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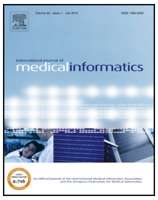

Predictors of willingness to use a smartphone for research in underserved persons living with HIV

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ABSTRACT

Objectives: The burden of HIV/AIDS is borne disproportionally by a growing number of racial and ethnic minorities and socioeconomically disadvantaged individuals. Developing mHealth interventions for the everyday self-management needs of persons living with HIV (PLWH) can be challenging given the current constraints of the U.S. healthcare system, especially for those from underserved communities. In order to develop effective, evidence-based mHealth self-management interventions, we need a better understanding of the factors associated with mHealth research. The purpose of this study was to assess factors associated with PLWH's for participation in research using smartphones.
Methods: We conducted a prospective cohort study (parent study) to examine the relationships among HIV self-management, age, gender and mental wellness. Relevant to this study, we analyzed the relationship between self-reported use of smartphones, willingness to use a smartphone for research, and other predictor variables including: HIV stigma, social isolation, social integration functions, and depression. We selected these variables because previous work indicated they may influence smartphone or mHealth use and because they also tend to be elevated in PLWH.
Results: We found increased age, HIV stigma and social isolation were negatively associated with smartphone use, which supports the use of smartphones for conducting research with PLWH but also suggests that age, stigma, social integration functions and social isolation need to be considered in research involving PLWH.
Conclusions: Findings here support smartphone use in research involving PLWH. However, future mHealth interventions targeting PLWH should take into account the inverse relationship between smartphone use and age, HIV stigma, and social isolation, and other predictor variables.

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1. Introduction

HIV imposes a significant burden on the health and quality of life of approximately 1.2 million Americans living with the disease [1]. The burden of HIV/AIDS is borne disproportionally by a growing number of racial and ethnic minorities and socioeconomically disadvantaged individuals [2]. Significant racial disparities exist in HIV incidence and care in the United States (U.S.) [3–6]. In 2011, 48.7% of new HIV diagnoses were among Blacks and 31.3% were among Latinos [7]. Blacks represent approximately 14% of the U.S. population, but accounted for an estimated 44% of new HIV infections in 2009. The HIV infection rate among Blacks is almost eight times as high as that of Whites (69.9 vs. 9.1 per 100,000) [8]. The HIV infection rate among Latinos was three times as high as that of Whites [9,10]. In addition, HIV disease progression and survival are worse among racial/ethnic minority patients [11]. These disparities underscore the importance of developing health interventions targeted for the needs of racial and ethnic minority groups.

HIV has changed from an acute illness to a chronic disease. The success of HIV medications and treatments has significantly changed the course of the disease [12]. While AIDS-related illnesses are no longer the primary threat, a new set of HIV-associated complications have emerged, resulting in a chronic disease that, for many, will span several decades of life. Current HIV treatment does not fully restore immune health and multi-morbidity (e.g., cardiovascular disease, bone disease and cancer) is associated with HIV disease [13–15]. In view of the change in the course of the disease, persons living with HIV (PLWH) are living longer but experiencing more symptoms associated with the disease and its treatment. More than a quarter of adults living with HIV are 55 years of age

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and older and the number is growing [16]. As the population of PLWH ages, there is a sharply increased risk of poorer everyday functioning and HIV-related disability, which supports the need to manage adverse symptoms in this population [17]. Yet targeting the everyday symptom-management needs of PLWH can be challenging because chronic disease management is difficult to support given the current constraints of our healthcare system (e.g., limited provide time, fragmented health information system), especially for those from underserved communities.

mHealth is the use of consumer-grade hardware – such as cellular phones, tablets, smartphones and other wireless devices – for the delivery of health services and information [18]. The ubiquitous nature of mobile technologies in daily life creates opportunities for health behavior management tools that were not previously possible [19]. mHealth can rapidly assess and modify health-related behavior and transform patients' decision-making about their health [18]. Smartphones can house mHealth applications (apps) designed to be used by patients and providers for diagnostics, behavioral prompts, reminders, and illness monitoring and self-management programs that extend beyond the traditional limits of a physical clinic. For example, a mobile behavioral sensing system was used by a small group of schizophrenia patients and found to be a feasible and acceptable approach for collection of behavioral data through the passive ascertainment of the patients' location, activity, and exposure to human speech as they went about their day [20]. Electronic patient monitoring devices have also been used to improve HIV antiretroviral therapy in a small group of PLWH who were sent SMS reminders to take their medications upon missing a scheduled dose [21].

The potential for information and communication technology, such as mobile apps, to enhance health behaviors through the provision of support (information, education, reminders, etc.) for behavior change has been well-documented over the last decade [22–29]. A growing body of research confirms the benefits of empowering PLWH consumers with information and decision-making support [30–36]. Patient participation in their health leads to increased satisfaction as well as positive behavior change patterns translating into improved clinical outcomes [37–39]. Individuals who use mobile apps to help manage their health may perceive these tools as more private, potentially increasing patients' willingness to disclose unhealthy behaviors and seek support tools [40,41]. This may be particularly important for diseases, such as HIV, that remain stigmatized and require substantial, complex, daily self-management.

mHealth also has the potential to bridge a divide in healthcare delivery among underserved racial and ethnic minority groups. The use of mobile technology has made a significant impact on communication, access, and information/resource provision to minority and underserved populations [42]. Nearly 2/3 of Americans are now smartphone owners, particularly those from racial/ethnic minority and low socioeconomic groups [43]. Of telecommunication technologies, mobile phones are one of the widest reaching, with 90% of Blacks, 92% of Latinos and 90% of Whites in the U.S. owning mobile phones as of 2014 [44]. In 2010, Blacks and Latinos, who are collectively of lower socioeconomic status in the U.S., use SMS at higher rates (79% and 83%, respectively) than Whites (72%), with adoption of mobile technology across all groups increasing over time [45]. Furthermore, emerging evidence suggests that underserved populations use smartphones as their primary method for accessing the Internet [46]. The use of mHealth can reduce economic disparities and personalize healthcare [47,48], which can be particularly relevant to PLWH because a majority of these persons are from underserved and minority groups [2,49,50].

Finally, mHealth can facilitate research participation by underserved PLWH through tailoring of information, messaging, and support; thus enhancing user control [51]. mHealth can also passively collect data on the PLWH's location, activity, and other important variables, minimizing subject burden and lost data. However, conducting research with PLWH can pose challenges including perceived HIV stigma, guilt or shame by being asked certain questions, or fear of criminalization [52–54]. mHealth, in particular the use of smartphones, can minimize these challenges through more anonymous data collection. However, little is known about smartphone use among minority PLWH and the factors associated with their willingness to use smartphones for research participation. Therefore, the purposes of this study were to: 1) describe current smartphone use in a predominately minority sample of PLWH and 2) to assess demographic and social factors associated with PLWH's willingness to use a smartphone for participation in a research study.

2. Methods

We conducted a prospective cohort study (parent study) to examine the relationships among HIV self-management, age, gender, and mental wellness [55–58]. In this cohort study, ($n = 102$), participants completed two data collection visits, one year apart. To ensure a representation of both women and older adults, subjects were purposively enrolled into four strata: men <50 years, men ≥ 50 years, women <50 years, and women ≥ 50 years. As part of the cohort study, participants completed a battery of measures including a self-report survey, 7-day actigraph and physical activity measures, heart rate variability testing, anthropomorphic measures (height, weight, waist-to-hip-ratio), vital signs, and serum measures [55,59]. The data presented in this analysis come from the second data collection time point of this study at which time 93 participants completed all study measures.

Relevant to this study, we analyzed the relationship between self-reported use of smartphones, willingness to use a smartphone for research, and other predictor variables including: HIV stigma, social isolation, social integration functions, and depression. We selected these variables because previous work indicated they may influence smartphone or mHealth use [60,61] and because they also tend to be elevated in this sample [56,58]. All procedures were approved by the University Hospitals, Case Medical Center Institutional Review Board.

2.1. Sampling and recruitment

Subjects were recruited from an HIV Research Registry housed in the Frances Payne Bolton School of Nursing at Case Western Reserve University in Cleveland, Ohio, at three Ryan White-funded HIV clinics (out of five in Cleveland) and two service organizations using IRB-approved letters to participants on the research registry and flyers directed at PLWH at the clinics and service organizations (posted by research study staff). We chose these sites for recruitment because they provide clinical and support services to the majority of HIV care and services to PLWH in Northeast Ohio. To be eligible for the study, interested parties needed to be adult (≥ 18 years of age), have a confirmed HIV diagnosis, currently prescribed HIV antiretroviral therapy, and English speaking. Due to study procedure restrictions, subjects were excluded if they had a diagnosis of insulin dependent diabetes or if they had a cardiac pacemaker. These exclusion criteria were applied because in the parent cohort study, subjects wore a holster monitor for which insulin dependent diabetes and cardiac pacemakers are contraindicated [55]. Our sample size and sampling methodology was determined based on the primary hypothesis of the parent study [56] that older adults would experience greater stress and isolation as compared with younger PLWH and that these outcomes would vary by gender. Accordingly, we initially recruited 102 PLWH in four equivalent

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