcare providers were both acceptable and attractive features. Privacy protection and invasiveness were the primary concerns, particularly around location tracking, illegal drug use, and sexual partner information. Concerns were ameliorated by use scenario or purpose, monetary incentives, and password protection. Privacy was not a major concern to mothers who considered passwords burdensome. Mothers' preferences focused on customization that supports mood, exercise and eating patterns, and especially using the mobile phone camera to photograph food to increase self-accountability.

Conclusions: Individualization emerged as the key feature and design principle to reduce user burden and increase attractiveness and acceptability. Mobile phone EMI uniquely enables individualization, context-aware and real-time feedback, and tailored intervention delivery.

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1. Introduction

1.1. Background

Healthcare costs are continuing to rise due to increasing burdens of chronic disease, which are the largest causes of death globally [1] and account for the majority of health care costs, for example, 78% of health care costs in the U.S. [2]. Changing daily routines for eating, exercising, stress, medical adherence, disease transmission risks, and alcohol, tobacco and other drug use can significantly improve health and reduce health care costs over time. Preventive behavioral interventions, based mostly on face-to-face counseling models, have had limited diffusion due to relatively high costs, logistical barriers, and high stigma associated with counseling [3]. Self-management or self-directed interventions are increasingly advocated to address these challenges [4]. Self-management interventions have been found to have positive impacts with a wide range of behaviors and user groups such as improved eating, physical activity, and stress management (i.e., relaxation, mood and coping) with people managing diabetes and heart disease risk [5–8] and increased stress-management behaviors and adherence to medication regimens, reduced substance use and transmission risk behaviors, and improved quality of life for people living with HIV [9,10]. Self-management and healthy lifestyle promotion for the prevention of disease require similar cognitive processes to transform intentions into behavior: capacity for self-evaluation; self-managed action with task- and time-specific, outcome-focused goal setting; and behavioral analysis to identify triggers (antecedents) and reinforcements for desired and undesired behaviors [11,12]. Thus, self-monitoring and feedback are the two most critical components of self-management [13,14].

Mobile phones offer the potential to broadly and cheaply diffuse more intensive self-monitoring, feedback, self-management and clinical support than has been possible previously. Mobile phones offer affordable, proximate, personalized, and continuous measurement in context. “Always on” and “always worn”, mobile phones can provide an intimate and detailed picture of an individual’s daily routines. This is especially true for smartphones, which support a diverse set of datastreams: automated traces of actigraphy, location, and other data that can infer physical activities, sleep, and environment; automated and manually entered physiological measures (e.g., readings from a glucose meter); and prompted and user-initiated self-reports of the user’s symptoms, behaviors, or environment in the moment. Time, location, actigraphy, and self-report data datastreams, appropriately managed, can be leveraged to trigger highly personalized interventions, and thus significantly improve an individual’s ability to understand and manage his or her own behaviors.

Three overlapping research methods have been used for daily or more frequent monitoring of behaviors and states of individuals acting in their natural contexts; the experience sampling method (ESM) [15], ambulatory assessment [16], and ecological momentary assessment (EMA) [17]. Triggering interventions using this data has recently been termed ecological momentary intervention (EMI), which provide real-time and context-aware interventions that occur with minimal disruption in individuals’ daily lives [18]. Mobile phone based EMI has the potential to both supplement existing clinical care (e.g., through mobile monitoring between clinic visits), and offer behavioral self-management support. For example, Burns et al. [19] recently piloted a mobile EMI for depression that used a machine learning process based on self-reported mood states and mobile-sensed context data (e.g., location) to predict future mood states. In turn, predicted mood states provided valuable feedback to mobile users and enabled context-related clinical responses.

1.2. Objectives

The potential impact of mobile EMI or self-management applications is dependent on their scalability and adaptability to be acceptable and attractive to diverse user groups and priorities. In order to ensure broad availability, adoption, and utilization, robust and tailorable platforms that can address diverse user groups are needed [20]. In this paper we report on findings from five focus group interviews with two diverse user groups: young mothers focused on diet, stress, and physical activity; and people living with HIV (PLH) focused on medication adherence, stress, emotional distress, substance use and sexual risk behaviors. These dissimilar populations serve to inform the development of platforms that can address a broad range of user needs by spanning a range of sensitive behaviors (sexual interactions and illegal drug use) to less stigmatized behaviors (diet, stress, exercise). The objective of this study is to identify the dimensions and ranges of issues that potential users anticipate may be important or salient to themselves or others in order to inform the development of robust, tailorable and adaptable mobile phone self-management EMI platforms and applications.

1.3. Literature review of feasibility studies

The evidence-base on feasibility and user preferences for mobile health applications is relatively limited and nascent. Researchers have conducted acceptability and feasibility studies for ecological momentary assessment (EMA) with personal digital assistants and mobile phones more recently, in which users are instructed and prompted to complete several assessments a day. Reviews of the EMA literature demonstrate that electronic EMA is acceptable and feasible for a variety of populations and health domains, even for marginalized populations and those with special needs, such as the elderly, individuals of low socioeconomic status, children, drug users, and individuals suffering from psychopathology [21].

Mobile phone-based EMA studies, on the other hand have only really begun in the past few years [21] and mobile-EMI is even more innovative [18]. Thus, there is relatively little literature published on user preferences for mobile EMI. Therefore, we use the literature derived from pen-and-paper and pocket computer-based EMA studies, as well as several recent mobile EMA studies, to identify key domains to consider when studying user preferences around mobile-EMI. Although different end user populations may have very different needs and preferences for mobile EMI support, we hypothesize that there are robust and essential features of