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A SYSTEMATIC REVIEW OF MOBILE HEALTH INTERVENTIONS FOR ANTIRETROVIRAL THERAPY ADHERENCE IN PUBLIC HEALTH

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ABSTRACT

Antiretroviral therapy is effective in stopping the development of HIV to AIDS, despite suboptimal adherence to HIV medication. Antiretroviral therapy (ART) helps patients live healthy lives and avoid transmission to others, despite the fact that there is no cure. Following intricate regimens is essential for both achieving desired results and preventing the spread of viruses that are resistant to drugs. The goal of the treatment is to reduce the viral load to an undetectable level. Nonetheless, adherence is a prevalent issue that arises from problems including mental health, hectic work schedules, and stressful home environments. Numerous research have been conducted on mobile health (mHealth), which is a novel strategy for enhancing drug adherence. People living with HIV (PLHIV) can now better adhere to antiretroviral therapy (ART) thanks to mobile health (mHealth) programs. mHealth methods remind patients of ART adherence or medical visits via SMS, phone calls, emails, or smartphone apps. One widely used mHealth tactic is SMS. To boost the efficacy of mHealth initiatives, systematic procedures to validate SMS customized to end-user preferences are needed.

Keywords: *antiretroviral therapy (ART), mobile health (mHealth), people living with HIV (PLHIV), public health.*

INTRODUCTION

The capacity of a patient to adhere to a treatment plan, take their prescriptions at the appropriate times and intervals, and observe dietary and pharmaceutical limitations is known as adherence. Several operational subunits of definition are included in adherence. For instance, dietary adherence is taking prescribed medications with, after, or before meals; adherence to dosage is taking the prescribed number of pills; and

adherence to scheduling is taking the specified number of pills consistently on time. Since abruptly quitting medication raises the risk of developing drug resistance, adherence becomes even more crucial with the introduction of new medications with extended half-lives [1]. The following elements have been thematically recognized as influencing adherence and retention: sociocultural factors, side effects, pre-ARV loss, switching to an alternative medicine system, and considerations pertaining to vulnerable groups. Triple ART is sometimes referred to as Highly Effective Antiretroviral Therapy or Potent Antiretroviral Therapy. Generally speaking, it is made up of two medication types that are divided based on how they work: nucleoside/nucleotide reverse transcriptase inhibitors (NRTI), protease inhibitors (PI), fusion inhibitors, integrase inhibitors, and non-nucleoside reverse transcriptase inhibitors (NNRTIs). The dynamic, multi-determined process of ART adherence is the responsibility of the patient and has characteristics that are typical for each age group and the medical team. The relationship of trust and connection between the service consumer and the health staff permeates this complicated topic [21]. Since effective antiretroviral medication (ART) has become widely available, the perception of HIV as a deadly infectious disease has evolved to one that is chronic and manageable. ART has shown a reduction in HIV transmission to non-infected individuals, as well as a reduction in HIV-related morbidity and mortality and an increase in life expectancy for those afflicted. Inhibiting viral replication and reducing the HIV viral load to the point that blood viral particles are undetectable are two benefits of antiretroviral therapy (ART). Nevertheless, viral replication occurs in lymphatic reservoirs even when the viral particles in PLHIV blood are not detectable [2].

Higher levels of ART adherence are therefore essential to sustaining long-term viral suppression. Suboptimal adherence to the ART regimen can lead to a number of negative outcomes, including inadequate inhibition of viral replication, the establishment of drug-resistant virus strains, immunological failure, the advancement of AIDS, increased hospitalization, and an increase in HIV-related morbidity and mortality [9]. These factors ultimately result in the failure of first-line ART medications [12]. Because second-line ART medications are more expensive, the HIV burden will increase, especially in nations with limited resources. Because fewer treatment choices will be available if drug-resistant germs are transferred to newly sick people, decreased adherence to ART also affects public health [16]. PLHIV must stick to the treatment plan, take ART at the recommended dosages and times, and follow dietary and medication guidelines. Maintaining adherence to ART is a complicated and ever-changing procedure [10]. PLHIV must also embrace a self-management approach in order to meet the therapeutic objectives [11]. This entails maintaining regular contact with their doctor, taking their prescription drugs on time, and using monitoring services like viral load and CD4 testing [18]. PLHIV may have enjoyed longer lives with higher life expectancies, but their lives may not have been as fulfilling. PLHIV had to deal with a number of health issues associated to the disease, including managing medicine and its negative effects, while also adhering to the ART routine throughout their lives [3]. Therefore, assessing PLHIV's Quality of Life (QOL) is crucial to establishing their general state of wellbeing [17].

" The WHO defines retention in care as "participation in a comprehensive package of prevention, support, and care services regardless of the specific clinic site" [13]. Therefore, being in care gives PLHIV the chance to continue receiving antiretroviral medications, to evaluate and manage any potential ART side effects, and to identify treatment failure early and take appropriate action. In order to assist them manage their chronic disease on their own, appropriate psychosocial support and guidance for secondary prevention should be given in addition to care [15,19]. Adherence to ART and retention in care may enhance the quality of life for PLHIV and prevent the spread of HIV infection [14]. However, improved immunological and clinical results are anticipated with increased levels of ART adherence. Immune suppression, the rise of drug-resistant virus strains, regimen failure, a reduction in available treatment alternatives, and higher treatment expenses are all consequences of suboptimal ART adherence. The secret to improving PLHIV clinical outcomes is retention in care [20].

Objectives

- To determine the level of ART adherence and the variables affecting PLHIV's adherence to ART;
- To assess the effectiveness of mobile health initiatives for antiretroviral treatment.

Research question

- How well can mobile health (mHealth) interventions work in public health settings to increase adherence to antiretroviral medication (ART) among individuals with HIV?

Literature review

Stigmatization and discrimination associated to HIV continue to affect all aspects of society. People with HIV are more stigmatized than those with any other chronic illness because HIV is an infectious disease that is connected to sexual activity and other high-risk behaviors. Additionally, there is currently no recognized therapy for HIV. PLHIV encounter a wide range of psychological disorders, including despair, anxiety, fear, rage, and feelings of loneliness, in addition to physical health issues. HIV-related stigma prevents people with HIV from accessing health care, which lowers their quality of life, causes poor adherence to ART, and ultimately raises morbidity and mortality. Despite the fact that HIV/AIDS is a major public health concern and that national and international health organizations provide information about HIV prevention to everyone, the number of new HIV cases worldwide continues to rise. [4] Additionally, some PLHIV continue to engage in high-risk behaviors, which is detrimental to continuing HIV/AIDS prevention initiatives. To lower the danger of super-infection and limit HIV transmission, it is crucial to have knowledge about HIV and how it spreads. Studies have shown that PLHIV who are adequately informed about HIV are more likely to adhere to antiretroviral treatment. The most common way for HIV to spread in India is through heterosexual relationships, usually from someone who is unaware of their HIV status. People who are aware of their sero-status are more likely to use preventive measures, such as condoms, to reduce the chance of transmission. It has been demonstrated that raising awareness and encouraging PLHIV to start ART early will lessen the HIV burden. These are crucial elements of all-encompassing HIV prevention plans. Understanding the signs and symptoms of HIV disease and the available treatments helps patients stay better informed about the illness and the difficulties they face taking HIV medication, which is crucial for increasing adherence to ART in HIV treatment care. Numerous studies' findings have revealed that PLHIV who receive HIV education and become more knowledgeable about the disease have improved quality of life, adherence to ART, and treatment outcomes.

HIV is a retrovirus that specifically targets the immune system's CD4 T-cells, compromising immunological function and lowering an infected person's immunity while increasing their vulnerability to opportunistic infections. The first step is HIV infection, which can take 10 to 15 years to progress to AIDS and, if left untreated, can be fatal. Since its introduction in 1996, ART has proven to be successful in treating HIV and improving the lives of those infected with the virus. Although ART strengthens the immune system and lowers the risk of opportunistic infection, it cannot reverse HIV infection, thus people living with HIV must continue taking ART for the rest of their lives. ART has demonstrated its effectiveness in preventing viral replication and reducing viral particles to the point where there are no detectable viral particles in PLHIV blood. With the help of ART, a disease that was once extremely deadly has become chronic and treatable, requiring lifelong care [5]. However, as there is no cure for HIV and no vaccine to prevent it, people living with HIV must take antiretroviral therapy (ART) for the remainder of their lives. Therefore, HIV treatment and management are similar to those of other chronic diseases, with a focus on drug adherence, care retention, and co-morbidity management. As ART has been more widely available, PLHIV adherence to treatment plans and retention in care have become increasingly important for ART success. Effective ART mostly depends on knowing when to begin treatment, receiving ongoing care and assistance, and

unquestionably maintaining high treatment adherence. The World Health Organization (WHO) defines medication adherence as "the extent to which a person's behavior in taking medication, following a diet, and/or making lifestyle changes aligns with established recommendations from a health care provider". Although perfect adherence (100%) to ART is advised, maintaining optimal adherence (>95%) for a lifetime is nearly impossible. Contrary to previous findings that claimed adherence to ART was necessary to achieve viral suppression ≥ 95%, effective ART regimens have shown that adherence levels as low as 75% can still suppress viral reproduction [6].

Methodology

Study design: Study was conducted in two phases

The purpose of the cross-sectional study in phase I is to ascertain the level of ART adherence, quality of life, HIV stigma, and HIV-related knowledge among PLHIV. Qualitative research: To gather further data from PLHIV, focus groups were held.

Randomized Controlled Trial (RCT) Phase II: An open-label, block randomized study was conducted to ascertain the effect of an HIV-educational intervention module on the level of ART adherence among PLHIV. We searched Cochrane, Medline, CINAHL, EMBASE, and Global Health for randomized control trials (RCTs) of mobile phone-delivered interventions aimed at enhancing adherence to antiretroviral medication.

Study subjects: PLHIV receiving HIV therapy.

Inclusion criteria: All PLHIV who were taking ART and who were at least 18 years old, as well as those who gave their agreement to participate in the study.

Exclusion criteria: PLHIV under the age of 18.

Data collection: As a requirement for the study, the participants were contacted and informed in their native tongue of the study's goals. Following this, their written informed permission was obtained.

Intervention group: For six months, PLHIV who are randomly assigned to the intervention group get both HIV education and the standard care offered by the ART clinic. The results of a cross-sectional study, focus group discussions, and input from a positive prevention program were used to construct HIV education interventional modules. Interventional modules for HIV education were put into practice and contextualized in the local language to fit the local context. Before the modules were used in the research settings, their content validity was examined [7]. Health care professionals and counselors would find these HIV educational modules useful in imparting HIV-related knowledge to PLHIV during their regular encounters.

Table 1- Socio-demographic characteristics of study participants (n=409)

Variables	n (%)
Gender	
Male	256 (62.6)
Female	153 (37.4)
Age group (years)	
18 - 30	024 (05.9)
31 - 50	312 (76.3)
>50	073 (17.8)
Marital status	
Married	265 (64.8)
Unmarried	054 (13.2)
Widowed	090 (22.0)
Socio-economic status*	

Upper middle	042 (10.3)
Middle/Lower middle	203 (49.6)
Lower/Upper lower	159 (38.9)
Lower	005 (01.2)
Duration of ART (months)	
<12	092 (22.5)
>13	317 (77.5)
Distance travelled (Kilo meters)	
<25	077 (18.8)
>25	332 (81.2)
Motivation to take ART	
Self-motivated	316 (77.3)
Compulsion	093 (22.7)
Opportunistic infections	
Present	028 (06.8)
Absent	381 (93.2)
CD_4 (cells/mm^3)	
<200	028 (06.8)
200-600	244 (59.7)
>600	137 (33.5)
Co-habitation status	
Living alone	016 (03.9)
Companion	393 (96.1)
Mode of transmission	
Sexual	394 (96.3)
Blood	002 (0.5)
Other	013 (3.2)

Experimental analysis

Factors affecting adherence to ART

ART adherence is a dynamic habit impacted by a number of interconnected factors. Understanding the significance of ART adherence, determining the causes of non-adherence is crucial for PLHIV therapeutic effectiveness and retention in care. Research carried out in environments with low resources has identified key factors that promote adherence to ART, such as positive treatment outcomes, lifelong initiatives, and social support.

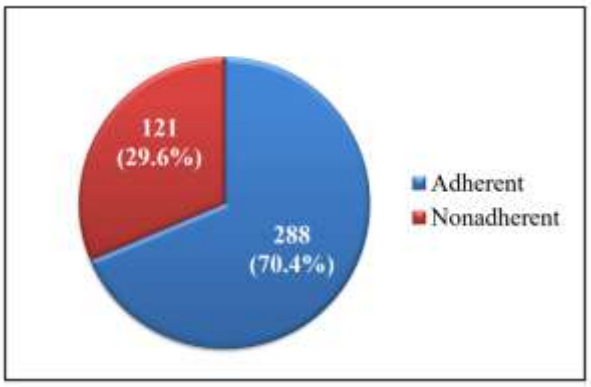

Figure 1: Adherence to ART among PLHIV (n=409

ART adherence is hampered by a number of factors, including stigma and prejudice, transportation costs, drug costs, and access to medical facilities.

Table 22- Change in HIV-related Knowledge scores among intervention and control groups

	HIV-related Knowledge				
Study groups	**At baseline**	**After 6 months**	**p-value***	**After 12 months**	**p-value***
Intervention	6.5 (1.9)	9.6 (2.0)	**<0.001**	11.5 (1.6)	**<0.001**
Control	6.1 (2.3)	6.9 (2.3)	0.054	9.6 (2.2)	**<0.001**

The main categories of factors influencing ART adherence include those connected to patients, medications, and the healthcare system [8].

Table 23- Change scores for HIV-related knowledge between the groups

HIV-related Knowledge	**Intervention**	**Control**	**p-value***
0 – 6 months	4 (1.5 − 5)	0 (-1 − 3)	**<0.001**
6 – 12 months	5 (3 − 7)	3 (1 − 5)	**0.003**
0 – 12 months	2 (1 − 4)	2 (1 − 5)	0.245

(i)Patient-related factors: These are the most frequently linked elements that influence a patient's adherence to antiretroviral therapy. These include socio-educational status, opportunistic infections, depression and other health conditions, age, gender, drug and alcohol use, and declaration of HIV status.
(ii)Factors related to medication: Treatment regimen characteristics can have a significant impact on adherence to ART. Pill burden, side effects, frequency, dose scheduling, daily medication administration, dietary restrictions, and drug interactions are some of the medication-related problems that make it difficult for people living with HIV to take their medications as directed.
(iii)Factors pertaining to the health care system, such as the interaction between patients and providers, the availability of ART, treatment accessibility, qualified medical professionals, facilities for diagnosis, counseling, and adherence monitoring, ART costs, etc.
(iv)Environmental or societal elements including financial difficulties, prejudice and stigma, social support, etc.

Conclusion

The cultural and geographic context of PLHIV has a significant impact on the level of adherence to ART and the factors that influence adherence to ART. In HIV health care, it is critical that PLHIV have sufficient understanding about HIV and how it spreads, the advantages of an ART regimen, the significance of adhering to ART, and the repercussions of not doing so. Outside of India, a range of intervention techniques were used to improve ART adherence. The findings of research done outside of India might not apply or be applied to the Indian context. Despite India's high HIV prevalence, little research has been done on intervention techniques to improve ART adherence through HIV education. The likelihood of non-adherence to ART is higher in developing nations like India because of a lack of knowledge about its use. As a result, patient education through HIV educational interventions is necessary to address ART adherence issues. ART adherence has increased dramatically as a result of educational interventions. Following intervention, there was a decrease in stigma associated with HIV and an increase in quality of life (QOL) domain scores across all QOL dimensions. PLHIV in the intervention group now know more about HIV thanks to the educational intervention. Instead, then implementing mobile phone-based therapies generally, specific initiatives that have been shown to be effective should be examined. Existing therapies may not be

as effective as those that target a broader variety of adherence difficulties. The impact and cost-effectiveness of such therapy should be evaluated in a randomized controlled trial in addition to long-term objective and clinically significant results.

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