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"Exploring Telehealth Feasibility for HIV Status in Individuals Aged 17 to 34 in Southwestern Nigeria"

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This is to certify that the doctoral dissertation by

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Abstract

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MPH, Walden University, 2015

BS, University of Baltimore, 2002

Dissertation Submitted in Partial Fulfillment of

the Requirements for the Degree of

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Abstract

The use of smart phones among young people in Southwestern Nigeria has grown since the early 1990's while traditional healthcare access had continued to deteriorate. HIV care centers have been concentrated in large cities, but earlier studies had shown higher prevalence of HIV in rural areas that constituted a larger portion of the population. However, existing studies had not adequately explored the use of mobile phones to supplement traditional healthcare access. The purpose of this study was to assess the feasibility of telehealth for healthcare access among individuals aged 17-34 with positive HIV status and those at high risk for the disease in Southwestern Nigeria. Using the health belief model (HBM) as theoretical foundation, a sample (n = 2,228) was selected from data collected from six Nigerian southwestern states. Out of 2,228, 910 (40.8%) were HIV positive while 1,318 (59.2%) were HIV-negative but at high risk. 1,459 (65.5%) used mobile phones for their HIV status while 769 (34.5%) did not. A chi-square test of association showed that there was a statistically significant association between mobile phone use and HIV status, with $X^2(1) = 5.173$, $p = .023$. Spearman's correlation analysis between mobile phone use and weekly HIV counseling sessions which depicted the efforts made to understand, prevent, or manage disease was significant ($p < .0005$). Findings from this study might present a stronger case for the use of mobile phones to supplement reliance on face-to-face counseling and other treatment in HIV prevalence in Southwestern Nigeria. The implication for social change can be a wider healthcare coverage for people living with HIV and those at risk for it if telehealth can be applied to complement existing traditional healthcare coverage which had been grossly inadequate. Such positive social changes would reduce HIV prevalence.

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Dedication

This dissertation is dedicated to my dear beautiful wife, Temitayo Bosede Olaniyi and my three adorable children, Folashade, Folashewa, and Michael Jr.

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My sincere appreciation goes to everyone who contributed in one way or the other to the successful completion of my doctoral dissertation. My first appreciation without any hesitation goes to my dissertation chair Dr. Frazier B. Beatty, who took up the task of mentoring me like a champion worthy of emulation. His guidance and total support which had been characterized by distinguished promptness ensured the timely completion of this study. Dr. Beatty made it a mission in providing outstanding support when needed, most often, outside his office hours. I am really grateful. I also want to express my sincere appreciation to Dr. Patrick Williams, the second committee member who made sure that a high quality dissertation emerged through hard work and critical scrutiny. I also thank the University Research Reviewer, Dr. Attila Hertelendy who provided timely and excellent edits to ensure Walden University's highest scholarly standards. Next, my particular appreciation goes to my wife, Temitayo Olaniyi who endured years of understanding and time consumed by this doctoral study, I really appreciate your support. Finally, my gratitude goes to my lovely children Folashade, Folashewa, and Michael Jr., who believed that this time shall come to pass and they will have my fullest attention again.

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Chapter 1: Introduction to the Study

Introduction

In 2013, as many as 3.5 million people were living with Human Immunodeficiency Virus (HIV) in Nigeria, and this makes Nigeria second only to South Africa in global HIV/AIDS prevalence (National Agency for Control of AIDS [NACA], 2015; National Health ICT, 2015; UNAIDS, 2015). In addition, 3.2 million individuals 15 years and older have the burden of the disease, of which 1.9 million are women (UNAIDS, 2015). According to United Nations (UN) data on Nigeria, deaths due to HIV/AIDS were 180,000, resulting in 1.8 million orphans, and further complicating the economic downturn of Nigeria in recent years (UNAIDS, 2015). Specifically, Oyo state had the highest incidence rate among the six states that constitute the southwestern region at 5.6% in 2013, while the prevalence was 47,393, a slight drop but still significant from the year before (NACA, 2015). Relatively, the HIV disease burden in Oyo State was 3 out of 100 individuals between the age of 15 and 49 years (Olashore, 2014).

Like other infectious and chronic diseases in sub-Saharan Africa (SSA), HIV prevention had remained problematic, subsequently accounting for 70% of the world's HIV/AIDS burden (Kharsany & Karim, 2016). This lopsided prevalence was largely due to healthcare access deficits for different population groups in SSA, particularly those located in rural areas. Specifically, Strasser, Kam, and Regalado (2016) found that deficits in healthcare access were most pronounced for chronic diseases such as HIV in rural areas of developing countries, especially in SSA more than anywhere else. Remarkable progress in HIV reduction is necessary through improved healthcare access via alternative methods. Such alternative healthcare access could be in the form of

telehealth applications adaptable to preventive care and disease management. Telehealth had been defined as the means through which medical care, public health, and health education are remotely delivered via the use of electronic technologies (Center for Connected Health Policy [CCHP], 2017). Precisely, telehealth typically uses information and communication technology (ICT) to support healthcare and other health services (Ajala, Adetunji, & Akande, 2015). This study sought to explore the feasibility of telehealth services as a vehicle for healthcare access for the purpose of understanding its benefits with the potential to create formidable social change as a result of vast reduction in HIV infections, as well as improved HIV disease management among affected individuals in this age group.

In this chapter, I will supply the background to the study, reveal the problem statement, and state the purpose of the study. The research questions together with their corresponding hypotheses are stated in alignment with the research topic and focus of the study. The health belief model (HBM) was the theoretical framework that was appropriate for this study because of its numerous constructs that were relevant to HIV prevention and management as well as telehealth operations based on existing research. The nature of the study was quantitative, and I stated the assumptions, limitations, and delimitations associated with my selected method. Finally, I identified the study's potential for positive social change.

Background

Distance to HIV care centers had for a long time been a major obstacle to healthcare access in AIDS prevention and management in Nigeria (AVERT, 2018). In

2013, for example, while Nigerian national HIV prevalence was 15.5% (or 3.5 million), rural/urban HIV prevalence in the southwestern part of the country was 2.6% and 2.4%, respectively (Awofala & Ogundele, 2016). This slight difference (0.2%) indicated that the prevalence was as critical in urban as it was in rural areas. However, by a wide margin, HIV clinics were widely concentrated in the urban areas despite higher population density (70%) in rural areas (Strasser, Kam, & Rigalado, 2016). Nationally, Nigerian rural HIV prevalence was higher at 4% compared to urban prevalence at 3% (AVERT, 2018). Prevalence of HIV in Southwestern Nigeria had also been identified with stigma and low HIV knowledge (Crowell et al., 2017). Cromwell et al. (2017) indicated that due to the stigma associated with HIV among men who sell sex (MSS) and men who have sex with men (MSM), there were persistent increases in unsafe sexual practices, in addition to vast reductions in willingness to attend HIV care centers. Out of 1552 men, 735 or 47.4% were MSS and 817 or 52.6% responded as MSM. In all, 53.4% were HIV positive, and stigma was identified as the major reason for avoiding HIV clinics altogether (Crowell et al., 2017).

Problem Statement

Existing research had consistently linked problems with HIV prevalence to healthcare access deficits in Southwestern Nigeria. Notable among the factors responsible for difficulty accessing healthcare was the inability of HIV patients to reach care centers due to distance from healthcare providers (Lankowski, Siedner, Bangsberg, & Tsai, 2014). The World Health Organization (WHO) repeatedly cited Nigeria for failing to live up to the standards of primary care previously established under colonial rule. This was because primary health centers had systematically degenerated and lost their functions to

urban cities where care centers were now commonly found (WHO, 2008). Proximity to care centers continued to be a challenge, and this situation had increased prevalence of HIV in rural settings in Southwestern Nigeria by 4% compared to urban centers (AVERT, 2017). Telehealth had been defined as an alternative health care delivery system using information technology (CCHP, 2017). In Southwestern Nigeria, the feasibility of modern telephone and other associated electronic communication tools which constituted primary telehealth operations (mHealth) had not been fully explored to address unacceptable HIV prevalence in the study population (AVERT, 2017). Precisely, these mHealth tools such mobile phones, tablets and personal digital assistants (PDAs) had also been vastly underused to reduce the problems created by lack of transportation and other barriers to healthcare access in terms of proximity to care centers (Powell et al., 2017). With direct relevance to public health practice and modest promotion from policy makers, mobile phone users stood a good chance of using their phones and other telehealth tools as means of accessing healthcare, especially when transportation to care centers in urban cities had become an issue that stood between healthcare and being susceptible to illness (Banerjee & Narasu, 2015; Ventola, 2014). Unfortunately, existing public health studies had not explored how feasible telehealth could be for addressing HIV infections as well as managing the disease among the study population.

Quantitative studies had been able to identify defects in behavior modification in many individuals at high risk for or living with HIV when applying traditional healthcare delivery. However, these defects could be reduced more quickly by a more convenient and quicker form of healthcare delivery via technology during interactions between

individuals and their healthcare providers using mobile technology (Syed et al., 2013). Through the use of telehealth, counselors could improve compliance with preventive measures and culture of health management, such as medication compliance, following up on preventive counseling, monitoring needle sharing, and encouraging condom use, all of which could be electronically contained with practical confidentiality (Saberi, Yuan, John, Sheon, & Johnson, 2013). Readmissions after discharge from healthcare facilities had been tied to noncompliance with medications and other discharge/follow-up instructions (Costantino, Frey, Hall, & Painter, 2013). Telehealth makes follow-up consultations more realistic and practicable than actual follow-up home visits, thus creating potential for improved compliance. The implications for public health here were improvements in patient outcomes and reduction in rebounds in hospital admissions. This is because telehealth has the capacity to asynchronously set the implementation of telephone follow-up meant to ensure post-discharge compliance with drugs and selfmanagement. Having highlighted these potential qualities of telehealth use in healthcare delivery, further studies to actually explore its relationship with HIV status at both prevention and management levels were needed to advance public health practice and create positive social change. Up until now, no known study had adequately explored this.

Purpose of the Study

The purpose of the study was to assess the feasibility of telehealth (the mHealth version) for HIV status among individuals aged 17-34 years in Southwestern Nigeria by assessing the association between telehealth and HIV status in this population. As a result of distance from home to HIV care centers, use of telehealth for HIV treatment and

management might be useful in complimenting traditional HIV care, which had been inadequate in Southwestern Nigeria.

Significance

An improved understanding of telehealth use and its relationship with HIV status among HIV patients deserved further study. Telehealth as a valuable application for rural healthcare delivery has the potential to increase motivation for compliance remotely (Hommel et al., 2013). This initiative provides potential encouragement for further public health research into the use of telehealth for healthcare access. Significant roadblocks such as sigma, persecution, and discrimination could be overcome by using electronic devices as basic as cellphone text messaging to communicate with healthcare providers in HIV treatment and counseling centers with the potential to reduce effects of stigma (Suthar et al., 2013). This study was critical to easing the predicament imposed by low socioeconomic status which could underlie the inability of HIV patients to reach providers for needed status monitoring of individuals at risk for HIV infections and disease management because telehealth had been found to be cheaper, especially for remote monitoring instead of typically expensive traditional visits to providers (American Hospital Association, 2016). This monitoring included very important laboratory tests, signs, and symptoms required to continuously monitor and remotely diagnose this disease without the need for expensive travel. The significance of this study was that its findings could be used to address other populations under different rationales, with the overall determination to reduce incidence rates of HIV infection and by extension HIV prevalence in Nigeria. In addition, reducing or eliminating deficits in healthcare access using telehealth in public health practice enhances technological knowledge which could

be capable of spreading to other health promotion programs that could use telehealth to promote participation and compliance. This would be beneficial to public health practice and resultantly lead to significant positive social change. This was particularly important for disease prevention, not just treatment.

Nature of the Study

The quantitative approach was the most appropriate method for this study. Questionnaire items from the code book used for data collection that structured secondary data were typically products of surveys that were numerically coded to describe trends, attitudes, and opinions of a population sample (Creswell, 2009). Therefore, quantitative data obtained from surveys during data collection could be used to measure and assess the feasibility of telehealth for HIV status among individuals at risk for or living with HIV among the study population. Examples of possible uses of telehealth include teleconsulting, video conferencing, and text messaging as a form of healthcare access (Kazanek et al., 2013). In particular, the mHealth version of telehealth (mobile phones, PDAs, and tablets) was most appropriate for the population and ease of data collection. The socioeconomic factors that were considered as possible confounding covariates included age, income, marital status, education level, and residential location, especially in terms of rural and urban areas.

The major predictor variables for this study included demographics that defined alternative health access (telehealth), HIV knowledge, and gender while the outcome of interest was HIV status. Other contributing factors to be explored were age, religion, residential location (rural versus urban), level of education, and income level. Using a quantitative approach, and provided the data fitted into assumptions of logistic regression,

and chi-square tests of association, these statistical tests would be wellpositioned to inferentially analyze this study. For these statistical tests, SPSS version 25 was used for the data analysis. The overall analysis included both descriptive and inferential statistics using the variables of interest including all the covariates selected in the data sets. Data manipulation was very likely to extract variables as needed from data sets coming from various states in Southwestern Nigeria.

The main independent variable (telehealth use) was measured at a nominal level dichotomously (yes/no) to assess the use or nonuse of telehealth as shown in the first research question. The components of telehealth needed to be addressed in the context of its usefulness, social influence, security, acceptance of technology, and enabling conditions (Cimperman, Brencic, Trkman, & Stanonik, 2013), and HBM was the theoretical foundation of this study.

The independent variable telehealth could also be assessed on the basis of technology use (mobile phones, tablets, PDAs, etc.) when patients are regularly asked about their perceptions of telehealth generally and also how they felt it had reduced the healthcare access gap created by lack of traditional healthcare services in their immediate environment. Among respondents, gender as a group variable might require stratification to effectively assess the roles of males and females. Gender could be coded as a dichotomous variable with only two possible responses (male/female). Each additional contributing factor of interest was described as it related to the outcome variable of interest. Comparisons were drawn between two major contributory factors, telehealth and HIV knowledge, to assess the contribution of each to HIV status. Other variables that

might help to understand the dependent variable HIV status revolved around socioeconomic status and would be controlled for as possible confounders.

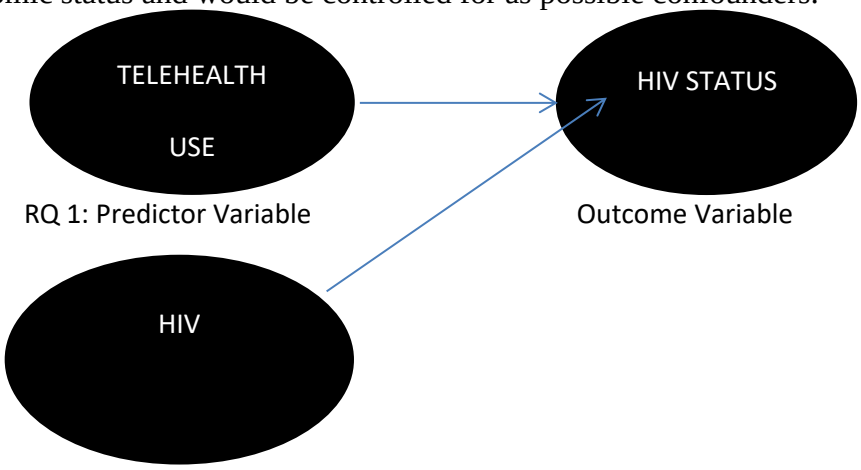


Figure 1. Independent and dependent variables

Research Questions and Hypotheses

The following were research questions for the study:

RQ1: How feasible is telehealth use (measured dichotomously as nominal variable [yes/no] as in frequency of use in the form of text messaging, video conferencing, and teleconsulting) for HIV status (prevention or management) among individuals aged 17–34 in Southwestern Nigeria?

RQ2: Is level of HIV knowledge (knowledge of risks, screening, containment strategies, intention or willingness to use telehealth, and benefits of antiretroviral therapy) associated with positive or negative HIV status among individuals aged 17–34 in Southwestern Nigeria?

RQ3: Is there an association between gender (being a female or male as related to marital status, income, and education) and positive or negative HIV status?

Research Hypotheses

The following were the hypotheses for the study:

$H_0$1: Telehealth use is not feasible in terms of HIV status among individuals aged 17–34 in Southwestern Nigeria.

H_a1: Telehealth use is feasible in terms of HIV status among individuals aged 17–34 in Southwestern Nigeria.

$H_0$2: There is no significant difference in HIV status among individuals aged 17-34 in Southwestern Nigeria based on HIV knowledge.

H_a2: There is significant difference in HIV status among individuals aged 17-34 in Southwestern Nigeria based on HIV knowledge.

$H_0$3: There is no association between gender and HIV status among individuals aged 17–34 in Southwestern Nigeria.

H_a3: There is association between gender and HIV status among individuals aged 17–34 in Southwestern Nigeria.

Theoretical Framework

The HBM, which remained one of the most used theories in predicting human behavior, was selected for this study. It was appropriate to adopt the HBM for this study in order to help predict the behavior of people at risk for, or already infected with HIV who could use the constructs of the HBM to perceive the health benefits of telehealth use in promoting healthy living.

HBM has five constructs listed as perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action, which were based on the assumption that an individual would take necessary actions to improve health

status, such as preventing HIV infection or managing existing conditions (Hochbaum, 1958). This was consistent with intentions to use preventive mechanisms such as condoms as barriers against heterosexual or homosexual activity-based infections and adopting telehealth to seek expert counseling, especially if such counseling was not available in the immediate environment. Because of an individual's perception of susceptibility to HIV infection, the teleconsulting aspect of telehealth could be a way to begin seeking health care remotely through the use of mHealth version of telehealth. In addition to susceptibility to the virus, persons living with, or at risk for HIV have the perception of severity of HIV as a chronic and incurable disease. An obstacle in the way of seeking health access could be in terms of costs, stigma, cultural and religious obstacles but the individual must devise ways to overcome these barriers by taking cue to action, especially when a benefit such as telehealth had been presented. Finally, selfefficacy encourages the individual to develop confidence that pre-infection, pretest, and post-test counseling could lead to improved health or avoidance of diseases such as HIV.

The constructs of HBM would be addressed in broader forms in Chapter 2.

According to Huang, Lin, and Chang (2009), social demographics and other potential variables relevant to the acceptance of technology (medium or high HIV knowledge, willingness to use telehealth) might ensure user acceptance of technology among the people at high risk for HIV infection and consequent acceptance of telehealth as a form of intervention vehicle. Chau and Hu (2002) said that user acceptance was critical towards making the population of interest integrate into the telehealth system within its network.

The HBM was relevant to acceptance of technology. In his study of HBM, Davis (1989) said that combination of perceived usefulness and perceived ease of use would create behavioral intention with the encouragement to use technology. This might help to understand why some individuals who were living with HIV would consider telehealth technology as a health benefit. HBM constructs were assessed when using logistic regression to predict HIV status subject to interaction between and within groups of independent variables. In the second research question, degree of HIV knowledge could be reflected in how much a person at risk for or living with HIV would accept telehealth after learning about the perceived benefits of doing so.

Definition of Terms

Gender: In the study, both male and females met the inclusion criteria. Both male and female genders were included in study population.

HIV knowledge: The knowledge to understand what the HIV virus really is, how it is acquired, and how it is spread in terms of short and long-term effects. HIV knowledge also includes the ability to recognize risks, benefits of prevention efforts, which include testing, protected sex, safe needle use, and management of HIV beyond prevention.

HIV status: The state of the individual regarding the virus that causes AIDS. Regarding status in this study, focus was on both pre-infection and post-infection stages of the disease before meaningful feasibility of telehealth could be clearly assessed for HIV status.

Telehealth: An alternative health care delivery system using information technology (CCHP, 2017). Telehealth is a remote form of healthcare delivery vehicle

(Hong et al., 2012) which could be classified into various categories based on the kinds of tools involved and what kinds of remote services are rendered (Human Resources & Resources Administration [HRSA], 2016).

Assumptions

This study assumed that participants who responded to having used mobile phones as major form of contact with their providers provided true information related to their HIV status. There were also assumptions of truthfulness regarding responses to questions about lifestyles including sexual practices, sexual orientation, and intravenous drug use, particularly needle exchange practices. There was also an assumption that each participant who lacked healthcare access due to distance at least would consider available options such as telehealth instead of nothing, because such options stood the best chance of addressing issues with internal validity, although the magnitude of telehealth consideration may vary. Constructs of HBM were aligned with telehealth in the following perceptions: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. Finally, it was assumed that participants in surveys who produced the data answered the questions with strong belief that their privacy was protected by appropriate ethics administrators who also recognized the severity of breaching underlying privacy laws and under whose institutional review board approval was given to collect all data.

Delimitations

Although there was a strong focus on telehealth, other covariates that are relevant to social demographic factors had provided broader scope of understanding beyond

telehealth as healthcare access. The participants included in this study were those who were not just at risk for HIV infection but might have been infected with the virus. Essentially, because this was a retrospective study, the participants were mainly those who were already HIV-positive but whose pre-infection statuses were documented during data collection in addition to their demographic data. Within this demographic, other contributing factors included but were not limited to age and residential location. The scope of this study did not extend beyond exploring feasibility of telehealth and the contributing effects of knowledge of HIV to HIV status regarding the population of interest. It did not discuss treatment or assumed public health activities to intervene in terms of the identified problem. This study did take steps to explain or control for variables that needed to be controlled for clear dissemination of results that might or might not establish strong telehealth feasibility for HIV. The population of interest included individual residents in Southwestern Nigeria who were at risk for HIV infection or already tested positive for the virus and were between the ages of 17 and 34. Older adults were excluded from this study because there is a low interest in smart phone use among this population, and there had been consistent lack of interest in registration for electronic health records (Greenwald, Stein, Clark, & Sharma, 2018). However, improved use of smart phones among the younger adults may influence older adults who are parents of these younger adults.

Limitations

A limitation of this study involved stigma regarding honest responses to questions about risky lifestyles. For example, the culture of the Yoruba people which is the dominant tribe in the Southwestern Nigeria put a heavy stigma on the commercial sex

trade, illicit drug use, and alternative sexual orientation all of which were high risks for testing positive for HIV. This stigma might have reduced quality of responses during original data collection, with strong potential for missing cases from the original survey. Regarding design, data for this study was based on prevalence and incidence rates across a particular point in time. Therefore, temporality may be lacking since it was not longitudinal. While true prospective cohort studies that would include reasonable follow up time would have yielded stronger validity, such a study design would also have been prohibitively expensive and time consuming for a dissertation (Creswell, 2009). In addition to issues of internal and external validity, limitation would typically exist also when considering possible confounding factors that accounted for HIV status due to spurious relationships between predictor and outcome factors. When there was a combination of factors, it became a heavy burden to pinpoint the actual variable directly responsible for outcome prediction. One final limitation was recall bias which could possibly have happened during original data collection. The current research had no control over participant selection since the study used secondary data.

Implications for Social Change

This study had the potential to create significant positive social change for the study population. Particularly in terms of healthcare access for HIV patients and those at risk for the virus, telehealth provided alternative care, which is more accessible than the traditional healthcare delivery system (Charrier, Zarca, Durand-Zaleski, & Calinaud, 2016). If the results of this study suggested a strong feasibility of telehealth for HIV status among the study population, a replication at wider scope in Nigeria would generalize to a much larger population especially in other regions where HIV prevalence

was higher than in Southwestern Nigeria, and where rural and urban population differentials reflected that of the study population.

Summary

In this chapter, I introduced the study by describing the major variables of interest, previewed the major sections of the chapter, and provided background to the study. I also stated the problem statement by clearly stating the research problem, followed by the purpose of the study. I stated the research questions with their relevant hypotheses, declared the HBM as the study's theoretical foundation, and described the nature of the study. Definitions were provided for the variables of interest and other important terms used in the chapter. Assumptions, scope, limitations, and delimitations were all stated, and finally, the significance of the study was explained.

HIV has been and is still a top public health problem in Nigeria in general and in Southwestern Nigeria in particular. This study's target population constitutes a formidable workforce age group that supports the economy. Females in this age group include a good percentage of childbearing population, and youths who mostly use mobile phones are included in this age group. This research had advocated the need for public health practice to explore alternative means of healthcare delivery, which will create more opportunities for women at risk for HIV infection but who also live too far away from needed health services. By extension, this initiative will reduce mother-to-child transmission (MTCT) of HIV because a reduction in mothers' chances of getting infected also reduces the child's potential for getting the virus from his or her mother. The expected results will be an indication of positive social change because incidence rates are bound to reduce as infection rates reduce.

Chapter 2 will include an extensive literature review related to this study concentrated on the study population and independent and dependent variables. I also will discuss how previous researchers had approached this problem differently, and the gap that would be identified formed the focus of this research to further contribute to body of knowledge. Chapter 3 will discuss the methodology required to conduct the observational study. The remaining chapters will explain how the study was conducted. A research plan will include the use of univariate descriptive method to describe each variable, and multivariate logistic regression will operationalize the independent and dependent variables with a view to explaining the gaps earlier identified through literature reviews. In Chapter 4, the results of the study are presented with tables and figures from both descriptive and inferential statistical analyses, while Chapter 5 will discuss findings from the results in Chapter 4, their implications for social change, and suggestions for further public health practice.

Chapter 2: Literature Review

In this chapter, peer-reviewed articles were used to better understand the main variables of interest in this study. The reviews were sought on the dependent variable HIV status and the independent variables telehealth, HIV knowledge, and gender to explain gaps in research regarding the relationships between variables. Other variables which could serve as covariates were also reviewed.

The literature review was carried out using Walden University Library databases, Google Scholar, PubMed, MEDLINE, and ProQuest. Search terms were: *telehealth*, *telemedicine*, *gender disparity*, HIV/*AIDS and telehealth*, *synchronous telehealth*, *asynchronous telehealth*, *health belief model*, *technology acceptance*, *HIV and health literacy*, and *HIV status and socioeconomic factors*. Concerted efforts were made to limit studies published between 2014 and 2019 with the exception of a few older references which were relevant to the study variables and origins of theoretical foundations.

Literature Search Strategy

Walden University library databases were used to access several articles for literature review. In addition, Google Scholar and institutional databases were searched for specific data to support literature.

Literature Review: Overview

In Nigeria, HIV was either directly or indirectly related to 160,000 deaths in 2016 (EquipHealth, 2017). HIV prevalence during the same time reached 3.2 million, including over 200,000 new cases (UNAIDS, 2018). Compared to other groups, HIV prevalence was highest among females and men who had sex with men (MSM). In fact, female commercial sex workers as well as MSM continue to be the most vulnerable groups

within Nigeria (Awofala & Ogundele, 2016). Some socioeconomic factors such as gender, education, income, and marital status had complicated clear understanding of the disease. For example, females had not only outnumbered males in terms of HIV prevalence in sub-Saharan Africa (Kharsany & Karim, 2016) but also were leading causes of death among women in Southwestern Nigeria (AVERT, 2017).

The current reliance on face-to-face interactions between patients and providers had not yielded acceptable results in terms of healthcare delivery to people at risk for and already suffering from HIV (Woods et al., 2016; Young & Badowski, 2017). Among this Southwestern Nigeria population where the majority still lived in rural areas, disproportionate location of most sero-clinics in urban areas had compounded the problems associated with healthcare access among HIV patients and those at risk for the virus (Abah, 2014). This was because health authorities in Southwestern Nigeria had not explored the feasibility of alternative healthcare access for HIV (Olanike & Fawole, 2014). In addition, there is an revealed unclear relationship between healthcare delivery via telehealth and HIV status. This had led to much less attention to HIV disease in rural areas in Nigeria (AVERT, 2017) and still did not explain how feasible alternative healthcare access with telehealth would be for HIV status. In essence, telehealth is a remote form of healthcare access with the ability to overcome barriers created by distance from the care source. As a form of healthcare delivery vehicle, telehealth could also be used to improve HIV knowledge to better understand HIV prevention and management, including enhanced ability for self-management of the disease.

The purpose of this study was to explore and assess the feasibility of telehealth use for HIV status at both prevention and disease management levels among individuals

in Southwestern Nigerians aged 17-34 years. Related objectives were to ensure clear understanding of other possible covariates in order to exclude any spurious relationship between the main independent variable and the outcome variable.

Okonko, Okerentugba, and Akinpelu (2012) discovered that 9% of women who went through conventional HIV testing at the Association for Reproductive and Family Health (ARFH) center in Ibadan, Southwestern Nigeria returned positive test results. They recommended improved frequency of testing among females to enable early detection and treatment of HIV infected persons. This recommendation thematically addressed HIV as a behavior-related disease which requires random testing with the purpose of arresting consequences of repeated high-risk behaviors across socioeconomic spectrum.

This chapter will state the research problem while also concisely introducing a synopsis of existing literature on the problem. Literature reviews related to content, methodology, and those combining content with methodology would be presented. How databases were accessed to conduct the literature review would be revealed and I would also name the search engines used. Selected literature were limited to the past 5 years (2013 to 2018) except in situations where literature to be referenced directly addressed the variables of interest or the choice of theoretical foundation for the study. The HBM which had been selected as the theoretical model for this study of HIV status and its various contributing factors was fully aligned with the study goals. The HBM was carefully selected based on how the same theory had been used in the past to successfully address similar phenomena. Finally, potential gaps in literature that needed to be addressed by this study revolved around the exploration of telehealth and were fully

discussed before providing transition to chapter 3 which detailed the method used in this study.

Literature Review Related to Contents

Telehealth is increasingly becoming a flexible form of healthcare access (Godstime, Kayode, & Halilu, 2009; Powell et al., 2017). In a comparable way, telehealth had been noted as an effective tool for enabling effective networks that were promoting patient-specific disease management at comparatively cheaper costs by 70% among rural population (Li & Wilson, 2013).

According to UNAIDS (2012a), 58% of all adults living with HIV were women (Harris, Hosegood, & Channon, 2014). Gender disparity to the disadvantage of women in HIV prevalence was actually higher in sub-Saharan Africa where prevalence among females aged 15-24 was 8 times as many as males in the same age group (Harris et al., 2014). Harris et al (2014) said Gender Inequality Index (GII) score was used to estimate country specific gender equality (UNDP, 2011a as cited by Harris et al., 2014). The GII was a 3-dimension indicator of reproductive health, empowerment, and labor market participation which was scored between 0 and 1. However, Gender Development Index (GDI), Gender Empowerment Measure (GEM), and African Gender Development Index (AGDI) were better known for evaluation compared to female to male (FTM) ratio in HIV infection rates and prevalence (Harris et al., 2014). The results from the Harris et al (2014) study showed FTM ratio of 3.3 among 25-49 year olds and this score correlated with countries where there were gender disparities against females across SSA except in Congo and Burkina Faso where more males actually were infected with HIV (Harris et al., 2014). FTM ratio was explained as female prevalence divided by male prevalence.

The resulting FTM ratio was skewed against women when FTM was greater than 1 (Harris et al (2014).

Probing deeper into gender disparity in HIV infection and prevalence, Okonko, Okerentugba, and Akinpelu (2012) in their study using simple random sampling, discovered that 18 (9%) out of 200 women who went through conventional HIV testing at the Association for Reproductive and Family Health (ARFH) center in Ibadan, Southwestern Nigeria returned positive results. The researchers recommended improved frequency of testing among females to enable early detection and treatment of HIV infected persons. This recommendation thematically addressed the need for faster and more frequent and random testing with the purpose of arresting consequences of repeated high-risk behaviors across socioeconomic spectrum.

Available evidences indicated that despite being born into the internet age, high risk individuals who were 17 years and older and who also lived and breathed the benefits of internet technology had not fully reaped the advantages of internet connectivity-enhanced telehealth services (Gebremedhin, Youjie, & Tesfamariam, 2017). This was because a vast portion of their daily internet use did not usually direct attention to health interventions (Anderson, 2001). Instead, internet use especially on social media discussions had been found to focus on other social issues such as sports, politics, romance, and academics (Escoffery et al., 2010). Despite documented moderate education level and technology use among this study population with 91 % being aware of effects and consequences of HIV, infection rates continued to increase (Gebremedhin et al., 2017). In addition, this continually evolving technological advantage made possible partly by education levels had not been fully tapped by policy makers to bridge the gap in

healthcare access between rural and urban dwellers in Southwestern Nigeria as reflected in the high prevalence noted among individuals regarding the burden of HIV disease (AVERT, 2017).

Telehealth being an information system-oriented health delivery technology essentially depends on precision of information system and engineering to deliver and retrieve accurate data either in real time or in stored and reproduced state, usually but not necessarily from electronic health records (HRSA, 2016). Southwestern Nigeria was one of the mostly educated regions of the country, hence the use of telehealth stood a good chance of being understood quickly and accepted unlike what obtained in most Northern states where there had been a long history of rejection sometimes violently, of technology-related health initiatives such as highly required vaccinations (Nasiru et al., 2012; Oku et al., 2017).

Telehealth providers used both synchronous and asynchronous telehealth applications to deliver health care, health education and therapy to patients from the distance but also to patients who were underserved, and not necessarily distant (HRSA, 2017). While synchronous telehealth allowed *real time* patient-provider interaction, asynchronous telehealth utilizes *stored health information*, where instructions and procedures were forwarded to the patient later (Toh, Pawlovich, & Grzybowski, 2016). Relevant hypotheses that could be advanced through the use of HBM based on technology usage intention included that sought alternative hypotheses for significant increase in healthcare access if telehealth was adopted to overcome problems related to lack of proximity to healthcare centers.

The usability of telehealth includes remote monitoring, and usability of telehealth technology. Physiologic parameters which also include comprehensive vital signs are part of telehealth usability. Activity and movement measurement (e.g. with sensors and triggers), wellness monitoring (e.g. in electronic patient assessment) are part of telehealth usability. According to Zhao, Li, Qian & Tsien, 2013), messaging regarding data collection, such as information sharing with care givers are also included in telehealth usability. Telehealth usability also includes ability to display trends and available timely data (e.g. weight, blood sugar, vital signs, activity, pain levels, and sleep patterns (Priya, Hariprasad, & Raghul, 2014). With these attributes, telehealth usability could enhance acquisition of literacy skills on both patient and provider's side of transactional healthcare (Durodola, 2016).

The usability of telehealth was summarized as follows:

The scope of this study was limited to exploring ways to understand telehealth use in relation to HIV infections due to deficits in healthcare access among individuals in the 17 – 34 years age group. Comparable in scope, Odeny et al. (2014) conducted study on focus groups discussion of health workers, and at-risk-for-HIV women attending clinics that monitor infant HIV clinics for the purpose of quick intervention. Their discussions were guided by the constructs of Health Belief Model. Text messages that were formed as a result of these discussions were used to effectively motivate the new mothers into bringing their infants for early HIV screenings (Odeny et al., 2014). While this might not work with all age groups particularly the elderly who typically resist new technologies (Forster et al., 2015), this method could however be replicated in other age groups that used smart phones considerably and who also belonged to active child-bearing age. Text

messaging was already a form of telehealth medium of transmission in the mHealth version of telehealth, and they were quite inexpensive, cost-effective, and were potentially good for mitigating stigma while protecting privacy because these mobile devices were operated at a personal level. Finally, the population of interest, particularly the target age group (17 – 34 years) represented optimally educated population group, formidable labor force, and child-bearing age group in the Southwestern part of Nigeria, and should therefore find it resourceful in procuring knowledge of HIV, chiefly as a result of modest education level among this study population.

Government and Private Sector Policy Approaches

Regarding telehealth use, there had not been any drastic or revolutionary changes in the way HIV prevention and management had been approached over the past several years among the population of interest (Ajala, Adetunji, & Akande, 2015). Besides the tremendous improvement made by international organizations in form of drugs supply, the attitudes of the most vulnerable individuals had not dramatically changed (NACA, 2016). Since HIV prevention was strongly tied to behavioral standards, there needed to be more attention directed to pre-exposure prophylaxis (PrEP) in the high-risk population based on behavior monitoring. Governmental approaches informed by research had struggled to discourage stigma but Nigerian government policy still persecuted and prosecuted HIV-infected individuals based on sexual orientation (Melhado, 2015).

Government policies had instead worsened **s**trong stigmatization and incarceration of homosexuals including those living with HIV. Government laws had prescribed 14 years in prison for this group (Melhado, 2015). Making homosexual lifestyle an offence would further promote closeting and underground activities among homosexuals. This

would in turn lead to reduced quest for health-seeking for fear of arrest and imprisonment. There had been world-wide condemnation of Nigeria's policy on certain people who were vulnerable to HIV (The Guardian, February 27, 2014; The New York Times, February 8, 2014; Human Rights Watch, October 20, 2016). Successive Nigerian administrations at the central level had been inconsistent with government policies on HIV prevention. Over all, despite Nigeria's high HIV prevalence, voluntary HIV testing remained low (Ogbo et al., 2017). Feasibility of telehealth healthcare

Utilization of philanthropic stake holders resulted in billions of dollars-worth of HIV drugs from foreign donors. Strong print and electronic anti-HIV campaign existed in major cities of Southwestern Nigeria. There was potential for mass education, improvement in HIV knowledge, and consequent deterrent among the general population due to anti-HIV publicity.

Scholarly Approach

Existing research works had attempted to find a more realistic approach devoid of political red tape that was typical with policy makers in African setting. Strasser, Kam, & Rigalado (2016) explored sub-Saharan Africa's poor healthcare access to HIV, especially among its rural populations which formed more than 70% of the total population. By extension, the study found that rural dwelling was associated with consequent lower life expectancy in sub-Saharan Africa which included Nigeria, particularly the study area. The strength of the study could be identified through its ability to use data from several countries in the sub-Saharan region. This multi-nation effort would allow for regional comparison of deficits in healthcare access and meaningful collaborative planning to address the problems, especially when other more affordable healthcare access such

telehealth were given serious attention. The weakness in the study might be their isolation of other possible confounders that might link their study sample to lower life expectancy. In a separate study, (Mondal & Shitan, 2013) were more specific about demographical factors in determining low life expectancy in low and medium low-income countries, which also included Nigeria. In addition to HIV prevalence, the authors also examined education level, effect of physician density, and total fertility rate

Telehealth

There was valid rationale for selecting telehealth use as independent variable because telehealth remained a principal contributing factor under consideration as specified in the research topic. Its interaction with other independent variables was expected to explore and determine its predictability of HIV status if its use was feasible for preventing or managing the disease. In addition, use of technology aligned with some of the constructs of the theoretical model being applied to the study, notably perceived benefits. Tsai (2014) aligned perceived benefits with technology use. Telehealth also featured prominently not only in the research topic, but also in research question 1 (RQ 1), and could be a good vehicle for delivering healthcare services in HIV if a strong association was established between them. When telehealth was applied as a form of health care access, the individuals at risk for, or suffering from HIV were presented with opportunities for improved knowledge of their HIV status, since health education which was directly related to HIV knowledge could also be delivered through telehealth services either synchronously or asynchronously or both (University of Twente, 2016).

Studies that were focused on telehealth technologies had slowly but gradually accelerated during the past two decades after a long period of lack of interest by

researchers (Brown et al., 2013). Telehealth use had been known to work well with perceptions contained in Health Belief Model (University of Twente, 2017) which could have been a good reason for the recent upsurge in popularity of telehealth among researchers. Due to the flexibility of telehealth application, its feasibility for disease intervention was likely to elicit some advantages (Ishola & Chipps, 2015). In their study of 144 randomly selected HIV-positive pregnant women, telehealth provided the flexibility to evaluate how mobile phone acceptance and commitment therapy could improve psychological state of mind using Action-Acceptance Questionnaire (AAQ-II) instrument for measurement. The recommendation of telehealth for understanding HIV status was based on the strength of the internal consistency of the measurement instrument - AAQ-II (Ishola & Chipps, 2015).

Overview of Telehealth

By definition, telehealth was a collection of means by which health services and health education were delivered. This "collection of means" could encompass services such as counseling (as in tele-counseling), home health, physical and occupational therapy, management and monitoring of chronic diseases, and enhancement of consumer or professional education (Health-IT, 2017). Specifically, mHealth version of telehealth would be explored since it was most feasible for HIV status among the study population. The key mechanisms by which telehealth worked were identified under two major headings:

Synchronous Version of Telehealth

This was an interactive transaction between the patient and the provider. Questions were asked, and updates were provided by the provider. Some patient

assessment could be done, and necessary data could be collected synchronously (Boston University, 2016). Treatments and/ or therapies were modified, and every health service was explained to the patient (Allely, 1995).

Asynchronous Version of Telehealth

This was not live transmission like the synchronous version, but it existed in form of transmission of health history such as recorded videos and digital documentations such as X-Rays, MRI, CAT-Scan and nuclear medicine records. These were electronically transmitted via secure communication channels to a provider (Allely, 1995). The information supplied were subsequently used to address health issues by the provider. Secure communication channels that were commonly used include emails, and other trusted channels (CCHP, 2017-a). Using computer networking, a process known as cutthrough switching was actually a method used for packet switching in computer science. In packet switching, a data frame (also known as a packet) was forwarded prior to the receipt of the whole frame (complete data units) when destination had been confirmed. This method which was entrenched in store and forward version of telehealth technology might be transmitted through intermediary posts where diagnosis might be made regardless of patient's actual location (CCHP, 2017-b).

Remote Patient Monitoring

This also entailed collected data but the data could be used by a provider in a separate location. The major difference in this component was that it allowed for more elaborate follow up monitoring of a patient's health data, and this could include discharged patients who still needed monitoring from home. Telehealth in this way could help to minimize re-admission rates (CCHP, 2017-a).

Mobile Health/mHealth

This component decentralized health care practice further through the use of personal cellphones, tablets, personal digital assistants (PDAs) and other devices which were capable of sending useful messages for health services. These messages could be individual, or could be as broad as public health emergencies that came in form of surveillance systems (CCHP, 2017-a). This could be particularly useful in times of outbreaks because such reporting could gain a lot of steam through collaborative action within the community, especially with the active participation of the social media. Precisely, mHealth defined a specific path of using mobile technology to achieve health outcomes (Health-IT, March 25, 2013). mHealth also highlighted cost-effectiveness component of telehealth use because the tools involved (cell phones, tablets) could be purchased by individuals and such tools could better manage privacy issues. Management of privacy issues were made possible because of the individualized usage of cell phones and other mobile devices which ordinary people carried around, and which could quickly report issues concerning health emergencies.

Current Trends in Telehealth

Telehealth feasibility for HIV status is better understood through the use of patient-to-provider /provider-to-patient communication in both synchronous and asynchronous situations as applicable. To actualize this, current innovations are being enhanced with e-visits, wearables, and secure messaging all embedded into mhealth tools such as mobile phones and tablets (Telehealth Advisory Board, 2018). Beyond hardware, telehealth is moving forward in terms of software applications. In a study published in New England Journal of Medicine, Dorsey & Topol (2016) identified three trends

namely: telehealth application transformation which paid more attention to providing convenience and cost reduction and not just increasing healthcare access; expanding provision of services in acute conditions to chronic conditions such as HIV management; and extending telehealth services beyond healthcare facilities to home and mobile devices. These trends jointly or individually tend to create feasibility of telehealth for HIV status.

Role of Telehealth in Health Care Access in Southwestern Nigeria

Telehealth continues to exert effective influence in healthcare access in Southwestern Nigeria. According to Ekanoye et al. (2017), telehealth has proven to be highly beneficial consistently in Southwestern Nigeria and such influence is spreading to other parts of the country in terms of healthcare coverage among HIV patients. The authors attributed this influence to increasing technical partnership between Nigeria and China in the area of satellite communications which was important for telehealth success. This was an improvement over a 2015 study by Ajala, Adetunji, and Akande (2015) which found that medical practitioners in Southwestern Nigeria were reluctant to integrate telehealth into health services including HIV care.

Telehealth cost effectiveness in Southwestern Nigeria. Smart phone use in Nigeria grew from 11 million users in 2014 to more than 23 million in 2018 (Statista, 2019). Individuals in the age group under study (17 -34 years) were heavily favored to adopt smartphone use than the older generation of people who are highly resistant to technology overhaul (Dinesen et al., 2016). Not only had telehealth been able to increase access to rural areas of Southwestern Nigeria, but it had done so at cheaper costs (URAC, 2017). The increasing patronage of health services by mobile phones had slowly but

steadily increased mobile phone usage for health care access, hence reducing the need for expensive visits to physicians' offices in places like Lagos, Ibadan and Ado-Ekiti, all in the Southwestern part of Nigeria (Statista, 2019)

HIV Knowledge

The rationale for selecting HIV knowledge resided in clarifying and quantifying required skills necessary to fully understand the importance of prevention and self-management in HIV disease process. HIV knowledge was key to understanding HIV as a chronic disease which became an integral part of the living conditions of the sufferer. HIV knowledge also enhanced the effectiveness of HIV disease reporting process, because it availed individuals living with HIV the knowledge to recognize the importance of controlling the disease through surveillance. Bekalu and Eggermont (2014) from the results of their study, opined that HIV knowledge was related to HIV/AIDS behavior change communication, which might help to further predict HIV status. HIV knowledge helped to educate on safe life styles, as well as manage living with the disease once an individual's HIV status shifted into the positive territory. It would therefore be incomplete to conduct a study on HIV without including knowledge of it so that both sides could fully understood. All the three research questions aptly expressed clarity on investigating the main independent variables as their associations were assessed with the dependent variable of choice (HIV Status).

HIV knowledge indicated the extent to which an individual (either at pre-infection or post-infection stage) was able to understand his/her disease process, ability to prevent HIV when he/she was not yet infected but probably at high risk, and his/her responsibilities towards managing the disease after being infected. Levels of HIV

knowledge had been a factor right from the emergence of HIV in the early eighties (Tayo et al., 2011). Existing research continue to reiterate the importance of HIV knowledge in the quest for improving access to care. Oljira, Berhane, & Worku (2013) in their cross-sectional study of students in Ethiopia showed that level of HIV knowledge was directly related to seeking health care for it.

In order to understand how telehealth could be used to predict and understand HIV status, the knowledge of the disease was necessary. Saberi et al (2013) in their study of youths and telehealth use to address HIV fears, the participants accepted that telehealth maintained their privacy and enhanced their knowledge of the disease. Kenya AIDS Indicator Survey (KAIS) of 2007 was a nationally representative survey that Cherutich et al (2012) used to investigate the extent of HIV knowledge as a determinant of HIV status. Using a sample size of 19,840 participants, 80% consented to interview and blood sample draws. Out of those who tested positive for HIV, 83.6% (95% CI: 76.2–91.0) did not know that they were infected with the virus. Other associated variables included in the HIV testing included "women living in urban area" ($p < .0005$). Conclusion showed an increasing testing trend with increasing HIV knowledge which were consistent with higher levels of education (Cherutich et al, 2012). This conclusion justified inclusion of HIV knowledge as a covariate in examining the determinants of HIV status.

Gender

The third research question (RQ 3) weighed in heavily on gender as a variable of interest because of the behavior and attitudinal differences between sexes which could determine HIV status either way. It was therefore highly desirable to examine the effect of gender as a contributing factor. This variable was particularly expected to play critical

role as part of the analysis in chapter 4 of this dissertation. Inclusion of gender as a variable in this review also meant that both genders, not just females needed to be studied for the purpose of group comparison keeping in mind the relevant socioeconomic factors that had the potential to either modify or compound the relationship between gender and HIV status. To properly review this variable, gender would be examined from the view point of a group variable which meant both sexes would be studied for their individual as well as joint contribution to HIV status. This comparison was necessary due to existing studies that found HIV infections disproportionately disadvantageous to females in Southwestern Nigeria (NACA, 2016). For example, how these two genders paid attention to HIV knowledge could be a very important determinant of their disease status. Healthcare access could be seen in a broad sense as the act of securing health care services. Health care access could also be perceived as a specialized form of healthcare access such as telehealth. The needed clarity was that appropriate aspects of telehealth that were relevant to HIV prevention and management must be employed for the exploration and investigation of gender differences in HIV infections.

In order to fully understand HIV prevalence, gender as an independent variable needed to be specifically studied. As a variable of interest, this study examined the role of gender differences as a group variable with the purpose of exploring if HIV status differ based on being male or female. It was also necessary to inquire whether gender spuriously confounded the relationship between telehealth and HIV status or between HIV knowledge and HIV status. Other areas that identified gender differences in HIV status included problems with intimate partner violence which had led to inability of the female gender to engage in safe sex even when they wanted to. In a South African study

of gender-based sero-positivity, Dunkle et al (2004) correlated HIV status in females with gender-based violence (GBV). Although empiric research had shown that connection between these two factors remained limited, Dunkle et al (2004) conducted the study of 1366 women who attended antenatal clinics and accepted HIV testing in Soweto, South Africa. Using Sexual Relationship Power Scale (SRPS), male control as measured by the SRPS (1.52, 1.13-2.04) were associated with being HIV positive (Dunkle et al., 2004). The study therefore concluded that women who encountered male violence or controlling male partners were at higher risk for HIV infection. As there were many possible covariates because HIV remained a behavior-related phenomenon, gender control as a factor for HIV infection in females might partly explain certain aspects of why gender disparity negatively affected females more than males.

Biological vulnerabilities

Magadi (2011) in her study of gender disparity in HIV infections among women described the role of female biological vulnerabilities to HIV infections. The study population included a sample of individuals aged 15 through 49, across sub-Saharan Africa with similar characteristics with my study population and its age group. Biological vulnerability and gender (being a female) was described as being explanatory covariates for HIV status because females anatomically present much larger surface area with susceptible mucous membranes that were exposed to body fluid contact during sexual activity especially during violent sexual activity (Magadi, 2011). There were also issues in relation to age at first sexual activity, and violent sexual contacts in rape situations which often resulted in tissue tears in vulnerable female body parts such as mucous membranes (p.538). These biological vulnerabilities increased gender differences in

heterosexual routes of HIV infections (Magadi, 2011). The study identified increased probabilities in becoming HIV positive when girls started having sex too early, thereby suggesting a connection between anatomical development and susceptibility to viral infection via sexual activities.

Curiously enough, the study concluded that sexual behavior could not be a contributory factor because while HIV infection risk among women was 70% higher than in men in that study, their sexual behavior as analyzed in the cross-sectional study was found to be similar (Magadi, 2011). The generally recognized gap in literature here was that due to its cross-sectional design, causality remained unclear, instead, association was more easily applicable in view of all the covariates observed by the author. For example, it was impracticable to determine whether HIV infections were due to the effects of some predisposing risk factors that were attributable to both HIV and gender (Magadi (2011). The specific recommendations from the Magadi (2011) study using multivariate logistic regression proposed multifaceted approach to identifying gender differences in HIV infections among the study population. Specifically, since early sexually activities were listed as one of the factors responsible for such differences in HIV infections, it was recommended that age of sexual debut be delayed, premarital sex in general be vastly reduced, behavior modification in terms of condom use be improved as they could all possibly be associated with gender in HIV infections (p. 537).

Other socio-economic factors

Socio-economic factors as we knew them, presented varying dimensions and degrees of influence on HIV status (American Psychological Association, 2017), and it was necessary to investigate some of these factors as possible covariates regarding their

levels of interactions with the dependent variable, HIV status. Several aspects of socioeconomic status had been known to directly affect an individual's ability to seek healthcare, and understand the implications of HIV status (American Psychological Association, 2017). As possible contributors, major socioeconomic factors included but not necessarily limited to income, age, education, residential neighborhood (rural or urban), and marital status.

HIV Status

HIV status was the study's outcome variable of interest. Apparently, all contributing factors of any disease were typically aimed at outcome of tests to see the presence of such diseases. Therefore, the health status in terms of presence or absence of a disease was always the basis for the investigation of such disease hence the rationale behind selecting HIV status as outcome variable. In this case, logistic regression which was based on predictability of presence (YES) or absence (NO) was the preferred method for the operationalization of this variable if the contributing variable to be regressed against it was continuous as they were found in the data set.

Frequent HIV Testing

HIV testing had always been the most practical way to continuously check the status of individuals at risk for the disease (AIDSInfo, 2017). In order to ensure these regular tests, high-risk patients in particular must get to healthcare centers for the monitoring of their pre-exposure prophylaxis (PrEP) (AIDSInfo, 2017). Failure to reach these centers presented imminent danger for required knowledge of their HIV status as well as the actual counseling needed to extend their disease-free status. If already infected, reaching those care centers would minimize the spread of the disease due to

potentials for improved knowledge of the disease (HIV knowledge), and improved on time, on-course treatment management. Finally, HIV testing remained a good strategy to control not only prevalence but also incidence rates of HIV because when incidence rates are reduced, prevalence also would drop over time as yearly occurrences of HIV infections are curtailed through frequent testing and subsequent awareness among the population under study (Musheke et al., 2013).

Transportation

A good portion of the population in Southwestern Nigeria, particularly the at-risk individuals lived in the rural and underserved areas where they travelled to urban centers to get tested regularly but the rate of testing remained low and the burden of transportation remained high (Tobin-West & Onyekwere, 2014). Many of these individuals faced significant challenges while embarking on travels to urban cities. Socioeconomic factors that were responsible for these challenges included income, gender, age, marital status, and residential neighborhoods (rural). Gaps did exist in literature regarding previous knowledge about the severity of lack of proximity to care centers as it related with attention to telehealth studies (Schnall et al., 2015). A competent technological approach (telehealth) was therefore necessary to fill this gap in order to make long distance travel to seek healthcare unnecessary but the association between telehealth and HIV status must be assessed first. Telehealth remained a viable option which needed to be explored with a view to applying remote monitoring of patients' progress with prevention and treatment efforts in mind.

Known and the Unknowns in Telehealth Use for HIV Prevention

In Southwestern Nigeria, adequate feasibility of telehealth in addressing health issues, particularly HIV had not been fully studied and the traditional face-to-face interactions with health providers overwhelmingly remained the way of healthcare access. According to Ajala et al (2015), only few medical facilities in Southwestern Nigeria had integrated telehealth services. However, it was also known that literacy and health literacy levels (socioeconomic factors) in Southwestern Nigeria were among the highest in the country (Ajala et al., 2015), and these extended to the use of electronic communication devices in the form of smart phones and other PDA devices (Egunjobi & Akerele, 2014). Despite these technological knowledge enhancements, the public health discipline in Nigeria had not demonstrated considerable willingness to turn attention to effective use of remote healthcare service delivery. For example, the only viable telehealth operations in the Southwestern Nigeria was located inside the University College Hospital Ibadan, and it was still at the infancy stage regarding inclusive operations with various operating health sectors in this part of the country. In addition, telehealth had not been fully integrated into public health programs in the country to correct some aspects of human resources for health (HRH) maldistribution (WHO, 2017). At the best, electronic health records (EHR) had attracted more attention than telehealth despite the close relationship between EHR and telehealth particularly the asynchronous version of it. What was vastly unknown was how far telehealth would go in reducing HIV prevalence among at-risk individuals within this well-enlightened population. This study intended to explore telehealth's feasibility as a form of healthcare access to better

understand HIV prevalence, for the purpose of generalizing the results to a much wider population in Nigeria as a future public health initiative.

This study sought to adopt the constructs of Health Belief Model (HBM) to further understand the feasibility of telehealth for HIV status. Individuals derive motivation through living examples, and that was exactly what good results with strong validity typically provide. Perceived ease of use of technology as inherent in telehealth, and perceived benefits as a component of HBM among the study population were particularly well aligned with persuading prospective users of telehealth with the aim of achieving enough sample for generalizability. This was made more possible by mHealth type of telehealth which enabled mass participation in telehealth usage through ordinary cell phones and other personal digital devices.

Literature Review Related to Methods

Using multi-level quantitative modelling of change in self perceived knowledge, Wao et al (2016) focused on the limited HIV knowledge of rural health care providers (HCPs). A telehealth project, Extension for Community Healthcare Outcomes (ECHO) was used to enhance the HIV knowledge of HCPs. Measures of HIV knowledge with Kirkpatrick's four level of program evaluation (KFLPE) was applied in assessing number of attendances and the degree to which trainees got interacted with one another at the training program (Wao et al., 2016). Clustering of participants according to unit-levels in nested form ensured that change in knowledge level (self-perceived knowledge of HIV) was not independent of the effects of the telehealth program (Wao et al., 2016). In other words, there was heterogeneous effect of telehealth intervention in the ECHO project (Szklo & Nieto (2014). Their method, which was the quantitative dominant component of

their mixed methods approach, was in alignment with this study's first research question which placed emphasis on the choice of telehealth interaction to test the hypothesis on that first research question, regarding association between HIV status and telehealth.

In their study of female military personnel (*n*=346) from two cantonments in Southwestern Nigeria, Essien et al (2010) applied cross-sectional design to investigate HIV knowledge. According to the authors, if the predictor variable was included in intervention programs, understanding of gender-based infections could be better addressed. This recommendation further supported the pursuit of the stated study goal and also helped to answer the second research question, which examined the relationship between level of HIV knowledge and HIV status among study participants and the population in general.

Participation in the Bristol (UK) telehealth random control trial (RCT) a.k.a. "the Healthlines Study" had been the main focus of Forster et al (2015) in their cross-sectional, two-linked surveys of subjects with depression and elevated risks for cardiovascular disease (CVD). Traditional care was compared with telehealth care. Among the study sample (*n*= 24, 152), gender was one of the main variables. Overall, there was low interest in participation as 4,131 (18%) accepted the study invite (Forster et al (2015). The most common reason for declining invitation to RCT was lack of access to the Internet or lack of computer skills, both reasons combining for 54.7% of the refusals (*n*=3,889). Rejection was more common among the elderly subjects (Forster et al., 2015). Among those who declined, males were 1,333 while females were 3,049.

Ohl et al (2014) in their study of the United States national Veteran's Administration (VA) subjects living with HIV (*n*= 23,669 with 10.2% [approx. 2,400]

rural) who were observed to have been at disadvantage for specialty medical services due to long distance were found to abandon their search for much-needed specialty clinics as distance to care centers increased. For every additional 15 minutes of travel time to a maximum of 90 minutes, use of specialty services fell from 88% to 71% among the rural dwellers (Ohl et al., 2014). Access by location was calculated from home to VA primary care and VA specialty clinics. Findings revealed 82% of rural veterans were less likely than urban veterans (87%), $p < .01$ to use specialty HIV clinics. Rural veterans were 82% vs 73% more likely to use primary care instead. Longer travel times at the increments of 15 minutes up to 90 minutes, were also associated with decrease of between 71% to 88% ($p < .01$) in the use of HIV specialty clinics but use of primary care centers increased from 68% to 86% ($p < .0001$) (Ohl et al., 2014). This analysis was done using multivariate regression models. The authors recommended use of telehealth by HIV specialty clinics for health access for the rural veterans in order to overcome this barrier to health access.

Theoretical Foundation.

The theory selected for this study was health belief model (HBM). A technical application of the HBM was explored to explain the perceptions of high-risk individuals regarding health seeking and willingness to overcome several obstacles leading to hardto-reach health care services with the intention to prevent HIV infections or manage existing positive HIV status. In order to explore the feasibility of telehealth use among the study population, a good understanding and acceptance of technology would be needed to explain the benefits of technology use in the health care field, especially in behavior-related health problems such as HIV. Health Belief Model was made of constructs which

effectively addressed the issues surrounding technology use among other aspects of health access. This aspect of health belief model therefore addressed and supported telehealth as a form of intervention in the manner of healthcare access.

The health belief model (HBM) which was developed by Hochbaum, Rosenstock and Kegels was rooted in psychology and it is a theory that predicts and explains health behaviors. Precisely, HBM postulates that individuals typically seek health through perceived susceptibility to illness, perceived seriousness, perceived benefits, and perceived barriers. Self-efficacy was added to these four constructs later (Jones et al., 2015). Indeed, the constructs of HBM had been used to promote screening and clinic utilization. HBM through other studies had also been found to be particularly in congruence with HIV screenings and behavior adaptation in prevention efforts (Tarkang & Zotor, 2015)

At its inception, health belief model was more inclined towards prevention than towards treatment (Rosenstock, 1974). This was because in the early 1950's with few notable exceptions, medical care received overwhelming attention in contrast to public health. This suggested that attention was focused on the individual than the population as a whole. The areas of health where medical care received attention and recognition more than public health were those of symptoms recognition, diagnosis, compliance with medications and surprisingly, screenings for diseases (Rosenstock, 1974). With the contributions made by HBM even as it was being modified over several decades, perceptions had shifted, and more understanding of how to address personal behavior related health issues such as HIV had increased (Rosenstock, 1974).

Adapting telehealth to address healthcare access is subject to the choice of the healthcare seeker whose choices are vastly limited by distance to care sources. Health Belief Model portrays a logic model that constructs the situational decision-making in healthcare seeking. In other words, HBM tries to create direction of actions where choices are being contemplated (Maiman & Becker, 1974). For these reasons, professionals cultivate the benefits of HBM to intervene in behavior-related phenomena particularly in diseases such as HIV which can be described as being both chronic and infectious. In this case, telehealth is seen as a delivery vehicle to achieve such goals and as such, this study can accordingly conduct inferential studies that will test or explore the feasibility and use of telehealth as a form of intervention if association between telehealth and HIV status can be established. The six constructs of Health Belief Model are therefore essential to critically propel the emotions behind using telehealth in seeking health. Among these constructs are those which can be effectively used to test research hypothesis on health-seeking.

The constructs of HBM are well known to researchers because they have been used for various kinds of health promotion spanning both prevention and treatment. The two components of telehealth (perceived ease of use and perceived usefulness) operationally influence usage intention in alignment with HBM (Tsai, 2014). It is noted that technological factors (as in telehealth) intersect with trust and intention (Tsai, 2014). Since trust and intention were obviously behavior-related, HBM constructs such as perceived benefits, perceived barriers, and cues to action were directly and critically related to usage intention which clearly indicated that technology was bound to affect behavioral intention (Tsai, 2014).

This study conducted literature reviews of several studies which employed methods of accessing healthcare through the theoretical lens of the health belief model. The constructs of this model often explained why, how and when individuals perceived what could help prevent or effectively manage disease as well as address its cost benefit. In some ways however, these methods were targeted towards groups, such as focus groups.

Constructs of Health Belief Model

The HBM constructs were listed as perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cue to action, self-efficacy.

Perceived Susceptibility. For those at risk for HIV infection, perceived susceptibility was the feeling that the risk of being vulnerable to the disease actually existed (Rosenstock, Strecher, & Becker, 1994). For those already infected, perceived susceptibility was the feeling that the disease might result in death or worsen health condition considerably. A measure of susceptibility was assessed by Greene, Rubin, Hale, and Walters (1996) by using three items which were designed on a 5-point Likert scale in the context of HIV/AIDS. These items were (”I worry that I might catch AIDS”); (“AIDS is a big concern to me”); and (“AIDS is not as big a problem as the media suggests” (coded in the reverse)). The Cronbach’s alpha of .73 validated internal consistency of this construct regardless of the reversed coding of the third item - *“AIDS is not as big a problem as the media suggests”* as analyzed by the study (Greene et al., 1996).

Perceived Severity. This translated to how seriousness of the disease might affect the overall health status. In this study, for those at risk but yet to be infected, the individual perceived the expected seriousness of the disease when he/she eventually tests positive

for the virus, because a risky lifestyle mighty be doomed towards HIV infection. For those who were already infected, they perceived the severity to be the possibility that the seriousness of the disease might lead to death or more complicated health status. Seriousness may be perceived in both direction and magnitude and the intention to seek health solutions was contingent on perceived benefits. Such benefits might be in terms of technology use (telehealth) in accessing health care.

In their study, Baghianimoghaddam et al (2010) explained perceived severity in a sample of female high school students where mean scores of knowledge of the disease (HIV Knowledge) were correlated with their perception of severity of the disease. Knowledge of the disease as correlated with ability to perceive severity of it was significant ($p < .05$). Those with low mean scores in perception of severity of HIV/AIDS were likely to ignore preventive behaviors, with high potential to spread the disease (Baghianimoghaddam et al, 2010). As one of the variables in this study, which also corresponded to a testable hypothesis in alignment with research question number 2 (RQ 2), this study might help to explain how relevant this covariate (HIV Knowledge) might turn out in its interaction with other factors to predict the outcome of interest (HIV Status) if a predictive statistical test such as logistic regression was applied.

Perceived barriers / perceived benefits / cues to action. Of particular relevance was cue to action which was defined as the trigger or stimulus to taking action in order to improve health, or change health behavior. In the absence of adequate traditional healthcare access, will such short-coming spur *cues to action* and prompt the use of technology (telehealth) as alternative form of healthcare access? What we knew about HBM generally was that an individual was motivated to take positive actions towards

improving or elevating his/her chances when seeking health services (healthcare access). To explain cues to action, all those actions that encouraged the individual and/or those actions that made such individual to actually *act* can be attributed to this HBM construct (Boston University, 2016). Internal cues were characterized by inner signs or warnings that could trigger an individual to act. Examples of these inner signs include wheezing which could trigger action to start a nebulizer treatment, and in the context of HIV, those actions could be described as those which promote compliance with antiretroviral drugs in HIV positive individuals, and compliance with regular testing for people at risk. External cues were those that were caused by *pressure* or *advice* from individuals who might or might not be experts in giving such advice, but the advice caused the listener to take action anyway (Boston University, 2016). Within the context of this study, external cue to action could be triggered by inability to travel to treatment center, and subsequent acceptance of telehealth as an alternative even if adequate attention was not dedicated to such initiative initially. In HBM studies, *cues to action* were often the antidote to *perceived barriers*, because such actions could build on the feelings derived from *perceived benefits* if the constructs were ordered. The motivation stemmed from the benefits to be achieved, hence cues to action to achieve such benefits (Jones et al., 2015).

Review and synthesis of existing studies related to research questions

In accordance with health seeking through the constructs of HBM, the first research question (RQ 1) that presents telehealth (text messaging, teleconferencing, tele-counseling/ consulting) as independent variable might actually be a determinant of HIV status. In a Canadian study, it was found that treatment or consultation with telehealth had worked with the same effect or better than traditional approach (Ontario HIV Treatment

Network, 2014). The author recommended telehealth in form of teleconsultation in collaboration with HIV specialists in order to develop their knowledge base, reiterating the viability of telehealth as health care delivery system.

The second research question (RQ 2) attempted to address the knowledge of HIV and its association with HIV status. It was therefore needful to examine how Hong et al (2012) explored the correlation between HIV knowledge and HIV status. The authors in their Kenyan study of HIV negative and HIV positive participants concluded that knowledge of HIV was a pre-requisite for understanding living with HIV, or staying away from contracting the virus (Hong et al, 2012). Mean scores were used as parameter to assess HIV knowledge. Mean scores coded as high HIV knowledge was 81% or higher while scores lower than 81% were coded low mean scores. The variables in this study were analyzed with bivariate logistic regression, and HIV knowledge was associated with either positive or negative HIV status (Hong et al, 2012). This seemed to address the second research question with the attendant variable HIV knowledge. In my study, adoption of logistic regression model would be a good statistical test to actually predict the status of HIV through association with the relevant independent variables of interest. Prediction of HIV was based on disease status or level and magnitude of risk occasioned by exposure to infections.

Connecting gaps in literature to prospective method

Methods used by researchers to study telehealth as it related to HIV status had widely been quantitative. Specifically, surveys had played critical roles in data collections, and many studies based on telehealth had been conducted with cross-sectional design. Design of questionnaires must take into consideration that patients'

underlying trigger to use telehealth must be enshrined in multiple perception such as those found in the health belief model. Since surveys were effective ways of accessing individual clinical perceptions, they must be designed with current trends in telehealth use (Langbecker, Caffery, Gillespie, & Smith, 2017). In some other cases, adaptive approaches had been used to understand the concept of telehealth based on systematic resource management through learning by practically applying those resources and then watch out for results (Law, & Wason, 2014). However, in order to identify knowledge gaps in telehealth study approaches, Ekeland, Bowes, and Flottop (2012) used systematic reviews to arrive at a conclusion which recommended that combination of qualitative and quantitative approaches might be necessary to fully understand the relationship between telehealth and HIV. Extracting 50 reviews out of 1,593 articles, the authors concluded that large number of studies would be required to produce evidence-based conclusions regarding the effectiveness and unambiguous explanations of telehealth operations.

This cultivation of perception at multiple fronts was at individual level, and through necessity, required privacy. To build on the privacy assurance initiated before and during data collection through informed consent, exploration of the feasibility of telehealth for HIV status must now include factors that addressed assurances of secure digital communication lines via encryption which could safeguard data packets delivery (Jaatinen, Forsstrom, & Loula, 2002). The encouragement needed in the use of telehealth as a form of healthcare access might further be achieved if enough confidence in the ability of technology to provide needed safe remote services could be aligned with constructs that motivate individual health beliefs. Over all, this study had identified the

gap in the study of telehealth as an exploratory factor which had not been used effectively to predict the status of HIV in individuals within my study population (Ajala et al., 2015).

Summary and Conclusion

In this chapter, I presented the literature review of problems caused by inadequate healthcare access and how technology could be explored to address such problems given significant association between telehealth and HIV status. The chosen theoretical foundation was Health Belief Model, and I reviewed literature from studies that supported its constructs in consonance with major variables named in this study. Furthermore, previous studies that applied HBM were explored and correlated with the method chosen for the present study. Finally, the constructs of Health Belief Model were also aligned with components of telehealth where applicable.

Telehealth use as an emerging healthcare delivery system was gaining momentum in many parts of Nigeria especially in the Southwestern area Ajala et al (2015). The components of telehealth could be adapted to various uses along HIV prevention continuum. This could be in form of using telehealth for counseling high-risk individuals in terms of life style modification, compliance with medications, and counseling.

As an iterative process, the literature review in this chapter would provide the general platform where design and methodology to be used in the next chapter could utilize existing research from the themes drawn out from this chapter. The population of interest already described in this chapter could form the source of sample frame, define the sampling technique, define the inclusion and exclusion criteria, and could provide guide in describing the appropriate secondary data which would be capable of supplying the needed variables.

Chapter 3: Methods

Introduction

Existing literature reviews on Nigeria had suggested that telehealth and socioeconomic factors could be determinants of improved access to HIV prevention or care. However, despite this, telehealth had not been adequately studied in terms of its true feasibility for HIV status among the population of interest in this study. In Southwestern Nigeria, especially in rural and underserved areas, lack of proper access to treatment for people living with HIV and inadequate screening or counseling for people at risk for the virus had been predominant (Nigeria Demographic & Health Survey [NDHS], 2013). The purpose of this study was to explore the feasibility of telehealth as a form of healthcare access for HIV. In addition, socioeconomic factors needed to be examined to adequately understand HIV status within this population. Among common socioeconomic factors, the study focused on gender and HIV knowledge as the other main contributing variables. HIV status was the outcome variable. This study adopted a cross-sectional design with a quantitative approach. With the cross-sectional design, a quantitative study could be used to describe prevalence as a result of exposure to disease based on deficits in healthcare access, which by extension also could limit opportunities for HIV knowledge. This chapter describes the choice of design and the rationale for selecting the design, defines the target population, and states the sampling method and sampling frame. This chapter will also explain how the sample size was calculated and the nature and source of the secondary data to be used, as well as the intended instrument to be used for operationalization of variables. Furthermore, the determination of effect size and justification for its determination, selection of alpha level, and power analysis will be

done in Chapter 3. Finally, this chapter will provide a data analysis plan and address potential threats to validity. A discussion on the issues of ethics will also be done in this chapter.

Study Variables

The study was conducted based on three main contributing variables and one dependent variable. The main independent variable of interest was telehealth which was aligned with RQ1. Associations between this main contributing variable and the outcome of interest (HIV status) remained the focus of the study. Other main contributing variables were HIV knowledge and gender. HIV knowledge was addressed by RQ2. Level of HIV knowledge was measured as an ordinal variable (low, medium, high). Gender was addressed by RQ3.

In addition to these main variables, other possible confounding or modifying variables were socioeconomic factors such as income, education level, marital status, and residential neighborhood. Finally, the outcome variable is HIV status which is based on predictive association of telehealth while controlling for other associated covariates to check for spuriousness. The association between telehealth and HIV status can be explained while controlling for HIV knowledge as a potential confounder

Research Design, Rationale, and Test of Hypothesis

The advantage in controlling cost and minimizing time were partly the reasons for using secondary data which was to be applied to the study quantitatively. Using a quantitative approach, the feasibility of adopting telehealth could be assessed as a nominal group variable with two groups (yes/no) which translated to use or nonuse of telehealth among individuals in the six Southwestern states of Nigeria. This was an

effective way to actually hypothesize telehealth use in RQ1 which sought to strongly explore how feasible telehealth was for HIV prevention and management. My second main independent variable (HIV knowledge), was coded at ordinal level of measurement (low/medium/high), and was assessed with this question: "how much knowledge of the HIV virus do you have?" As for gender, only dichotomous (0 - male; 1 – female) responses were required. It was necessary to assess how usage of telehealth was associated with improved HIV status (increasing CD4 counts as a result of telehealth influence with ARV compliance, reduction in opportunistic infections, and better adherence to medications, particularly anti-retroviral drugs), hence the use of ordinal level of measurement to operationalize telehealth variable as reflected in research participants' weekly HIV education.

The quantitative research method for assessment of association rather than impact was appropriate for describing exposure and prevalence of disease, estimating its frequency, and examining time trends of populations because measuring of impact rather than association would suggest the need for interventional study (Friss & Sellers, 2009). This study had no intention to procure intervention, but rather assess feasibility of applying telehealth by presenting correlations with its effectiveness in HIV prevention or management. In constructing the research questions, associations were sought between telehealth and HIV status (RQ1), HIV knowledge and HIV status (RQ2), and gender and HIV status (RQ3).

Since many socioeconomic factors (age, marital status, education level, income, residential location) could be suspected in terms of possibly confounding the relationship between telehealth and HIV, there was a need for this study to examine measure of

association between telehealth and HIV status by computing the odds of becoming HIV positive before it actually happened, or prolonging life even after testing positive for the virus. Controlling for confounders could be made through stratification of each contributing group variables. However, in situations where any of these socioeconomic factors acted as both effect modifier and confounding variable, adjustment of such variables was contraindicated. Multiple correlational analyses could be conducted in order to assess relationships between independent variables and the dependent variable with particular attention to within groups and between groups in order to specifically investigate the interrelationships between all the independent variables as they each and jointly contributed to associations with the dependent variable. In particular, because this study was focused on exploring the feasibility of telehealth on HIV status, it was essential to infer some form of correlation between telehealth, gender, HIV knowledge, and HIV status.

The research questions for this study were:

RQ1: How feasible is telehealth use (measured dichotomously as nominal variable [yes/no] as in frequency of use in the form of text messaging, video conferencing, and teleconsulting) for HIV status (prevention or management) among individuals aged 17–34 in Southwestern Nigeria?

RQ2: Is level of HIV knowledge (knowledge of risks, screening, containment strategies, intention or willingness to use telehealth, and benefits of antiretroviral therapy) associated with positive or negative HIV status among individuals aged 17–34 in Southwestern Nigeria?

RQ3: Is there an association between gender (being a female or male as related to marital status, income, and education) and positive or negative HIV status?

Research Hypotheses

The following were the hypotheses for the study:

$H_0 1$: Telehealth use is not feasible in terms of HIV status among individuals aged 17–34 in Southwestern Nigeria.

$H_a 1$: Telehealth use is feasible in terms of HIV status among individuals aged 17–34 in Southwestern Nigeria.

$H_0 2$: There is no significant difference in HIV status among individuals aged 17-34 in Southwestern Nigeria based on HIV knowledge.

$H_a 2$: There is significant difference in HIV status among individuals aged 17-34 in Southwestern Nigeria based on HIV knowledge.

$H_0 3$: There is no association between gender and HIV status among individuals aged 17–34 in Southwestern Nigeria.

$H_a 3$: There is association between gender and HIV status among individuals aged 17–34 in Southwestern Nigeria.

The specified hypotheses was tested with chi square tests of association and logistic regression for the predictive values of the independent variables on the outcome of interest (HIV status) subject to their strength of associations. Logistic regression was the ideal test for correctly predicting HIV status as outcome based on the interactions between and within the groups included in the independent variables if independent variables were at measured at continuous level (Laerd Statistics, n.d.).

Methodology

Setting and Sample

The setting and sample of this study described the population and its characteristics, which was also to aid the inclusion and exclusion criteria. Sampling was discussed in detail in reference to the nature of the target population and its representativeness. The Southwestern Nigerian population remained culturally homogeneous, which essentially meant that inhabitants had common culture. This made it easy to generalize the results of this study without extreme consideration for many nonspecific demographics. The exact location and names of the facilities where the data came from in the six Southwestern state needed not be revealed as a further measure to protect identities, especially if such understanding was initiated by the data provider's Institutional Review Board (IRB), or such understanding was based on general principles of ethical standards expected of research undertakings as set forth by the Nigeria ethics board.

Population

The study population comprised of individuals between the age of 17 and 34 and resident in Southwestern Nigeria. These individuals were adjudged to be either at risk for HIV infections, or were already HIV positive. Also, this sample included individuals in this age group (17-34 years) who might or might not be HIV positive, but with their highrisk history traceable through questionnaires supplied during original data collection. Point estimates for this population were the mean, median, and variance. Prevalence was based on those reported in 2017, when the data was collected.

In Southwestern Nigeria which consisted of six states namely: Ekiti, Lagos, Ogun, Ondo, and Osun states, prevalence was recorded highest in Oyo state with 5.6% of the national prevalence in 2013 alone.

HIV Prevalence among individuals in Southwestern Nigeria

Table 1.

HIV Prevalence by State in Southwestern (SW) Nigeria in 2013

State	Prevalence by State (%)	Mean SW Prevalence (2.6)
Ekiti	0.2	
Lagos	2.2	
Ogun	0.6	
Ondo	4.3	
Osun	2.6	
Oyo	5.6	
TOTAL	**15.5**	

The sample population was selected based on available survey questionnaires around the same time regarding prevalence of HIV infections which had been documented from government surveys such as National Agency for the Control of AIDS (NACA). The result of merging of inserted data files from data source made it possible for me to select enough sample for the study. Essentially, I leaned towards a sample of more than 2000 because this would be a good representation of the study population based on data from previous studies in 2010 which estimated 6,548 as total HIV

prevalence in the region (Bashorun et al., 2014). The sample included individuals that met the specified inclusion criteria and because of the large sample size, and it would be easier to detect the effect and ensure that just .80 statistical power would be good enough. Finally, the sample size would increase the chances of generalizability.

Sampling and Sampling Procedures

Secondary data gave little or no control in terms of sampling. This was because not being part of the original collection crew tended to unobtrusively decontaminate the original data, which could not and should not be altered even during secondary use for different purposes (Frankfort-Nachmias, Nachmias, & DeWaard, 2015). As a result of this, and for the reasons of taking precautions against threats to validity, my intention was to check the sample size to see if it would be adequate for my study purpose and population. In addition, because I had a predetermined minimum sample size that I planned to use in mind, I described how I would have calculated my sample size. I intended to base my sample size on three items: alpha level ($\boldsymbol{\alpha}$ =.05), effect size, and statistical power because these three items would have influenced the required power in my study. The selected alpha level was .05 and this meant that only 5% chance was allowed for the possibility of a Type I error which essentially indicated appropriately rejecting my specified null hypotheses (Burkholder, 2010). Regarding effect size, the considerations of applying or not applying the independent variables as determinants of HIV status mimicked the occurrence of an intervention which in real sense was not part of the plan in this study, but essential in order to derive the M_1 and M_2 components of a standard effect size calculation in general (Mean Difference / Standard Deviation) and Cohen's *d* formula ($(M_1 - M_2) / SD$) in particular for the effect size calculation

(Burkholder, 2010). I planned for a medium size Cohen's *d* effect size (.50 – .80) because I was hoping for a very large sample size which made medium effect size easier to detect. This was more practicable than expecting large effect sizes in small samples (Burkholder, 2010). Finally, the statistical power represented the probability of a particular statistical test detecting a real effect in an inferential statistics (Burkholder, 2010). A large sample could stand a better chance of detecting effect of a mean difference between two groups, more precisely the relationship which existed or observed between two variables (Field, 2013). The statistical power desired was .80 in order to determine that the effect or group mean difference was detected 80% of the time meaning that null hypothesis would be rejected 80 times out of 100 repetitions of the study (Burkholder, 2010). This was feasible given my sample size which was expected to be large enough to enhance such detection. Thus, the type II error (β) was be limited to .20 (i.e. 1-β = .80). The power analysis could be done using the *t*-test family in correlation point bi-serial model with the g*power software version 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007). However, to avoid power estimation from appearing to lean towards continuous data, my variables which could behave like continuous variables would be coded as group variables. It was essential to estimate power with categorical variables in mind in order to make effects of interaction clear.

Sampling Technique

The total HIV prevalence in Southwestern Nigeria according to 2013 estimates had been documented to be 15.5% with a Southwestern regional mean prevalence of 2.6% (NACA, 2014). Since data source contained databases from six states namely: Lagos, Ogun, Osun, Oyo, Ekiti and Ondo states, This study strived to ensure

representativeness by adopting a probability sampling technique which would allow random selection of participants from each of those states by using proportional stratified technique followed by simple random sampling. Each state was treated as a stratum, and quantified according to its % proportion which would also be reflected in the raw population figures. Table 2 below assigns each stratum its % prevalence as illustrated below:

Table 2

Proportional Sampling of HIV Samples in Southwestern Nigeria

State	**% Prevalence**	**% of National Prevalence**	**% of Total S'West Prevalence**
	Mean [2.6]	**(3.4)**	**(15.5)**
Lagos	2.2	0.65	0.85
Ogun	0.6	0.18	0.23
Oyo	5.6	1.65	2.2
Ondo	4.3	1.26	1.65
Osun	2.6	0.76	1.0
Ekiti	0.2	0.06	0.08

In proportional stratified samples as depicted in Table 2, each group in the 6group samples ensured proper representation of each of the six groups (Frankfort-Nachmias, Nachmias, & DeWaard, 2015) which translated into the 6 states in Southwestern Nigeria. Whatever these proportional 6-group stratified samples reflected in the secondary data that came from each of the six Southwestern states was added together to constitute the single sampling frame and then a probability sampling technique could be administered to randomly represent the states in this homogeneous population. This ensured equal chance for each participant in the sample. Since this sample was being extracted from different states, it might be necessary to re-apply appropriate weight.

Data Collection

The secondary data was collected and stored in the archives of the AIDS Initiative Project in Nigeria (APIN). The facilities were located in every state of Nigeria with headquarters at Abuja. Access was gained into the necessary datasets through official request through application to the ethics committee of APIN and study conduction only started after Walden University's IRB approval on October 2, 2018. The datasets was screened for needed variables, and this was followed by necessary manipulations to merge, split, clean, and weight the resulting dataset from the various datasets that came from the archives guided by the appropriate inclusion and exclusion criteria. The data set that resulted from recruitment process during original research was thoroughly checked for procedures taken to minimize bias. Issues such as selection bias, recall bias during recruitment were particularly investigated to the best ability of the researcher. For example, the questionnaires used for data collection was inspected in the code book. The

scales that grouped constructs in the questionnaire items needed to be tested for their Cronbach's alpha values to determine their internal consistency with SPSS. This was because the integrity of the data collection process was critical. Possibilities of missing data emerged from data entry errors, intentional omission of responses by respondents were checked to examine possible missing data. Recall bias was also possible during the data collection process since people often forget previous behaviors that occurred depending on how long ago such behaviors occurred. In addition, because of the sense or feeling of shame, respondents might choose to provide inaccurate responses or none at all in order to avoid perceptions of moral decadence due to the shame that came with multiple sex partners, nonadherence to using condoms, illicit drug use and irresponsible needle sharing.

Inclusion and exclusion criteria

Included in this research activity were people at risk for HIV, or HIV-positive individuals, 17 – 34 years old, resident in Southwestern Nigeria and with medical and social history linked to some or all of the following; worked as a sex worker, had multiple sex partners, engaged in intravenous drug use, had limited healthcare access, lived in underserved, or distant locations to available HIV screening and counseling centers. Telehealth use or otherwise was also be added as a criterion for selection as applicable. Finally, all individuals included in the study had given their written consent before data collection, and the APIN institutional review board (IRB) approval was sought and secured as well as Walden University's own IRB approval. Excluded from the study were non-resident of Southwestern Nigeria, outside the age group 17 – 34, and with no evidence of high-risk lifestyle for HIV. Nomadic and institutionalized subjects were also

excluded from this study due to problem with accessing this sub-population and deeper ethical constraints.

Instrumentation

As secondary data user, I did not develop any instrument for this study. The codebook had been compiled, and the only adjustments was done during data cleaning to conform with inclusion criteria such as recoding variables to create additional variables but with no alteration to original data. The datasets for this study were obtained from the Acquired immune-defficiency syndrome (AIDS) Prevention Initiative in Nigeria (APIN) Abuja, Nigeria. All applicable instruments used by original researchers were obtained and inserted into the Appendix. What is most certainly available were data from weekly HIV counseling in form of aptitude test samples. The data collection points were at various participating facilities of APIN in all six Southwestern states of Nigeria. The custodians of the data sets (APIN) was a non-governmental, and did not charge fees for data supply. The codebook contained survey questionnaires which were aligned with the data set that was supplied and used to answer the research questions.

Operationalization of Constructs

In survey questionnaires, responses were sought for variables named or closely identical to gender, HIV knowledge, and use of technology (telehealth). The questionnaires reflected the independent variables as they related to their measurability. This was necessary in order to analyze their relationships, and correlation not only within-groups, but also between groups as they jointly or separately contributed to the strength of associations with the outcome variable (HIV Status). Possible confounding factors were listed as age, marital status, income, residential location/neighborhood, and

gender among others. Logistic regression and chi-square tests were used to assess associations.

Description and measurement of variables which were classified according to their roles as either dependent, independent or possible confounders were operationalized according to responses in the survey questionnaires after data cleaning as enumerated in the following order:

Dependent variable

- *HIV STATUS* - Potential responses were dichotomous in the form of (1 – Negative "tested negative for HIV virus"; 2 – Positive "tested positive for HIV virus")

Independent variables

- *Telehealth Use* – Potential responses will be (yes/no) and measured at nominal level (This variable essentially operationalized telehealth (specifically *m*Health [texting with mobile phones, PDA's, video conferencing, teleconsulting]) for HIV status (prevention or management).
- *HIV knowledge* – Potential responses were (1 – Low; 2 – moderate; 3 – high) and measured at ordinal level. This was applicable to research question 2: "Is level of HIV knowledge (knowledge of risks, screening, containment from further spreading the virus, and benefits of antiretroviral therapy) associated with positive or negative HIV status among individuals aged 17 – 34 in Southwestern Nigeria? Sample questions that determined HIV knowledge were: "Can a person become HIV positive by shaking hands with an infected person?", "How far can avoidance of multiple sex partners prevent HIV?", and "How knowledgeable are you about condom use?" On a five-point Likert scale, HIV knowledge was

measured with this questionnaire items which were already present in secondary data that was used.

- *Gender* – Potential responses were (1 – Male; 2 – Female), categorical, dichotomous and measured at nominal level.

Potential Confounding variables

- *Age* – Potential responses will be direct answer in years at interval level.
- *Marital status* – Potential responses are (1 –Single; 2 – Married) and measured at nominal level.
- *Residential location* – Potential responses are (1 - Rural; 2 – Urban), and measured at categorical scale based on these two distinct locations which clearly defined the effective use telehealth as related to distance.

Data Analysis Plan

Data analysis plan were both descriptive and inferential. Descriptive statistics was used to explore each variable with a view to explaining their characteristics using univariate analysis. It was necessary to describe these variables as well as infer relationships. Inferential statistics was needed to analyze the relationships between each independent variable and the dependent variable in order to deeply understand the feasibility of telehealth in particular, for HIV status. Using inferential statistics, there was the need for further understanding of how confounding could create spuriousness between the IVs and the DV.

Descriptive Analysis

Descriptive statistics included the summaries of the distribution of various scores using tables and/or graphical representations, in addition to descriptive statistical indices (Forthofer, Lee, & Hernandez, 2007). Each quantitative variable was analyzed with descriptive univariate statistics which showed frequencies from where indices such as mean, mode, median, variances, and standard deviation were summarized with the use of statistical indices to assess measures of central tendency and dispersion (Forthofer, Lee, & Hernandez, 2007). In order to be more cautious about outliers since they could overestimate range, Trochim (2006) suggested that standard deviation could best estimate dispersion. SPS version 25 was the choice of software to handle descriptive statistics. Frequencies were used to detect missing data, and those data were accordingly deleted or retained if they did not constitute up to 5% of the data spread. According to McKnight, Souraya, and Figueredo (2007), such missing data would be considered missing completely at random (MCAR).

Inferential Analyses

Inferential analysis tended to infer relationship (s) among variables, with the purpose of generalizing such relationship found in the sample to a much larger population with similar characteristics (Frankfort-Nachmias, Nachmias, & DeWaard, 2015). *Univariate Analysis.* This was used to assess one variable at a time. Univariate analysis was valuable in conducting descriptive statistics and producing frequencies, graphical assessment of a single variable such as assessment of normality in histograms. For each independent variable and the dependent variable, this analysis was required to fully understand the nature of their data.

Bivariate and Multivariate Logistic Regression

Logistic regression used predictability to express associations between predictor (s) and the outcome variable. But there would be greater application of chi-square tests if the variables were categorical. In this statistical logistic regression test, the predictor variables needed to be continuous variables but the outcome variable which was subject to predictive values must be dichotomous categorical variable (Laerd Statistics, n.d.). Predictor variables could either be one or more variables, which meant regression could either be a bivariate or multivariate inferential statistical test. In my study, this test availed me the opportunity to compare multiple interactions to determine HIV status among contributing factors such as HIV knowledge, telehealth, gender, and other socioeconomic factors such as marital status, age, residential neighborhood, and income.

In this study, bivariate analysis were used to compare and match two variables (one independent and the dependent variable) to assess relationship. This could be telehealth, HIV knowledge, or gender as each variable was related to HIV status. This statistical test was good when each independent variable needed to be examined separately with the dependent variable to assess individual variable's influence on the outcome variable. Specifically, to my study, bivariate analysis was used to assess association and predictability of HIV status from each independent variable where appropriate.

As stated in the preceding paragraph, multivariate regression was valuable in analyzing association among several contributing factors and one outcome variable such as HIV status. Particularly in situations where there were several suspected contributing factors (including covariates among socioeconomic factors), multivariate analysis could

help to resolve confounding by adjusting for them. Possible confounders in my analysis were age, income, marital status, and residential locations (based on distance from care center). Applying stratification to suspected confounding group variables helped to disentangle spurious associations through this statistical test (Forthofer, Lee, & Hernandez, 2007).

Statistical Software

The desired software was SPSS (Predictive Analytics Software [PASW]) and version 25 was used for analyses. G*power version 3.1.9.2 was used to ascertain enough statistical power for the study as well as determine effect sizes. In the data sources, data files with .SAV extensions were preferred, because they were compatible with SPSS, and if other file extensions (such as .SAS, XLS etc.) were used, they were needed to convert them to SPSS first as part of data preparation before analyses. The data was specifically exported from Excel spreadsheets into SPSS from its default file document prior to any manipulations.

Data Preparation

Part of ensuring data stability and a smooth inferential statistics was to make sure that the data was clean. Common errors such as missing data which usually resulted data entry errors were checked and corrected through descriptive statistics which displayed the frequencies. Established methods of handling missing data included list-wise deletion, pair-wise deletion, hot deck imputation, mean substitution, or the regression substitution (Howell, 2007). It was a matter of using which of these strategies was needed.

Examining code books very critically had the potential to reveal negatively worded codes which might require reverse coding. Additionally, survey questionnaires

might reveal interview errors, particularly in form of skipped responses, and they all needed to be repositioned to avoid reduced validity of data (Field, 2013). Histograms might be used to check for existing normality of data, which would also help to determine the type of statistical test to be used for inferential analysis. If this normality did not exist, decision about alternative, corresponding non-parametric test would then be made (Laerd Statistics, n.d.).

How feasible telehealth use was (measured as ordinal variable [used/not used]) in form of text messaging, video conferencing, teleconsulting) for HIV status (prevention or management) among individuals aged 17 – 34 in Southwestern Nigeria? The occurrence of telehealth use could explain its association and feasibility for HIV status.

Statistical Analysis

This study planned to conduct statistical tests using logistic regression models for the purpose of predicting the categories of the outcome of interest. There was also the need to use chi-square to test associations among variables. In HIV prevention research, follow up is very important because it is a disease which is strongly tied to behavior. In support of data cleaning, conducting descriptive statistics helped to identify the missing data through display of the frequencies. The normality of the data could be assessed through histograms and regression lines showing the relationship between or among the variables (George & Mallery, 2011). To this end, simple t-tests could be conducted to test for normality of the data. The regression model from logistic regression tests would also show the proximity of the data along the regression lines, as well as expose the outliers which might then be deleted to improve the integrity of the data set. The purpose of this study was partly to examine the impact of predictor variables such as telehealth, HIV

knowledge, selected socioeconomic factors, particularly gender on outcome variable (HIV STATUS). Among individuals at risk for HIV, analysis of logistic regression lines would be focused on whether these lines crossed each other or not. Logistic regression would also avail strong validity through revealing the necessary odds ratios (OR) to evaluate the extent of risk inherent in the lack of adequate health care access from alternate approaches such as telehealth (Szklo & Nieto, 2014). By providing the odds ratio as a result of logistic regression tests, the goal of the study (exploration of telehealth and socioeconomic factors on HIV status) stood a better chance of for assessment so that policy makers could begin to seek appropriate, wider utilization of telehealth as a vehicle for health care access, and positive social change among people at risk for, or already infected with HIV.

From survey questionnaires, it was possible to collect data from HIV patients about the period between when they actively began certain high-risk behaviors, and the time they tested positive for HIV. If more than one contributory factor led to such status, we needed to analyze the interactions between those independent variables, and calculate the odd ratios. Rationale for selecting logistic regression over linear regression was value versus probability (Field, 2013). This was true because once HIV positive test was reported, value of infection did not count, so it became less relevant to measure such data at continuous level since there would be no big or small HIV status, the response would be stated as either positive or negative status. Logistic regression reports probabilities and it would be either Yes or No on HIV status. Finally, in logistic regression, calculation of odds ratio effectively added to the predictive power of the independent variables, hence the need to compute the odds of positive HIV status given these contributing factors.

Statistical Test of Assumptions

There were plans to conduct regression models, but such plans came with possible pitfalls from assumptions that could reduce validity of research if violated. Compliance with these assumptions would enhance the accuracy of prediction of the outcome variable, and test the fitness of the regression model to the data. Complying with assumptions are also good to properly analyze the variation in the outcome variable which could be explained by the interactions of the independent variables, and finally, enhance ability to test the hypotheses on the regression equation since this is a clear way to understand the fitness of data into the regression line. It was therefore planned that these assumptions of the types of statistical tests to be conducted were included in the data analysis plan. The assumptions of logistic regression were listed as follows:

Independence of Errors

Usually referred to variabilities in the outcome variable, and it would usually be as a result of violation of independent observations in the predicting variables. This could influence the probability of what category the outcome variable fell into, which would otherwise be known as over-dispersion and it could incorrectly decide the *p* value in the outcome variable (Laerd Statistics, n.d.).

Multicollinearity

There should not be too much linearity between any two or more independent variables. Precisely, extreme correlation between two or more independent variables would make it very difficult to decide which of them contributed to the variances that explained the predictability in outcome variable. For example, a correlation of 1 or near 1 between two independent variables triggers clumsy explanation of each of them in the

outcome variable. (Laerd Statistics, n.d.). A typical example could be HIV knowledge, a main independent variable (IV) and education level, a possible covariate. Multicollinearity may exist because both tended to address learning.

Threats to Validity and Reliability

Validity

Typically, unclean data could be threats to validity. What I was looking for in the secondary data to be used were problems with missing data, how participants were selected, how survey was conducted, and presence of any bias (usually selection and recall). Regarding external validity, interaction effects of my categorical variables needed to be well explained through regression analysis and other applicable tests. By using regression to explain the independent variables as they predicted outcomes or explained associations where applicable, the risk of additive interaction between two contributing factors creating such influence simultaneously on the dependent variable was minimized (Analysis Factor, 2018). For example, there was possibility of additive interaction between HIV knowledge and gender which could simultaneously influence HIV status thereby creating some ambiguity in such influence. If the dependent variable were regressed on these independent variables one at a time, the influences would better explain and improve the validity of their interaction (Analysis Factor, 2018).

Internal and External Validity

The extent of clear conclusions regarding drawn causality from the study would amount to the internal validity of the study (Crosby, DiClemente, & Salazar, 2013). After sampling had been done, the participants who had been assigned to groups remained in such assigned groups to sustain internal validity (Creswell, 2009). Problems would

typically arise if participants that were randomized into groups based on similar characteristics turned out to differ based on certain demographic attributes such as HIV knowledge, attitudes towards technology (in this case, telehealth) or even gender, the strength of validity of cause-effect analysis would have been terribly weakened (Crosby et al., 2013). Threat to another type of validity which was usually due to incorrect participants matching but with different resultant threat was that of external validity.

External validity referred to problems with generalizability (Creswell, 2009). The sample must be correctly generalizable to the much larger population (Crosby et al., 2013). To avoid threats to external validity, the extent to which inferences were drawn from a sample must correctly reflect the population of interest and not beyond that (Creswell, 2009; Szklo & Nieto, 2014). Specific caution was taken to prevent overmatching in the groups, as this would negatively affect external validity. Furthermore, the characteristics of the sample must correctly reflect those from the larger population (p.162). Finally, the study needed to address avoiding construct and statistical conclusion validity.

Statistical Conclusion Validity

Threat to this type of validity occurs when insufficient statistical power is applied to run a statistical test. This usually leads to wrong inferences from the contributing variables in explaining the outcome of interest (Creswell, 2009). Therefore, if the data is not normally distributed, nonparametric tests may be more suitable to test the hypothesis especially if the potential violation of critical assumptions for such test cannot be robustly overcome. Hypothesis needs to be operationalized by appropriate statistical test to ensure validity of correctly rejecting a null hypothesis.

Reliability

Reliability of instruments could be based on checking integrity of the survey instruments used for data collection. The data regarding mHealth use revolved around frequency and magnitude of use. This could only be measured with questionnaire items and the reliability confirmed with Cronbach's alpha for internal consistency (Frankfort-Nachmias, Nachmias, & DeWaard, 2015). Regarding the outcome variable, measuring instruments were essentially blood collection equipment which were supposed to be subjected to calibration. By the nature of being secondary data, calibration was presumed done at the time of original data collection to measure CD4 counts for HIV status determination and continuous monitoring.

Ethical Procedures

Institutional Review Boards (IRB) from Walden University and APIN both ensured that appropriate permissions were sought and received before studies that involved human subjects were conducted. IRB approval number 10-02-18-0456300 dated October 2, 2018 was obtained from Walden University before my study began on the secondary data. My study involved vulnerable humans in terms of stigma, legal issues with their life styles, and Health Insurance Portability and Accountability Act (HIPAA). Since medical records received heavy privacy protection, IRB additionally ensured that university rules were adhered to, before granting permission to apply officially for secondary data. De-identification of the research participants was another ethical preference which makes it a requirement to protect identities of human research subjects. Finally, informed consent was required to complete ethical obligations of the researcher and the data source. The researcher is ethically required to check for adherence to

informed consent procedures during the original data collection, in order to make such data valid. To this end, I had completed the training by the National Institutes of Health (NIH) for the protection of human research participants since December 17, 2015 and my certificate of completion number was 1938414. IRB approval was obtained from Walden, as required.

There are no conflict of interest regarding this study. No connection whatsoever with the intended data source, no financial incentives are linked to this study and the sole purpose of the data being sought from University College Hospital's APIN/PEPfAR facility is for my dissertation.

Agreements for data access

The agreement to use secondary data from APIN was granted in late September, and was be turned in to Walden University IRB in addition to other required documents. Collection of data commence as soon as my proposal was approved, and my Walden IRB approval has been granted shortly after APIN also gave their own permission.

Summary

In this chapter, a detailed discussion of my study design and methodology had been presented, and this included research questions with their relevant hypotheses. There was a detailed explanation of my intended sample size and sampling technique. The sample was going to be drawn proportionally from each state that constitute the Southwestern part of Nigeria, and then sampled randomly. The research design was cross-sectional with a quantitative approach. Secondary data handling including its preparation for statistical tests was fully explained noting the expected barriers that might come up in the course of the study from this point henceforth, and how I planned to

mitigate those challenges. The population of study was individuals who were at risk for, or already living with HIV, aged 17 to 34 and resident in Southwestern Nigeria. Declared outcome of interest was HIV status, and the hypotheses were tested based on three contributory factors, telehealth, HIV knowledge, and gender. Potential confounding variables such as age, education level and socioeconomic factors were also assessed for spuriousness. For each variable, level of measurement was mentioned, and their coding was explained. I also revealed the choice of logistic regression and chi-square tests of association in my data analysis plan. Finally ethical obligations were discussed as well as IRB permissions from Walden University and from the data source. Chapter 4 detailed the results from statistical analysis from the secondary data, how effect sizes were actually represented, and the statistical power used.

Chapter 4: Results

Introduction

This chapter presents the study conducted after proposal approval. The study was based on 2017 HIV secondary data collected by the Harvard-sponsored AIDS Prevention Initiative in Abuja, Nigeria. The study focused on the research topic by using appropriate variables as described in the proposal with the guidance of inclusion criteria.

This study was conducted using both descriptive and inferential statistics to assess the feasibility of telehealth for HIV status among individuals aged 17 to 34 in Southwestern Nigeria who were living with HIV or at risk for the disease at the time of the study. The APIN dataset provided a sample containing 2,228 cases extracted from a proportionally drawn and merged population of six Southwestern states totaling 28,700 participants in 2017 using inclusion criteria. Inclusion criteria were that individuals were between 17 and 34 years and either used or did not use mobile phones to receive HIV/AIDS intervention in the areas of treatment or prevention. Determining telehealth feasibility for HIV status required assessments of associations between the two variables, taking into consideration other possible confounding variables.

In order to test the hypothesis for RQ1, it was necessary to establish a relationship between telehealth and the dependent variable HIV status. If a null hypothesis can be rejected, the alternative hypothesis will establish feasibility. Participants' telehealth use as the main independent variable also took into consideration other sociodemographic variables such as age, gender, HIV knowledge, marital status, and residential location (urban versus rural) as they were found in the dataset. Use of mobile phone less than once was considered non-use of telehealth. The Nigerian Southwestern states included in the data were

Lagos, Oyo, Ondo, Ogun, Osun, and Ekiti states. The main variables in the study were analyzed using descriptive statistics. In addition to the main independent variables telehealth, HIV knowledge, and gender, other independent variables included age, marital status, and residential location. The outcome variable of interest was HIV status, which involved participants living with HIV as well as participants who were still negative but at high risk for the disease.

Research Questions and Hypotheses

The research questions for this study were:

RQ1: How feasible is telehealth use (measured dichotomously as nominal variable [yes/no] as in frequency of use in the form of text messaging, video conferencing, and teleconsulting) for HIV status (prevention or management) among individuals aged 17–34 in Southwestern Nigeria?

RQ2: Is level of HIV knowledge (knowledge of risks, screening, containment strategies, intention or willingness to use telehealth, and benefits of antiretroviral therapy) associated with positive or negative HIV status among individuals aged 17–34 in Southwestern Nigeria?

RQ3: Is there an association between gender (being a female or male as related to marital status, income, and education) and positive or negative HIV status?

Research Hypotheses

The following were the hypotheses for the study:

$H_0 1$: Telehealth use is not feasible in terms of HIV status among individuals aged 17–34 in Southwestern Nigeria.

$H_a 1$: Telehealth use is feasible in terms of HIV status among individuals aged 17–34 in Southwestern Nigeria.

$H_0$2: There is no significant difference in HIV status among individuals aged 17-34 in Southwestern Nigeria based on HIV knowledge.

H_a2: There is significant difference in HIV status among individuals aged 17-34 in Southwestern Nigeria based on HIV knowledge.

$H_0$3: There is no association between gender and HIV status among individuals aged 17–34 in Southwestern Nigeria.

H_a3: There is association between gender and HIV status among individuals aged 17–34 in Southwestern Nigeria.

Data Analysis

In this section, each variable was described using univariate analysis. There were three independent variables (telehealth, HIV knowledge, and gender), and one dependent variable (HIV status). Descriptive statistics explained the main independent variables in addition to other explanatory sociodemographic variables. Among the independent variables, age and weekly HIV counseling sessions were the only continuous variables found in the data set. Weekly HIV counseling sessions were important in estimating and measuring HIV knowledge. This might play a role in determining strength, magnitude, and direction of their association with HIV status in inferential statistics.

Descriptive Statistics

The data were analyzed using SPSS version 25. The main independent variable (mobile phone use) in addition to age, HIV knowledge, marital status, gender and residential location, was a categorical variable. A one-sample *t* test was performed to compare population with hypothesized mean. For example, attendance requirements at the counseling centers were a minimum of 14 weeks and maximum of 51 weeks out of 52

possible weeks in 2017. With 33 being a good number, it was used as reference for comparison in the one-sample *t* test. Tests of normality for the data distribution in these two continuous variables (age and weekly HIV counseling) were conducted in compliance with assumptions of normality.

HIV Status

In the sample (n = 2,228), a total of 910 participants (40.8%) responded as "yes" to testing positive for HIV, while 1,318 participants (59.2%) responded as "no" (see Table 3).

Table 3

Frequencies for HIV Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Positive	910	40.8	40.8	40.8
	Negative	1318	59.2	59.2	100.0
	Total	2228	100.0	100.0	

Table 4

*Gender * HIV Status Crosstabulation*

			HIV Status		
			Positive	Negative	Total
Gender	Male	Count	238	448	686

		Expected Count	280.2	405.8	686.0
		% within Gender	34.7%	65.3%	100.0%
		% within HIV Status	26.2%	34.0%	30.8%
		Adjusted Residual	-3.9	3.9	
	Female	Count	672	870	1542
		Expected Count	629.8	912.2	1542.0
		% within Gender	43.6%	56.4%	100.0%
		% within HIV Status	73.8%	66.0%	69.2%
		Adjusted Residual	3.9	-3.9	
Total		Count	910	1318	2228
		Expected Count	910.0	1318.0	2228.0
		% within Gender	40.8%	59.2%	100.0%
		% within HIV Status	100.0%	100.0%	100.0%

Of the 910 participants who reported positive HIV status, 672 (73.8%) were females while 238 (26.2 %) were males. This reflected what several studies had reported over the past several years about females being more highly infected with the virus than males (Oseni, Okafor, & Sekoni, 2017). The remaining 1,318 participants who tested negative but still at high risk for the disease comprised of 870 (66%) females and 448 (34 %) males (see Table 4).

In Table 5, this study reported the association between HIV status and residential location in terms of rural or urban setting, and distance to HIV care centers. In their

subSaharan study of HIV and transportation-related attendance problems with HIV care centers, Lankowski et al (2014) reported higher HIV prevalence in rural than urban communities.

Table 5

*Residential Location * HIV Status Cross tabulation*

			HIV Status		
			Positive	Negative	Total
Residential Location	Rural	Count	506	752	1258
		Expected Count	513.8	744.2	1258.0
		% within Residential Location	40.2%	59.8%	100.0%
		% within HIV Status	55.6%	57.1%	56.5%
		Adjusted Residual	-.7	.7	
	Urban	Count	404	566	970
		Expected Count	396.2	573.8	970.0
		% within Residential Location	41.6%	58.4%	100.0%
		% within HIV Status	44.4%	42.9%	43.5%
		Adjusted Residual	.7	-.7	
Total		Count	910	1318	2228
		Expected Count	910.0	1318.0	2228.0

	% within Residential Location	40.8%	59.2%	100.0%
	% within HIV Status	100.0%	100.0%	100.0%

The HIV status of the participants from the rural community reflected more positive tests (506 of 910 [55.6%]) than those from urban communities (404 of 910 [44.4 %]) see Table 5). This is also a reflection of higher prevalence of HIV in rural than urban areas, which may also be linked to the distance to the cities where HIV clinics that provided screenings and counseling for HIV prevention were located.

Table 6

Frequencies for Mobile Phone Use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	1459	65.5	65.5	65.5
	No	769	34.5	34.5	100.0
	Total	2228	100.0	100.0	

In all, 1,459 (65.5%) respondents used telehealth to access care for their HIV status while 769 (34.5%) did not use telehealth as shown in the frequency table (see Table 6)

Table 7

HIV Status Mobile Phone Use Crosstabulation

			Mobile Phone Use		
			Yes	No	Total
HIV Status	Positive	Count	621	289	910
		Expected Count	595.9	314.1	910.0
		% within HIV Status	68.2%	31.8%	100.0%
		% within Mobile Phone Use	42.6%	37.6%	40.8%
	Negative	Count	838	480	1318
		Expected Count	863.1	454.9	1318.0
		% within HIV Status	63.6%	36.4%	100.0%
		% within Mobile Phone Use	57.4%	62.4%	59.2%
Total		Count	1459	769	2228
		Expected Count	1459.0	769.0	2228.0
		% within HIV Status	65.5%	34.5%	100.0%
		% within Mobile Phone Use	100.0%	100.0%	100.0%

Specifically among those who used mobile phones (n=1,459), 838 (57.4 %) participants reported negative HIV status while 621 (42.6 %) participants reported positive HIV status. This indicated that mobile phones were being used more frequently

for prevention of HIV than they were being used to manage the disease after infection had already occurred (Table 7).

Table 8

*Mobile Phone Use * HIV Knowledge Crosstabulation*

			HIV Knowledge			
			Low	Medium	High	Total
Mobile Phone Use	Yes	Count	175	626	658	1459
		Expected Count	354.9	507.5	596.6	1459.0
		% within Mobile Phone Use	12.0%	42.9%	45.1%	100.0%
		% within HIV Knowledge	32.3%	80.8%	72.2%	65.5%
		Adjusted Residual	-18.7	11.1	5.6	
	No	Count	367	149	253	769
		Expected Count	187.1	267.5	314.4	769.0
		% within Mobile Phone Use	47.7%	19.4%	32.9%	100.0%
		% within HIV Knowledge	67.7%	19.2%	27.8%	34.5%
		Adjusted Residual	18.7	-11.1	-5.6	
Total		Count	542	775	911	2228
		Expected Count	542.0	775.0	911.0	2228.0

		% within Mobile Phone Use	24.3%	34.8%	40.9%	100.0%
		% within HIV Knowledge	100.0%	100.0%	100.0%	100.0%

Out of the participants who answered "yes" to mobile phone use (n =1,459), 658 (45.1%) fell into the high category in this three-group (low/medium/high) variable and that accounted for nearly four times as those who responded in the low category (175; 12.0%). HIV knowledge was determined by weekly post-counseling aptitude tests (PCAT) usually made up of 20 questions which grouped respondents who consistently answered 18 questions or more [A] correctly as having "high HIV knowledge"; 15 – 17 [B] correct answers as having "medium HIV knowledge"; and less than 13[C] correct answers was considered "low HIV knowledge" (Appendix F and Appendix G).

Table 9

Mobile Phone Use HIV Status Crosstabulation

			HIV Status		
			Positive	Negative	Total
Mobile Phone Use	Yes	Count	621	838	1459
		Expected Count	595.9	863.1	1459.0
		% within Mobile Phone Use	42.6%	57.4%	100.0%

		% within HIV Status	68.2%	63.6%	65.5%
	No	Count	289	480	769
		Expected Count	314.1	454.9	769.0
		% within Mobile Phone Use	37.6%	62.4%	100.0%
		% within HIV Status	31.8%	36.4%	34.5%
Total		Count	910	1318	2228
		Expected Count	910.0	1318.0	2228.0
		% within Mobile Phone Use	40.8%	59.2%	100.0%
		% within HIV Status	100.0%	100.0%	100.0%

In this study, participants who used mobile phones for their HIV status (621) were more than twice as many as those who did not use mobile phones for HIV status (289) (see Table 9).

Telehealth

Results from figure 2 below show proportional telehealth use (mHealth version) as the main independent variable. In the bar chart, mobile phone users contained more respondents who were at risk for HIV but had not tested positive for the disease (slightly more than 800), while those who used mobile phones and were now living with HIV were slightly more than 600 (see Fig. 2). Among those who did not use mobile phone for their HIV status, nearly 250 respondents reported having tested positive for HIV while nearly 500 among this group still remained HIV negative, despite being at high risk for

the disease.

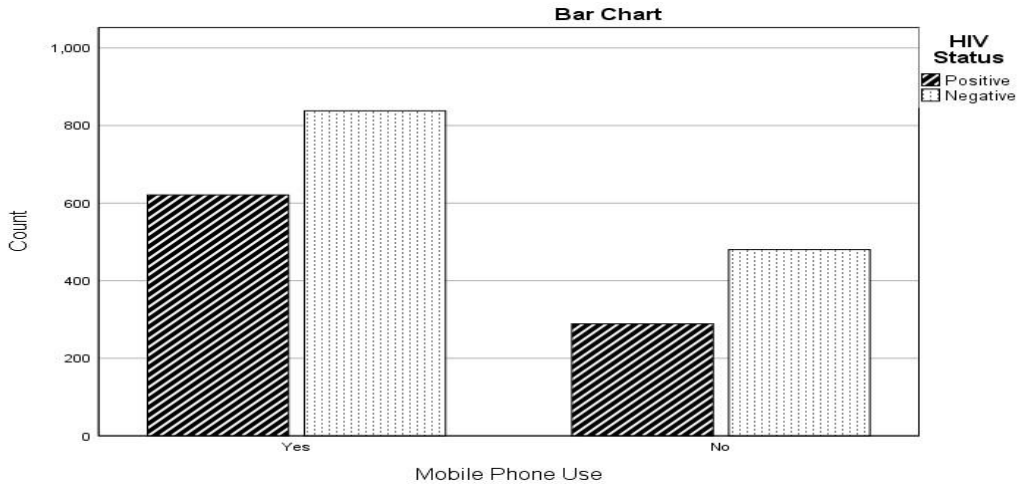


Figure 2. Mobile phone use and HIV status.

Residential Location, Mobile Phone Use, and HIV Status

Existing research showed that mobile phone use had shown tendency to provide alternative health care access to people living with HIV or at risk for the disease in overcoming the challenge posed by distance from HIV clinics (Ajala, Adetunji, & Akande, 2015). In Table 10, 787 (53.9 %) of all mobile phone users for HIV care access came from rural communities while 672 (46.1%) live in the cities where the clinics are disproportionally located.

Table 10

Residential Location Mobile Phone Use Crosstabulation

			Mobile Phone Use		
			Yes	No	Total
Residential Location	Rural	Count	787	471	1258
		Expected Count	823.8	434.2	1258.0

		% within Residential Location	62.6%	37.4%	100.0%
		% within Mobile Phone Use	53.9%	61.2%	56.5%
		Adjusted Residual	-3.3	3.3	
	Urban	Count	672	298	970
		Expected Count	635.2	334.8	970.0
		% within Residential Location	69.3%	30.7%	100.0%
		% within Mobile Phone Use	46.1%	38.8%	43.5%
		Adjusted Residual	3.3	-3.3	
Total		Count	1459	769	2228
		Expected Count	1459.0	769.0	2228.0
		% within Residential Location	65.5%	34.5%	100.0%
		% within Mobile Phone Use	100.0%	100.0%	100.0%

HIV Knowledge

Results from Table 11 showed significant Pearson's and Spearman's correlation between mobile phone use and HIV knowledge (p <.005).

Table 11

Symmetric Measures

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	-.288	.021	-14.205	.000[c]
Ordinal by Ordinal	Spearman Correlation	-.267	.022	-13.081	.000[c]
N of Valid Cases		2228			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Table 12 shows that 911 of 2,228 (41 %) possessed high HIV knowledge, with 775 of 2,228 (35 %) in the medium category, and 542 of 2,228 (24 %) in the low HIV knowledge category (Also see Appendices F and G).

Table 12

Frequencies for HIV Knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low	542	24.3	24.3	24.3
	Medium	775	34.8	34.8	59.1
	High	911	40.9	40.9	100.0

	Total	2228	100.0	100.0

Residential location

Since telehealth is about remote health care access, residential location is also a main variable which is being assessed as a covariate for feasibility for HIV status. Southwestern Nigeria still suffers access deficit in traditional HIV care. Nearly 70% of the population still live in the rural areas where HIV clinics are hard to come by (AVERT, 2017; Abah, 2014). Table 13 shows that 1,258 respondents (56.5 %) were domiciled in rural areas while 970 (43.5 %) lived in the urban communities.

Table 13

Group Statistics for Residential Location

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rural	1258	56.5	56.5	56.5
	Urban	970	43.5	43.5	100.0
	Total	2228	100.0	100.0	

Gender

HIV infection among females in Southwestern Nigeria had followed the trend of disproportionate HIV infection rates which is typical of sub-Saharan Africa

(Kharsany, 2016). In my sample, females who reported positive HIV status gender-wise, 604 out of 825 (73.2 %) were about three times the number of males 221 out of 825 (26.8 %) who reportedly tested positive for the disease (see Table 14).

Table 14

Gender HIV Status Crosstabulation

			HIV Status		
			Positive	Negative	Total
Gender	Male	Count	221	465	686
		Expected Count	254.0	432.0	686.0
		% within Gender	32.2%	67.8%	100.0%
		% within HIV Status	26.8%	33.1%	30.8%
		% of Total	9.9%	20.9%	30.8%
		Adjusted Residual	-3.1	3.1	
	Female	Count	604	938	1542
		Expected Count	571.0	971.0	1542.0
		% within Gender	39.2%	60.8%	100.0%
		% within HIV Status	73.2%	66.9%	69.2%
		% of Total	27.1%	42.1%	69.2%
		Adjusted Residual	3.1	-3.1	

Total	Count	825	1403	2228
	Expected Count	825.0	1403.0	2228.0
	% within Gender	37.0%	63.0%	100.0%
	% within HIV Status	100.0%	100.0%	100.0%
	% of Total	37.0%	63.0%	100.0%

Weekly HIV Counseling

In table 15, a one-sample *t* test was conducted to compare the scores in weekly HIV counseling with a reference number derived from 33 weeks of HIV counseling attendances. The mean weekly attendance within the sample was 31.69 (*SD* ± 8.7).

Table 15

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Weekly HIV Counseling sessions	2228	31.69	8.704	.184

In Table 16, mean attendance significantly compares to the test value of 33 ($p <$ .0005). Mean difference was -1.31 (*CI* 95%; -1.67, -.95). -1.67 (lower boundary of confidence interval) and -.95 (upper boundary of confidence interval) did not include zero, therefore the difference was significant. This result called for need to improve

attendances at HIV clinics, and this may be required for improved health care access where telehealth may play a complementary role to traditional health care access.

Table 16

One-Sample Test for Weekly HIV Counseling

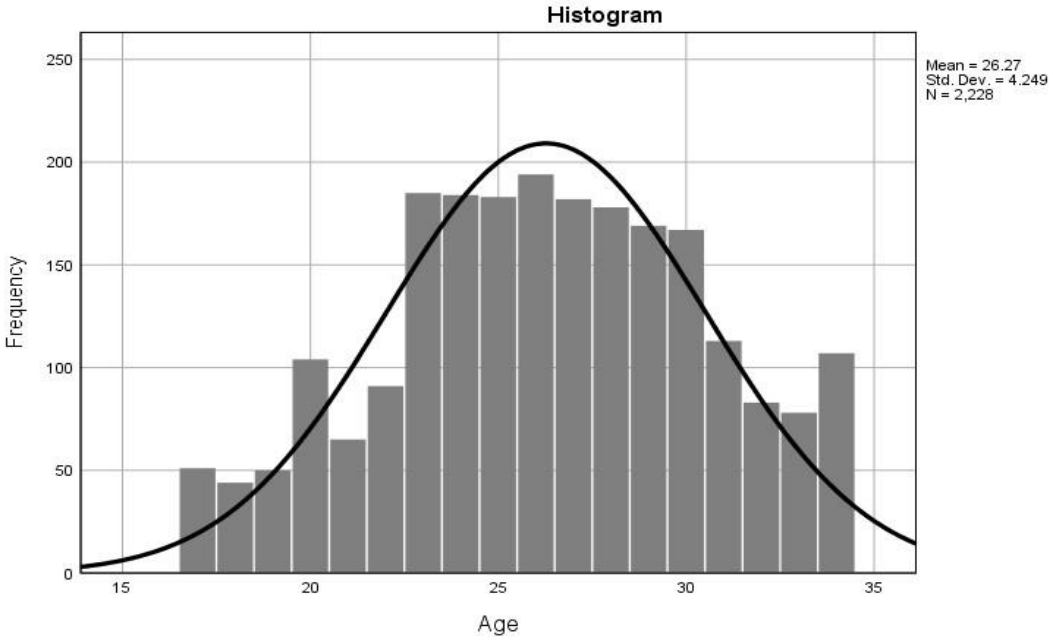
	Test Value = 33					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Weekly HIV Counseling sessions	-7.090	2227	.000	-1.307	-1.67	-.95

Age

The inclusion criterion regarding age was placed between 17 years and 34 years, mainly because of this age group's greatest affinity for mobile phone use when compared to other age groups (Ajala, Adetunji, & Akande, 2015). Because it was coded as a scale variable, test of normality was performed to assess data distribution. A coding of ordinal or nominal level of measurement would have violated normality assumptions since the data will no longer be continuous. SELECT CASES command advanced with "if"

conditional statement was used to extract this variable from the original data set to conform to the age range of interest to satisfy the inclusion criteria. For easy assessment, the choice of visual assessment was the histogram in Figure 3.

Figure 3. Age



Test of Assumptions

Assumptions of normality, outliers, and collinearity were checked to improve validity of the results in this study. In the one-sample *t* test, age and weekly HIV counseling sessions were tested for normal distribution. This was because both variables were continuous variables which assumed scale level of measurement and were normally distributed

Test of Normality

The assumptions of the continuous variables in the data set included normal distribution of the data. In Figure 3, the histogram showed normal distribution of the data for age, since most of the data fell under the normal curve. In Table 17, the mean,

median, and mode are approximately equal for age at 26.27, 26.00, and 26 respectively
Table 17

Age

N	Valid	2228
	Missing	0
Mean		26.27
Median		26.00
Mode		26
Std. Deviation		4.249
Skewness		-.128
Std. Error of Skewness		.052
Kurtosis		-.628
Std. Error of Kurtosis		.104
Minimum		17
Maximum		34

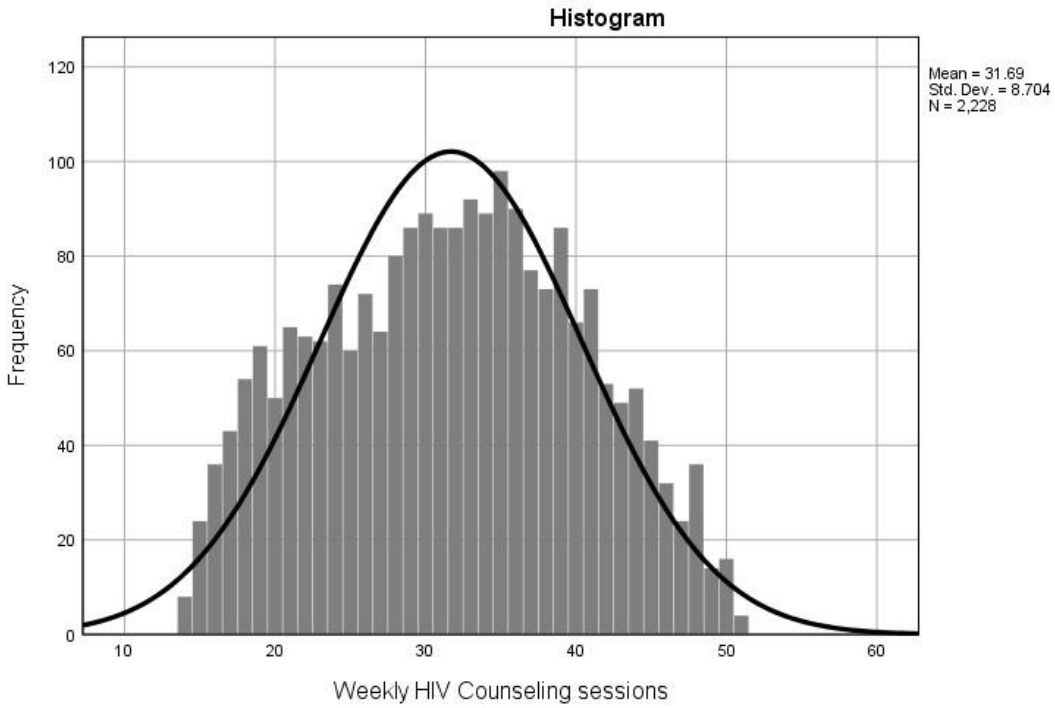


Figure 4. Weekly HIV counseling sessions

In Figure 4, the histogram showed approximately normal distribution for weekly HIV counseling while in Table 18, weekly HIV counseling also showed 0.000 skewness and fairly normal 2-tails, making it symmetrical enough for normal distribution of the data.

Table 18

Weekly HIV Counseling Sessions

N	Valid	2228
	Missing	0
Mean		31.69
Median		32.00

Mode	35
Std. Deviation	8.704
Skewness	.000
Std. Error of Skewness	.052
Kurtosis	-.844
Std. Error of Kurtosis	.104
Minimum	14
Maximum	51

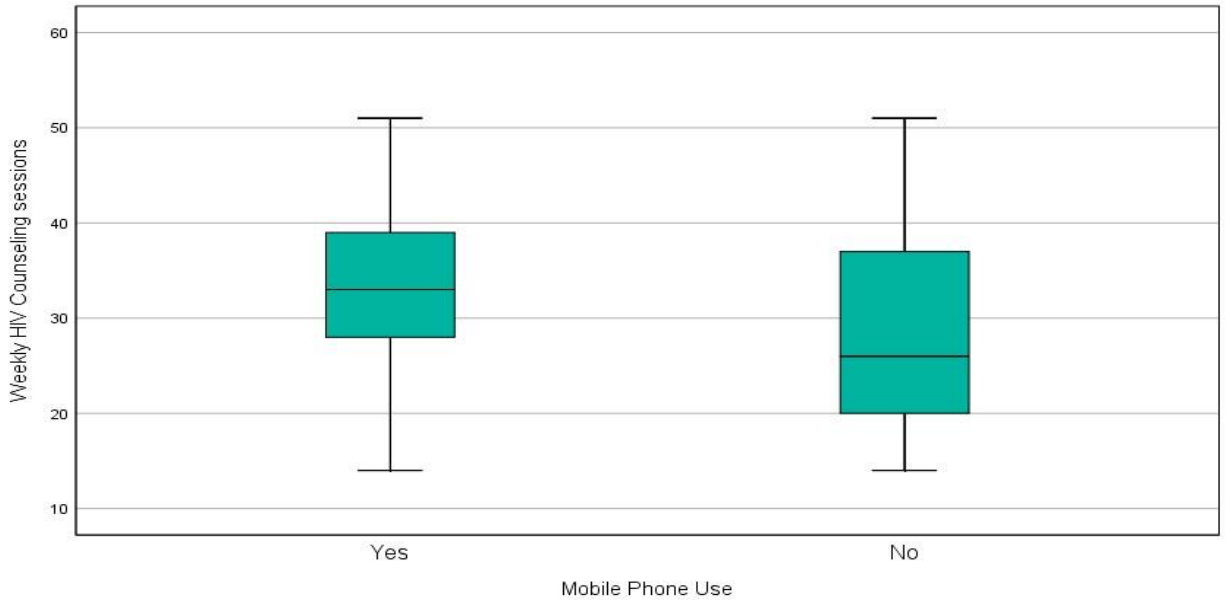


Figure 5. Mobile phone use and weekly HIV counseling

Checking for Outliers

In the APIN dataset used for this study, the reasons for checking for outliers are primarily due to possibilities of data entry errors, measurement errors, and genuinely unusual values. Outliers can be checked with boxplots. In figure 5, the continuous

variable related to HIV status (weekly HIV counseling sessions) was plotted against mobile phone use. No outliers were noted in the boxplot.

Multicollinearity Diagnostics

The independent variables tested for high correlation with HIV status included gender, mobile phone use, weekly HIV counseling sessions, residential location, age, and marital status. All the independent variables showed high correlation, which could pose problems with independence of observations. There was high tolerance (> .200) in all the independent variables diagnosed. However, variance inflation factor (VIF) for each independent variable remained within normal limits (< 10.0) as shown in Table 19.

Table 19

Coefficients

Model		Collinearity Statistics	
		Tolerance	VIF
1	Gender	.991	1.009
	Mobile Phone Use	.875	1.142
	Weekly HIV Counseling sessions	.790	1.265
	Residential Location	.840	1.190
	Age	.714	1.401
	Marital Status	.724	1.382

Checking Data for Model Fit

Many of the tables that reported bivariate analyses were conducted through crosstabs. It was necessary to check a critical assumption of chi-square test which required that cell counts amount to 5 or greater in 2 X 2 cross-tabulations. In Table 20 which was used to test the first hypothesis, all four expected count cells were greater than five. The mobile phone use * HIV Status Crosstabulation table had 595.9 as the value for mobile phone use among participants who tested positive for HIV while the expected count for those who tested positive but did not use mobile phone for HIV care was 314.1. The remaining expected counts cells were those who were negative for HIV status and used mobile phones for HIV prevention efforts (863.1), while those who tested negative and never used mobile phones for prevention was 454.1. This shows that the cell count assumption was not violated.

Table 20

*Mobile Phone Use * HIV Status Crosstabulation*

			HIV Status		
			Positive	Negative	Total
Mobile Phone Use	Yes	Count	621	838	1459
		Expected Count	595.9	863.1	1459.0
		% within Mobile Phone Use	42.6%	57.4%	100.0%
		% within HIV Status	68.2%	63.6%	65.5%
		% of Total	27.9%	37.6%	65.5%

	No	Count	289	480	769
		Expected Count	314.1	454.9	769.0
		% within Mobile Phone Use	37.6%	62.4%	100.0%
		% within HIV Status	31.8%	36.4%	34.5%
		% of Total	13.0%	21.5%	34.5%
Total		Count	910	1318	2228
		Expected Count	910.0	1318.0	2228.0
		% within Mobile Phone Use	40.8%	59.2%	100.0%
		% within HIV Status	100.0%	100.0%	100.0%
		% of Total	40.8%	59.2%	100.0%

Hypothesis Testing

Various statistical tests were used to test the hypotheses included in this study. The three research questions corresponded to each hypothesis that were tested in this study.

H_01: Telehealth use (text messaging, video conferencing, teleconsulting) is not feasible for HIV status among individuals aged 17 – 34 in Southwestern Nigeria.

Ha1: Telehealth use (text messaging, video conferencing, teleconsulting) is feasible for HIV status among individuals aged 17 – 34 in Southwestern Nigeria.

A chi-square test of association between telehealth (mobile phone use) and HIV

Status was conducted (see Table 21). There was a statistically significant association in Phi value between mobile phone use and HIV status, $X^2(1) = 5.173$, $p = .023$. The variables were not independent of each other as shown by the results of this chi-square test, and if independence of observations did not exist, there must be some form of association between the variables. Therefore, the null hypothesis was rejected.

Table 21

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.173[a]	1	.023		
Continuity Correction[b]	4.969	1	.026		
Likelihood Ratio	5.197	1	.023		
Fisher's Exact Test				.023	.013
Linear-by-Linear Association	5.171	1	.023		
N of Valid Cases	2228				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 314.09.

b. Computed only for a 2x2 table

Inferential statistics were conducted to assess association between telehealth and

HIV status. Association between variables needed to exist in order for feasibility to occur. HIV status needed to be associated with weekly HIV counseling and HIV knowledge. Studies have shown that among the Southwestern Nigerian population, a considerable number of individuals who were at risk for the disease were not aware of their HIV status (Oseni, Okafor, & Sekoni, 2017). Counseling and testing could have reduced being unaware of HIV status.

Table 22

Correlations

			Mobile Phone Use	Weekly HIV Counseling sessions
Spearman's rho	Mobile Phone Use	Correlation Coefficient	1.000	-.253**
		Sig. (2-tailed)	.	.000
		N	2228	2228
	Weekly HIV Counseling sessions	Correlation Coefficient	-.253**	1.000
		Sig. (2-tailed)	.000	.
		N	2228	2228

**. Correlation is significant at the 0.01 level (2-tailed).

Checking Correlation between Telehealth and Weekly HIV Counseling

In Table 22, the Spearman's correlation analysis was significant ($p < .0005$). This indicated strong association between mobile phone use and seeking understanding or measure of HIV status through Weekly HIV counseling sessions. If such measure could be done through weekly HIV counseling, mobile phone use was therefore feasible for HIV status by association through weekly HIV counseling since those weekly meetings were all about how to improve their HIV status. Already the strong association between mobile phone use and HIV knowledge had been shown in Table 8, where participants who used mobile phone had the highest HIV knowledge 658 out of 1,459 respondents (45.1%) almost three times as many as participants who did not use mobile phones but whose scores were still grouped in the "high" category (n=253).

Testing for Strength of Association between Independent Variables

Testing for independence of explanatory variables means rejecting the null hypothesis between such variables if an association existed. There was no independence between variables if they were significantly associated with each other. In other words, there must be significant difference in the *p* value in a chi-square test of association in order to achieve independence of observations.

Telehealth and HIV Knowledge

Using the 2 X 2 crosstabs, a Pearson's Chi-Square test of association was conducted between mobile phone use (telehealth) and HIV knowledge. There was a statistically significant association between mobile phone use and HIV knowledge, $X^2(1) = 362.752$, $p < .0005$ (see Table 23).

Table 23

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	362.752[a]	2	.000
Likelihood Ratio	354.459	2	.000
Linear-by-Linear Association	185.091	1	.000
N of Valid Cases	2228		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 187.07.

Telehealth and HIV Status

After assessing HIV status with the magnitude of weekly HIV counseling and HIV knowledge, it was necessary to further test the association between mobile phone use and HIV status with particular attention to symmetric measures table. In Table 24, because telehealth and HIV Status were both 2 X 2 formation, both Cramer's *V* and Phi values measured strength of association in terms of effect size. In this case, each of the values is .048 which is significant at $p = .023$, also, $\varphi = .048$, $p = .023$

Table 24

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.048	.023
	Cramer's *V*	.048	.023
N of Valid Cases		2228	

There was a statistically significant association in Phi value between mobile phone use and HIV status, $X^2(1) = 5.173$, $p = .023$ (see Table 18). The null hypothesis can be rejected.

Ho2: There is no significant difference in HIV status among individuals aged 17 - 34 in Southwestern Nigeria based on HIV knowledge.

Ha2: There is significant difference in HIV status among individuals aged 17 - 34 in Southwestern Nigeria based on HIV knowledge.

To assess group difference in HIV status among individuals aged 17 to 34 in this sample based on HIV knowledge, it was desirable to examine multiple correlations among the three variables. A 2-tailed Spearman's correlation coefficient (see Table 25) was conducted to assess association between HIV status and age of the respondents.

Spearman's test was selected over Pearson's because HIV knowledge and HIV status were both categorical variables. There was positive correlation between HIV knowledge and HIV status (.032). As an individual's HIV knowledge increases, management of, or living with HIV disease can be better understood, and HIV prevention efforts in at-risk individuals would likely become more effective. With a positive correlation of (.004), the result also showed that as one gets older, so will HIV knowledge get better but not necessarily HIV status as explained by the negative correlation between age and HIV status in the model (-.029). This test showed that HIV knowledge would not be the basis for HIV status among people aged 17 to 34 years, so the null hypothesis could not be rejected. This further suggests that age was not a confounder in the relationship between HIV knowledge and HIV status.

Table 25

Correlations

			HIV Knowledge	Age	HIV Status
Spearman's rho	HIV Knowledge	Correlation Coefficient	1.000	.004	.032
		Sig. (2-tailed)	.	.851	.130
		N	2228	2228	2228
	Age	Correlation Coefficient	.004	1.000	-.029

		Sig. (2-tailed)	.851	.	.176
		N	2228	2228	2228
	HIV Status	Correlation Coefficient	.032	-.029	1.000
		Sig. (2-tailed)	.130	.176	.
		N	2228	2228	2228

$H_0$3: There is no association between gender and HIV status among individuals aged 17 – 34 in Southwestern Nigeria.

Ha3: There is association between gender and HIV status among individuals aged 17 – 34 in Southwestern Nigeria.

In Table 26, the crosstabulation showed an association between gender and HIV status. The design of this study sought association and not prediction. With disproportionate infection rates among females 604 out of 825 (73.2%) compared with males 221 out of 825 (26.8%), there was an association between being female and being HIV positive in the sample. This was enough to reject a null hypothesis for RQ3.

Table 26

*Gender * HIV Status Crosstabulation*

			HIV Status		
			Positive	Negative	Total
Gender	Male	Count	221	465	686

		Expected Count	254.0	432.0	686.0
		% within Gender	32.2%	67.8%	100.0%
		% within HIV Status	26.8%	33.1%	30.8%
		% of Total	9.9%	20.9%	30.8%
	Female	Count	604	938	1542
		Expected Count	571.0	971.0	1542.0
		% within Gender	39.2%	60.8%	100.0%
		% within HIV Status	73.2%	66.9%	69.2%
		% of Total	27.1%	42.1%	69.2%
Total		Count	825	1403	2228
		Expected Count	825.0	1403.0	2228.0
		% within Gender	37.0%	63.0%	100.0%
		% within HIV Status	100.0%	100.0%	100.0%
		% of Total	37.0%	63.0%	100.0%

Summary

The research questions guiding this study were stated in Chapter 4 in addition to their corresponding hypotheses. The research questions were stated at the opening of the chapter to refocus on the study purpose. Each variable was described using mostly univariate analyses. This was followed by how to explore the feasibility of telehealth for HIV status through analysis of associations among main variables. Four tests of assumptions were conducted to increase validity of the research, and two of the

hypotheses were able to reject the null hypothesis. Significant association was found between telehealth and HIV status, and also between gender and HIV status. However, the null hypothesis could not be rejected when association was assessed between age and HIV status based on the HIV knowledge of participants in hypothesis 2. Multicollinearity diagnostics was performed using the variable inflation factors (VIF) instead of tolerance. The use of crosstabulation tables appeared to have helped because most of the independent variables were categorical at their level of measurement.

Chapter 5 discusses the implications of the findings, suggests the relevance of the findings to public health practice, recommends what needs to be done towards further research, and discusses potential social change implications for the study.

Chapter 5: Discussion, Implications, Recommendations, and Conclusions

Introduction

In Chapter 4, both descriptive and inferential statistics were used to present study results. This chapter presents a discussion of study findings, implications, and recommendations for further studies and public health practice. Chapter 5 will conclude by disclosing study limitations.

In the Southwestern part of Nigeria, existing literature has not adequately addressed the use of mobile phones as alternative means of accessing healthcare among individuals living with or at risk for HIV. This study was conducted to assess the feasibility of telehealth for HIV status by evaluating its relationship with each of the three major independent variables (telehealth, HIV knowledge, and gender). In order to establish feasibility, it was necessary to assess associations between each main independent variable and the dependent variable through bivariate analyses. This study used univariate, bivariate, and multivariate analyses to assess paired and multivariate interactions between the dependent variable and the main independent variables. This study focused on a subset (n = 2,228) of a larger population (N = 28,700) from six Southwestern states in Nigeria (Lagos, Oyo, Ondo, Osun, Ogun, and Ekiti states) in 2017. Approval number 10-02-18-0456300 dated October 2, 2018 for this study was obtained from Walden University IRB after initial approval from the IRB of APIN in Abuja, Nigeria.

Interpretation of Findings

The results of the tests of hypotheses for RQ1 revealed a strong association between telehealth and HIV status. The null hypothesis was rejected in favor of the research hypothesis ($p = .023$), and both Phi and Cramer's V were also significant ($p = .023$, $\varphi = .048$).

The association between age and HIV status was analyzed, with the results showing no relationship. When age was included in the model produced by multiple logistic regression, age was not significant ($p = .142$) as a contributing factor to HIV status while the odds ratio for such an association was less than 1 (.986; see Appendix A). This is consistent with the 2.8% HIV prevalence among the age range (15-49 years, which included the age range in this study). This was why RQ2 was measured at ordinal level (low, medium, high), and according to individual test scores from post-weekly HIV counseling was unable to reject the null hypothesis ($p > .05$).

With $H_0 3$, gender was reported as significant for HIV status in the sample (see Table 4). Out of 910 participants who reported positive HIV status, 672 (73.8%) were females while 234 (26.2 %) were male. In other words, being a female was three times more likely to result in positive test for HIV than being a male. These results appeared to be consistent with studies that reported gender-based disparities in HIV incident rates and prevalence. For example, Oseni, Okafor, and Sekoni (2017) reported in 2017 that HIV infection rates in females were almost three times as the infection rates for males.

Similarly, AVERT (2017) said in 2017 that 58% of new HIV cases were women, and Ogunmola, Oladosu and Olamoyegun (2014) also found that 71.3% of their sample who tested positive for HIV were females while 28.7% were males.

Other Covariates

Interpretation of the study findings should not be generated through hypothesis testing only. Other variables which were not mentioned directly in the research questions should also be discussed in terms of their relationship to the findings of the study, since all variables were involved in the study.

Residential location. Distance played a critical role in adopting telehealth for HIV care (Grubaugh et al., 2008; HRSA, 2015). However, the United States Department of Agriculture (USDA, 2018) reported that people living in rural areas had not been receptive enough to using telehealth to address health issues despite the shortage of care givers in these areas. This study was consistent with most studies that associated rural residential location with telehealth use, and not with the view expressed by USDA. Correlation of Residential location with telehealth was done with both Phi and Cramer's *V* values of .076 (normal range: -1 and +1), which indicated the magnitude of telehealth use. In this study, residential location in association with telehealth was also significant ($p = .002$).

Weekly HIV counseling sessions. Assessment of HIV status was important since HIV status by itself as the dependent variable was coded as a dichotomous group variable which limited the statistical tests it could be used for since it is not a continuous variable. The results of weekly counseling sessions showed that most participants who attended weekly HIV counseling fell into the high attendance category, which was between 35 and

52 weeks (see Appendix C). Wood et al. (2016) argued in his study that telehealth use could translate into high capacity counseling attendance.

Marital status. The results of this study for marital status showed that among those who tested positive for HIV (n = 910), more individuals were single (n = 538; 59.1%) and 372 (40.9%) were married (see Appendix D). This is likely to be due to multiple sex partners or simply because age is positively correlated with marital status (.431) and that correlation was significant p< .0005. After controlling for other variables, being married significantly reduced the odds of being HIV positive (Shisana et al., 2016).

Findings related to Theoretical Foundation

The HBM presents the belief that individuals seek health through perceived susceptibility to illness, perceived seriousness, perceived benefits, and perceived barriers leading to cue to action (Jones et al., 2015). A binary logistic regression analysis was conducted to predict HIV status with weekly counseling attendance which can be interpreted to show an individual's intention to seek more knowledge about one's disease status. Results showed that attending HIV counseling sessions significantly predicted improved HIV status, p = .001 with an odds ratio (OR) of 1.016 (*CI* 95%: 1.006 - 1.026).

Strengths and Limitations

The most notable strength of this study is the scope of HIV status that was treated as the dependent variable. Furthermore, this study was first to address the full spectrum of HIV status via telehealth feasibility. Previous studies had focused on telehealth use for either prevention or management but not both. This study had included samples from both sides. The study sample of participants was random and proportional to the

prevalence in the 6 southwestern states of Nigeria, and this increased the validity of the research while also reducing selection bias. The data sets APIN consisted of HIV-positive clients and fewer while those at risk but still negative for HIV were in higher numbers and had to be extracted from the data provider's registers. This indicated that research attention to HIV prevention had been disproportionately higher in favor of clients who are already living with the disease despite being fewer than those at risk. This study assessed HIV status in the context of not just living with the disease but also in the context of being at risk for the disease. Telehealth as the main independent variable was perceived as a vehicle for health care access, and its use should address the HIV status in individuals at risk and those already living with the disease.

As a form of limitation, no variable in the data set was available for assessing the economic benefits of telehealth application for HIV status. Residential location was a big reason for adopting telehealth for HIV care, however, absence of income as a variable in the data set made it impossible to assess the economic benefit of telehealth use in order to compare with existing studies which had associated rural locations with poverty, compared to urban areas and by extension, inability to afford acceptable HIV care. Yu and Hailey (2013) reported that economic benefits of telehealth use for HIV status had limited data, and the data for this study had also provided limited data on economic benefits of telehealth five years after that study. A possible complication with generalizing this study to the larger population remained the existence of other organizations in this region in Nigeria who also collected data for HIV studies. These organizations report to National Agency for Control of AIDS (NACA), whose data was

not included in the final study. A systematic study may provide much stronger basis for generalization to Nigeria's Southwestern HIV community.

Implications for Social Change

This study contributes to positive social change by going a few steps above previous research works in terms of exploring relationships between telehealth and HIV status. Only very few studies had ever focused on actual exploratory study of telehealth as vehicle for alternative health care access until now. What had been the major focus was causality and where those studies existed, none had gone far enough to holistically address healthcare access. Saberi et al. (2013) focused extensively on adopting telehealth for more effective medication compliance, and their sample was limited to people living with HIV alone. Health care access must also involve those who are at risk but not yet positive for the disease. In other words, positive social change is more meaningful when prevention is factored in because that will be the best way to reduce incidence rates, and consequently, HIV prevalence. By including participants who are HIV negative, this study had therefore added to the body of knowledge. Since HIV status is closely related to behavior, Health belief model (HBM) was a compatible theoretical foundation as it adds to public health knowledge that behavior is not only limited to how to prevent HIV through perceived dangers, but also behaviors regarding management of already positive clients to avoid disease spread.

Overall, regarding social positive change, this study presents the potential to increase access to health care in a population where traditional health care access remains a problem (Lankowski et al., 2014). Although this study population sample was drawn from southwestern region of Nigeria, the results can be generalized to a much larger

population in Nigeria. Finally, including participants who are at risk but yet to test positive for the disease is desirable for positive social change because if such people can sustain remaining HIV positive, the burden of viral assault to the body will be greatly reduced and that will make a difference to the workforce and the economy.

Recommendations

Data collection for HIV studies in Nigeria needs to address in stronger terms, the issue of confidentiality in a society where individuals not only suffer stigma, but also had to deal with hostile and heavily punitive government policies towards critical HIV-related sub-populations such as men who have sex with men, commercial sex workers (CSW), and intravenous drugs users, all of which attract prison sentences if caught (The Guardian, January 13, 2014). Enhancing privacy protection will increase higher response rates in surveys. Researchers should call for subsidized mobile phones ownership especially among the low-income groups who are at risk for HIV, and who live far away from HIV clinics. Where adequate funding is available, longitudinal studies may produce more generalizable results than cross-sectional studies which capture the data across a particular time of observation. In particular, survival studies will benefit from such longitudinal designs in order to more properly address effectiveness of intervention. Above all, findings from this study might present a stronger case for the use of mobile phones to supplement reliance on face to face counseling and other treatment modalities geared towards reducing HIV prevalence in Southwestern Nigeria which are presently not effective enough among the HIV population in this region.

In order to attract more mobile phone users to seek HIV care with telehealth, subsidies may be introduced by the authorities or nongovernmental organizations.

Furthermore, promoting affordability of mobile phones might be an added incentive to smartphone ownership among the HIV population who might choose to adopt telehealth. This will further translate to increased compliance with testing and counseling against dangerous needle exchange among people at high risk for HIV. For example, confidentiality can be assured through end-to-end messaging with which mobile phones are now commonly encrypted.

Conclusion

Results of this study indicated close association between telehealth and HIV status in both infected and at-risk participants. Gender (being female) was also strongly associated with being HIV positive, and this was consistent with several studies conducted few years before this study. Age did not play any part in the association between HIV knowledge and HIV status. This indicated that HIV prevalence cuts across age groups and not peculiar to individuals aged 17 – 34 years in Southwestern Nigeria. Finally, findings from this study indicated that use of telehealth by rural dwellers would increase their access to healthcare which had been found to be lacking with reliance on traditional healthcare access alone.

References

Abah, R. C. (2014). The demographic implications of the HIV prevalence in Nigeria. *Journal of Public Health in Africa*, *5*(1), 277

AIDS Info (2017). The basics of HIV prevention. Retrieved fromhttps://aidsinfo.nih.gov/understanding-hiv-aids/fact-sheets/20/48/the-basicsof-hiv-prevention

Ajala, F.A., Adetunji, A.B., & Akande, N.O. (2015). Telemedicine acceptability in southwestern Nigeria: Its prospects and challenges. *COMPUSOFT, 4*(9), 1966-71.

Allely, E. B. (1995). Synchronous and asynchronous telemedicine. *Journal of Medical Systems, 19*(3), 207-208. doi: 10.1007/BF02257174

American Hospital Association. (2016). Telehealth: Helping hospitals to deliver costeffective care. Retrieved fromhttp://www.aha.org/content/16/16telehealthissuebrief.pdf

American Psychological Association (2017). HIV/AIDS and socioeconomic status. Retrieved from http://www.apa.org/pi/ses/resources/publications/hiv-aids.aspx

Analysis Factor (2018). What is factor analysis? Retrieved from https://www.spsstutorials.com/spss-factor-analysis-tutorial/#what-is-factor-analysis

Anderson, K. J. (2001). Internet use among college students: An exploratory study. *Journal of American College Health, 50*(1), 21-26. doi: 1080/07448480109595707

Anderson, K., Francis, T., Ibanez-Carrasco, F., & Globerma, J. (2017). Physician's perceptions of telemedicine in HIV care provision: A cross-sectional web-based survey. *JMIR Public Health Surveillance, 3*(2), 31-35. doi: 10.2196/publichealth.6896

Full Name of Author (2017). Gender inequality and HIV. Retrieved from https://www.avert.org/professionals/social-issues/gender-inequality

Full Name of Author. (2018). HIV and AIDS in Nigeria. Retrieved from https://www.avert.org/professionals/hiv-around-world/sub-saharan-africa/nigeria

Awofala, A. A., & Ogundele, O. E. (2016). HIV epidemiology in Nigeria. *Saudi Journal of Biological Sciences, 24*(6), 697-703. doi:10.1016/jjbs.2016.03.006

Ayodele, O., & Ayodele, O. M. (2016). Urban-rural differentials in HIV/AIDS knowledge of Nigerian senior secondary school students. *International Journal of Health Sciences, 4*(3), 35-41.

Badowski, M. E., & Nyberg, C. R., & Chaiyaperm, V. (2016). Perceptions of pharmacy trainees completing a clinical experience in an HIV telemedicine clinic at an urban academic medical center. *Currents in Pharmacy Teaching & Learning, 8*(6), 840-884.

Baghianimoghaddam, M. H., Foghani, H., Zolghadr, R., Rahaii, Z., & Khan, P. (2010). Health belief model and HIV/AIDS among high school female students in Yazd, Iran. *Journal of Research in Medical Sciences, 15*(3), 189-190.

Banerjee, A. K., & Narasu, M. L. (2015). Can mobile phones transform healthcare in low and medium income countries? *BMJ, 350.* Doi: https://doi.org/10.1136/bmj.h1975C

Bashorun, A., Nguku, P., Kawu, I., Ngige, E., Ogundiran, A., … Nsubuga, P. (2014). A description of HIV prevalence trends in Nigeria from 2001 to 2010: What is the progress, where is the problem? *Pan African Medical Journal, 18*(Suppl 1). 3. doi:10.11695/pamj.supp.2014.18.1.4608.

Beckers Hospital Reviews (2018). *The case for implementing post-discharge call program*. Retrieved from: https://www.beckershospitalreview.com/finance/thecase-for-implementing-a-post-discharge-call-program.html

Bekalu, M. A., & Eggermont, S. (2014). The role of communication inequality in mediating the impacts of socioecological and socioeconomic disparities on HIV/AIDS knowledge and risk perception. *International Journal for Equity in Health, 13*: 16. doi: 10.1186/1475-9276-13-16

Biese, K., Lamantia, M., Shofer, F., McCall, B., Roberts, E. … Whitehead, J. (2014). A randomized trial exploring the effect of a telephone call follow-up on care plan compliance among older adults discharged home from the emergency department. *Academic Emergency Medicine, 21*(2). 188-95. doi: 10.111/acam.12308

Boston University (2016). *Behavioral change models: Health Belief Model*. Retrieved from: http://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/BehavioralChangeTheories/BehavioralChangeTheories2.html

Brown, W., Yen, P-Y., Rojas, M., & Schnall, R. (2013). Assessment of the Health-IT usability evaluation model (Health - ITUEM) for evaluating mobile (mHealth) technology. *Journal of Biomedical Informatics, 46*(6). 1080-1087. doi: https://doi.org/10.1016/j.jbi.2013.08.001

Burkholder, G. J. (2010). *The absolute essentials of sample size analysis - Or: You too can be a statistical power guru* [PowerPoint Presentation]. Retrieved from https://class.waldenu.edu/bbcswebdav/institution/USW1/201610_27/PH_PUBH/PUBH_9001/artifacts/The_Absolute_Essentials_of_Sample_Size_Analysis_(REV_05_2010).

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches (3rd Ed.).* Thousand Oaks, CA: SAGE Publishers.

Crosby, R. A., DiClemente, R. J., & Salazar, L. F. (2013). *Research methods in health promotion (Custom Ed.).* San Francisco, CA: John Wiley and Sons.

Center for Connected Health Policy [CCHP] (2017). *What is telehealth?* Retrieved from: http://www.cchpca.org/what-is-telehealth Center for Connected Health Policy [CCHP] (2017). *What is telehealth?* Retrieved from: http://www.cchpca.org/whatis-telehealth

Center for Connected Health Policy [CCHP] (2017-a). *What is Telehealth?* Retrieved from: http://www.cchpca.org/what-is-telehealth

Center for Connected Health Policy [CCHP] (2017-b). *Store and Forward*. Retrieved from: http://www.cchpca.org/store-and-forward

Charrier, N., Zarca, K., Durand-Zaleski, I., & Calinaud, G. (2016). Efficacy and cost effectiveness of telemedicine for improving access to care in the Paris region: Study protocols for eight trials. *BMC Health Services Research, 16*: 45. doi: 10.1186/s12913-016-1281-1

Chau, P.Y.K., Hu, P. J-H. (2002). Investigating healthcare professionals' decisions to accept telemedicine technology: An empirical test of competing theories.

Information & Management, 39: 297–311.

Cherutich, P., Kaiser, R., Galbraith, J., Williamson, J., Shiraishi, R. W., … Bunnell, R. (2012). Lack of knowledge of HIV status, a major barrier to HIV prevention, care and treatment efforts in Kenya: Results from a nationally representative survey. *PLoS One, 7*(5). e36797. https://doi.org/10.1371/journal.pone.0036797

Cimperman, M., Brencic, M. M., Trkman, P., & Stanonik, M. (2013). Older adults' perceptions of home telehealth use. *Telemedicine Journal and E-Health, 19*(10). 786-790. doi:10.1089/tmj.2012.0272

Constantino, M. E., Frey, B., Hall, B., & Painter, P. (2013). The influence of postdischarge intervention on reducing hospital re-admission in a Medicare population. *Population Health Management, 16*(5). 310-316. doi:10.1089/pop.2012.0084

Crowell, T. A., Keshinro, B., Baral, S. D., Schwartz, S. R., Stahlman, S., … Ake, J. A. (2017). Stigma, access to healthcare, and HIV risks among men who sell sex to men in Nigeria. Journal of International AIDS Society, 20(21489). http://www.doi.org/10.7448/IAS.20.1.21489

Dahlui, M., Azahar, N., Bulgiba, A., Zac, R., Oche, O. M. … Chinna, K. (2015). HIV/AIDS-related stigma and discrimination against PLWHA in Nigerian population. *PLoS ONE 10*(12): e0143749. https://doi.org/10.1371/journal.pone.0143749

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *Management Information Systems Quarterly, 13*(3). 319-340. doi: 10.2307/249008. Accessed from: http://www.jstor.org/stable/249008

Dunkle, K. I., Jewkes, R. K., Brown, H. C., Gray, G. E., McIntryre, J. A., & Harlow, S. D. (2004). Gender-based violence, relationship power, and risk of HIV infection in women attending antenatal clinics in South Africa. *The Lancet, 363*(9419), 1415-1421. https://doi.org/10.1016/S0140-6736 (04)16098-4

Durodola, O. O. (2016). Technology acceptance model as a predictor of using information system to acquire information literacy skills. *Library Philosophies and Practice (e-journal).1450.* http://digitalcommons.uni.edu/libphilprac/1450

Earl, A., Albarracin, D., Durantini, M. R., Gunnoe, J. B., Leeper, J., & Levitt, J. (2009). Participation in counseling programs: High-risk participants are reluctant to accept HIV-Prevention counseling. *Journal of Consulting and Clinical Psychology, 77*(4). 668-679. doi: 10.1037/a0015763

Ekeland, A. G., Bowes, A., & Flottorp, S. (2012). Methodologies for assessing telemedicine: A systematic review of reviews. *International Journal of Medical Informatics, 81*(1). 1 – 11.

Egunjobi, R. A. & Akerele, J. A. (2014). Health information literacy as a predictor of community information service utilization among citizens in public-national libraries in Southwestern Nigeria. *Library Philosophies and Practice (ejournal).1148.* http://digitalcommons.unl.edu/libphilprac/1148

Escoffery, C., Miner, K. R., Adame, D. D., Butler, S., McCormick, L., & Mendell, E. (2010). Internet use for health information among college students. *Journal of American College Health, 53*(4), 183-188. Doi:10.3200/JACH.53.4.183-188

Faul, F., Erdfelder, E., Lang, A.-G, & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39:* 175-191

Forster, A., Horspool, K. A., Edwards, L., Thomas, C. L., Salisbury, C., … O'Cathain, A. (2015). Who does not participate in telehealth trials and why? A cross-sectional survey. *Trials, 16*(258). doi: 10.1186/s13063-015-0773-3

Forthofer, R. N., Lee, E. S., & Hernandez, M. (2007). *Biostatistics: A guide to design analysis*

Frankfort-Nachmias, C., Nachmias, D., & DeWaard, J. (2015). *Research methods in the social sciences (8th Ed.).* New York, NY: Worth Publishers.

Friss, R. H., & Sellers, T. A. (2009). *Epidemiology for public health (4th Ed.).* Sudbury, MA: Jones and Bartlett

Gebremedhin, S. A., Youjie, W., & Tesfamariam, E. H. (2017). Predictors of HIV/AIDS knowledge and attitude among young women of Nigeria and Democratic Republic of Congo: Cross-sectional study. *Journal of AIDS and Clinical Research, 8:* 677. doi:10.4172/2155-6113.10005677

George, D., & Mallery, P. (2011). *SPSS for Windows step by step: A simple guide for reference 18.0 Update (11th Ed.).* Boston, MA: Pearson Education

Glanz, K., Lewis, B. K., & Rimer, F. M. (2002). *Health Belief Model (3rd Ed.).* San Francisco, CA: Jossey-Bass Publishers

Godstime, J.K., Kayode, O.P., & Halilu, S. A. (2009*). Telemedicine development in Nigeria. National Space Research Development Agency (NASRDA).* Retrieved

from: http://www.un-spider.org/sites/default/files/james_3rd_wsbonn_23_10_09.pdf

Greenwald, P., Stein, M. E., Clark, S., & Sharma, R. (2018). Older adults and technology: In telehealth, they may not be who you think they are. International Journal of Emergency Medicine, 11(2). Doi: 10.1186/s12245-017-0162-7ucin, N. O., & Berk, O. S. (2015). Technology acceptance in healthcare: An integrative review of predictive factors and intervention programs. *Procedia – Social and Behavioral Sciences, 195*(3). 1698 – 1704. https://doi.org/10.1016/j.sbspro.2015.06.263

Grubaugh, A.L., Cain, G. D., Elhai, J. D., Patrick, S. L., & Frueh, C. (2008). Attitudes towards medical and mental health care delivered via Telehealth applications among rural and urban primary care patients. *The Journal of Nervous and Mental Disease, 196*(2) 166-170

Haenssgen, M. J., & Ariana, P. (2017). Healthcare access: A sequence-sensitive approach. *SSM – Population Health, 3:* 37–47.

Harris, K., Hosegood, V., & Channon, A. A. (2014). Gender disparity in HIV prevalence: A national-level analysis of the association between gender inequality and the feminization of HIV/AIDS in sub-Saharan Africa. *African Population Studies, 28:* 1132-1145

Health-IT (2013). *The rise of mHealth*. Retrieved from: https://www.healthitoutcomes.com/doc/the-rise-of-mhealth-0001

Health-IT (2017). *What is Telehealth?* Retrieved from: https://www.healthit.gov/telehealth

Health Resources and Services Administration [HRSA] (2016). *The Federal Telehealth Compendium.* Retrieved from: https://www.healthit.gov/sites/default/files/federal_telehealth_compendium_final_122316.pdf.

Hochbaum, G. M. (1958). *Participants in medical screening programs: A sociopsychological study.* Washington, DC: US Department of Health Education and Welfare.

Hommel, K.A., Hente, E., Herzer, M., Ingerski, L.M., & Denson, L.A. (2013). Telehealth behavioral treatment for medication nonadherence: A pilot and feasibility study. *European Journal of Gastroenterology and Hepatology, 25*(4): 469-473. doi: 10:1097/MEG.0b013e32835c2a1b

Hong, S. Y., Thompson, D., Wanke, C., Omosa, G., Jordan, M. R., … Mwamburi, M. (2012). Knowledge of HIV transmission and associated factors among HIVpositive and HIV-negative patients in rural Kenya. *Journal of AIDS and Clinical Research, 3*(7). 170. Doi: 10.4172/2155-6113.1000170

Hospital Reports (November 13, 2018). *Rural patients use telehealth less frequently than urban patients, USDA finds.* Retrieved from: https://www.beckershospitalreview.com/telehealth/rural-patients-use-telehealthless-frequently-than-urban-patients-usda-finds.html

Howell, D. C. (2007). *The SAGE handbook of social science methodology*. Thousand Oaks, SAGE Publications

HRSA (2015). *Telehealth in rural America*. Retrieved from:

https://www.hrsa.gov/advisorycommittees/rural/publications/telehealthmarch2015.pdf

Huang, J-H., Lin, Y-R., & Chuang, S-T. (2007). Elucidating user behavior of mobile learning: A perspective of the extended technology acceptance model. *Electronic Library, 25*(5). 585-598

Human Rights Watch (October 20, 2016). *Nigeria: Harsh law's severe impact on LGBT community*. Retrieved from: https://www.hrw.org/report/2016/10/20/tell-mewhere-i-can-be-safe/impact-nigerias-same-sex-marriage-prohibition-act

Innovate Medtec. (2016). *Digital health tools closing HIV prevention and control gaps in Africa*. Retrieved from: https://innovatemedtec.com/content/digital-health-toolsclosing-hiv-prevention-and-control-gaps-in-africa

Ishola, A. G., Chipps, J. (2015). The use of mobile phones to deliver acceptance and commitment therapy in the prevention of mother-to-child HIV transmission in Nigeria. *Journal of Telemedicine and Telecare, 21*(8).

Jaatinen, P. T., Forsstrom, J., & Loula, P. (2002). Teleconsultations: Who uses them and how? *Journal of Telemedicine and Telecare, 8*(6). 319-324. doi: https://doi.org/10.1258/135763302320939194

Jones, C. L., Jensen, J. D., Scherr, C. L., Brown, N. R., Christy, K., …Weaver, J. (2015). The Health Belief Model as an explanatory framework in communication research: Exploring parallel, serial, and moderated mediation. *Health Communication, 30*(6). 566-576. doi:1080/10410236.2013.873363.

Karim, Q. A, Karim, S. A, Frohlich, J. A., Grobler, A. C., Baxter, C., … Taylor, D. (2010). Effectiveness and safety of Tenofovir Gel, an antiretroviral microbicide, for the prevention of HIV infection in women. *Science, 3329*(5996). 1168-1174. doi:10.1126/science.1193748

Karim, Q. A., Kharsany, A. B., Frohlich, J. A., Baxter, C., Yende, N., … Karim, S. S. (2011). Recruitment of high-risk women for HIV prevention trials: Baseline HIV prevalence and sexual behavior in the CAPRISA 004 Tenofovir Gel. *Trials, 12*(67). Doi: 10.1186/1745-6215-12-67

Kazanek, D., Bostrom, A., Montgomery, E. T., Ramjee, G., de Bruyn, G., … van der Straten, A. (2013). Intimate partner violence and condom and diaphragm nonadherence among women in an HIV prevention trial in Southern Africa. *JAIDS Journal of Acquired Immune Deficiency Syndrome, 64*(4). 400-408. doi: 10.1097/QAI.0b013e3182a6b0be

Koziol, N., & Arthur, A. (2011). *An introduction secondary data analysis.* Nebraska Center for Research. Retrieved from: http://r2ed.unl.edu/presentations/2011/RMS/120911_Koziol/120911_Koziol.pdf

Laerd Statistics (n.d.). *Binomial Logistic regression: Assumptions*. Retrieved from: https://statistics.laerd.com/premium/spss/blr/binomial-logistic-regression-in-spss-5.php

Lankowski, A. J., Siedner, M. J., Bangsberg, D. R., & Tsai, A. C. (2014). Impact of geographic and transportation-related barriers on HIV outcomes in sub-Saharan Africa: A systematic review. *AIDS Behavior, 18*(7). 1199-1223. doi: 10.1007/s10461-014-0729-8

Langbecker, D., Caffery, L. J., Gillespie, N., & Smith, A. C. (2017). Using methods in telehealth research: A practical guide. *Journal of Telemedicine Telecare*. doi: https://doi.org/10.1177/1357633X17721814

Lankowski, A. J., Siedner, M. J., Bangsberg, D. R., & Tsai, A. C. (2014). Impact of geographic and transportation-related barriers on HIV outcomes in sub-Saharan Africa: A systematic review. *AIDS Behavior, 18*(7). 1199-1223. doi: 10.1007/s10461-014-0729-8

Law, L. M., & Wason, J.M.S. (2014). Design of telehealth trials: Introducing adaptive approaches. *International Journal of Medical Informatics, 81:* 870-880

Lee, Y., Kozar, K. A., Larsen, K. R. T. (2003). The technology Acceptance Model: Past, present and future. Communications of the Association for Information Systems, 12(50).

Li, J., & Wilson, L. S. (2013). Telehealth trends and the challenge for infrastructure. *Telemedicine and eHealth, 19*(10). doi: 10.1089/tmj.2012.0324

Lin, C-C. (2013). Exploring the relationship between technology acceptance model and usability test. *Information Technology and Management, 14*(3). 243-255.

Magadi, M. A. (2011). Understanding the gender disparity in HIV infection across countries in sub-Saharan Africa: Evidence from the demographic and health surveys. *Sociology of Health & Illness, 33*(4): 522-539. doi: 10.1111/j.1467-9566.2010.01304.x

Maggetti, M., Gilardi, F., & Radaelli, C.M. (2015). *Designing research in social sciences*. Melbourne, Australia: SAGE publications

Maiman, L. A., Becker, M. H. B. (1974). The Health Belief Model: Origins and correlates in psychological theory. *Health Education Monographs, 2*(4). 336-336. doi: https://doi.org/10.1177/109019817400200404

McKnight, P. E., McKnight, K. E., Souraya, S., & Figueredo, A. J. (2007). *Missing data: A gentle introduction*. New York, NY: Guilford

Melhado, L. (2015). In Nigeria, anti-gay law associated with increased stigma and discrimination. *International Perspectives on Sexual and Reproductive Health, 41*(3). 167-168

Mondal, M. N., & Shitan, M. (2013). Impact of socio-health factors on life expectancy in the low and lower middle income countries. *Iran Journal of Public Health, 42*(12). 1354-1362

Musheke, M., Ntalasha, H., & Gari, S., Mckenzie, O., Bond, V. … Merten, S. (2013). A systematic review of qualitative findings on factors enabling and deterring uptake of HIV testing in sub-Saharan Africa. *BMC Public Health, 13:* 220

NACA (2016). *Gender and HIV*. Retrieved from: http://naca.gov.ng/wordpress/wpcontent/uploads/2017/05/Fact-Sheet-Women-Girls-Gender-Equality-and-HIV-in-Nigeria.pdf

Nasiru, S-G., Aliyu, G. G., Gasasira, A., Aliyu, A. H., Zubair., Mandawari, S. U., … ElKamary, S. S. (2012). Breaking community barriers to polio vaccination in northern Nigeria: The impact of a grass roots mobilization campaign (Majigi). *Pathogens and Global Health*, *106*(3). 166-171

National Health-ICT (2015). *National Health ICT Strategic Framework.* Retrieved from:

http://www.uspf.gov.ng/images/filestemp/National_Health_ICT_Strategic_Framework2015-2020-DRAFT.pdf

National Agency for the Control of AIDS [NACA] (2014). *Nigeria's prevalence rate.* Retrieved from: http://naca.gov.ng/nigeria-prevalence-rate/

Nigeria Demographics and Health Survey [NDHS] (2013). National Population Commission. *Nigeria Demographics and Health Survey*. Rockville MD, USA:

Nigeria Health Watch (2015). *2014 National HIV sero-prevalence: Burden of HIV among women attending ANC in Nigeria. National AIDS/STI Control program*. Retrieved from: http://nigeriahealthwatch.com/wp-content/uploads/bsk-pdfmanager/1176_2014__National_HIV_Seroprevalence_Sentinel_Survey_among_Pregnant_Women_Attending_Antenatal_Clinics_in_Nigeria._FMOH_1229.pdf

Odeny, T. A., Newman, M., Bukusi, E. A., McClelland, R. S., Cohen, C. R., … Camlin, C. S. (2014). Developing content for a mHealth intervention to promote postpartum retention in prevention of mother-to-child HIV transmission programs and early infant diagnosis of HIV. *PLoS One, 9*(9). E106383. doi:10.1371/journal.pone.0106383

Ogbo, F. A., Mogaji, A., Ogeleka, P., Agho, K. E., Idoko, J., … Page, A. (2017). Assessment of provider-initiated HIV screening in Nigeria with sub-Saharan African comparison. *BMC Health Services Research, 17:* 188. doi: https://doi.org/10.1186/s12913-017-2132-4

Ogunmola, O.J., Oladosu, Y.O., & Olamoyegun, M. A. (2014). Relationship between socioeconomic status and HIV infection in a rural tertiary health center.

HIV/AIDS –Research and Palliative Care, 6: 61 - 67

Ohl, M. E., Richardson, K., Kaboli, P. I., Perencevich, E. N., Vaugh-Sarrazin, M. (2014). Geographic access and use of infectious diseases specialty and primary care services by veterans with HIV infection: Implications for telehealth and shared care programs. *Journal of Rural Health, 30*(4). 412-421. https://doi.org/10.1111/jrh.12070

Okonko, I. O., Okerentugba, P. O., & Akinpelu, A. O. (2012). Prevalence of HIV among attendees of ARFH center in Ibadan, Southwestern Nigeria. *Middle-East Journal of Scientific Research, 11*(1). 7 – 12.

Oku, A., Oyo-Ita, A., Glenton, C., Fretheim, A., Eteng, G., … Lewin, S. (2017). Factors affecting the implementation of childhood vaccination communication strategies in Nigeria: A qualitative study. *BMC Public Health, 17(*200). doi: 10.1186/s12889-017-4020-6

Olanike, B. A., & Fawole, P. (2014). Expanding access to voluntary HIV counseling and testing in the rural communities of Oyo State, Nigeria: Home-based approach for improving uptake. *European Scientific Journal, 10*(15). 430-448

Olashore, E. (2014). *HIV burden in Oyo State, Nigeria*. Retrieved from: https://www.slideshare.net/lakelash/hiv-burden-in-oyo-state-nigeria

Oleribe, O. O., Oladipo, O., Osita-Oleribe, P., Nwachukwu, C., Nkwopara, F., … Nsubuga, P. (2014). Commonization of HIV/AIDS services in Nigeria: The need, the processes, and the prospects. *Pan African Medical Journal, 19*: 329. doi: 10.11604/pamj.2014.19.329.5138

Oljira, L., Berhane, Y., & Worku, A. (2013). Assessment of comprehensive HIV/AIDS knowledge level among in-school adolescents in eastern Ethiopia. *Journal of the International AIDS Society, 16*: 17349. http://dx.doi.org/10.7448/IAS.16.1.17349

Ontario HIV Treatment Network (2014). *Telemedicine and HIV Healthcare.* Retrieved from: http://www.ohtn.on.ca/wp-content/uploads/sites/9/2014/11/RR88-Telemedicine.pdf

Oseni, O. E., Okafor, I. P., & Sekoni, A. O. (2017). Issues surrounding HIV status disclosure: Experiences of seropositive women in Lagos, Nigeria. *International Journal of Preventive Medicine, 8:* 60 doi: 10.4103/ijpvm.IJPVM_136_15

Paniz, V. M. V., Fassa, G., Maia, M. F. S., Dominiques, M., & Bertoldi, A. D. (2010). Measuring access to medicines: A review of quantitative methods used in household surveys. *BMC Health Services Research, 10:* 146. Https://doi.org/10.1186/1472-6963-10-146

Patient Engagement Health IT (2018). *Patient engagement strategies for post-discharge follow-up care*. Retrieved from: https://patientengagementhit.com/features/patient-engagement-strategies-for-postdischarge-follow-up-care

Powell, R. E., Henstenurg, J. M., Cooper, G., Hollander, J. E., & Rising, K. L. (2017). Patient perceptions of telehealth primary care video visits. *Annals of family medicine, 15*(2). 225-229.

Priya, L., Hariprasad, R., & Raghul, R. (2014). Real time monitoring of vital signs using wireless technique. *International conference on green computing communication and*

electrical engineering (ICGCCEE). Doi: 10.1109/ICGCCEE.2014.6922304 Rosenstock, I. M. (1974). Historical origins of Health Belief Model. *Health Education Monographs, 2*(4). 328-335. doi: https://doi.org/10.1177/109019817400200403

Saberi, P., Yuan, P., John, M., Sheon, N., & Johnson, M. O. (2013). A pilot study to engage and counsel HIV-positive African American youths via telehealth technology. *AIDS Patient Care, 27*(9). 529-532. Doi: 10.1089/apc.2013.0185…

Schnall, R., Bakken, S., Rojas, M., Travers, J., & Dieguez, A. C. (2015). *m*Health as a persuasive tool for treatment, care and management of persons living with HIV. *AIDS and Behavior, 19:* S89-S89. doi: 10.1007/s0461-014-0984-8

Shisana, O., Risher, K., Celentano, D.D., Zungu, N., Rehle, T. … Evans, M.G.D. (2016). Does marital status matter in an HIV hyperendemic country? Findings from the 2012 South African National HIV prevalence, incidence and behavior survey. *AIDS Care, 28*(2). 234-241. doi: 10.1080/09540121.2015.1080790

Strasser, R., Kam, S. M., & Regalado, S. M. (2016). Rural healthcare access and policy in developing countries. *Annual Review of Public Health, 37*: 395-412

Suthar, A. B., Ford, N., Bachanas, P. J., Wong, V. J., Rajan, J. S., … Baggaley, R. C. (2013). Towards universal voluntary HIV testing and counseling: A systematic review and meta-analysis of community-based approaches. *PLoS Med 10*(8): e1001496. https://doi.org/10.1371/journal.pmed.1001496

Szklo, M., & Nieto, F. J. (2014). *Epidemiology: Beyond the basics (3rd edition).* Burlington, MA: Jones & Bartlett Learning.

Tarkang, E. E., & Zotor, F. B. (2015). Application of the Health Belief Model (HBM) in HIV prevention: A literature review. *Central African Journal of Public Health,*

1(1). 1-8. doi:10.11648/j.cajph.20150101.11

The Guardian (February 27, 2014). *Nigerian authors condemn country's new anti-gay law*. Retrieved from: https://www.theguardian.com/books/2014/feb/27/nigeriaanti-gay-law-critic-adichie-kay-habilaThe Guardian (January 13, 2014). *Nigeria's President signs law imposing up to 14 years' jail for gay relationships.* Retrieved from: https://www.theguardian.com/world/2014/jan/13/nigerian-president-signsanti-gay-law

The New York Times (February 8, 2014). *Nigeria tries to "sanitize" itself of gays*. Retrieved from: https://www.nytimes.com/2014/02/09/world/africa/nigeria-useslaw-and-whip-to-sanitize-gays.html?mcubz=1

The Joint United Nations Programme on HIV/AIDS [UNAIDS] (2015). *HIV/ AIDS estimates*. Retrieved from: http://www.unaids.org/en/regionscountries/countries/nigeria

The Vanguard (May 4, 2016). *Number of HIV-positive people in Lagos drops*. Retrieved from: http://www.vanguardngr.com/2016/05/number-hiv-positive-people-lagosdrops/

Tobin-West, C. I., & Onyekwere, V. N. (2014). Human immunodeficiency virus screening in rural communities of Rivers State, Nigeria: Challenged and potential solutions. *Annals of African Medicine, 13*(4). 161-168.

Toh, N., Pawlovich, J., & Grzybowski, S. (2016). Telehealth and patient-doctor relationship in rural and remote communities. *Canadian Family Physician, 62:*

961-963

Trochim, W. M. K. (2006). *Research methods-knowledge base*. Retrieved from: http://www.socialresearchmethods.net

Tsai, C-H. (2014).The adoption of a telehealth system: The integration of extended technology acceptance model and Health Belief Model. *Journal of Medical Imaging and Health Informatics, 4:* doi:10.1166/jmihi.2014.1278

University of Twente (2017). *Health Belief Model: Explaining health behaviors.* Retrieved from: https://www.utwente.nl/en/bms/communication-theories/sortedby-cluster/Health%20Communication/Health_Belief_Model/

UNWomen (2016). *Facts and figures, HIV and AIDS: Prevalence and new infections*. Retrieved from: http://www.unwomen.org/en/what-we-do/hiv-and-aids/facts-andfigures

Wao, H., Aluoch, M., McIntosh, S., Mhaskar, R., Orrick, J. J., … Djulbegovic, B. (2016). Impact of telehealth training on health care providers' knowledge in HIV/AIDS care: A mixed methods evaluation. *Journal of the International Society of Telemedicine and eHealth, 4*: e14

Ventola, C. L. (2014). Mobile devices and apps for healthcare professionals: Uses and benefits. *Pharmacy and Therapeutics, 39*(5). 356-364

Woods, B. R., Unruh, K. T., Martinez-Paz, N., Annese, M., Ramers, C. B., … Spach, D. H. (2016). Impact of a telehealth program that delivers remote consultation and longitudinal mentorship to Community HIV providers. *Open Forum Infectious Diseases, 3*(3). Doi: https://doi.org/10.1093/ofid/ofw123

World Health Organization (2008). Nigeria still searching for right formula. *Bulletin of the World Health Organization, 86*(9). Retrieved from: http://www.who.int/bulletin/volumes/86/9/08-020908.pdf

World Health Organization [WHO] (2017). *Global Workforce Alliance: Nigeria*. Retrieved from: http://www.who.int/workforcealliance/countries/nga/en/

Young, J. D., & Badowski, M. E. (2017). Telehealth: Increasing access to high quality care

by expanding the role of technology in correctional medicine. *Journal of Clinical Medicine, 6*(2). 20. doi: 10.3390/jcm6020020

Young, S., & Chiu, J. (2014). Innovative use of technology for HIV prevention and care: Evidence, challenges and the way forward. *Journal of Mobile Technology in Medicine, 3*(15). 1-3. doi:10.7309/jmtm.3.1S.1

Yu, P., & Hailey, D. (2013). Cost-effectiveness of telehealth in the management of chronic conditions. *Journal of comparative effectiveness research, 2*(4). 379-81. doi: 10.2217/cer.13.41

Zhao, F., Li, M., Qian, Y., & Tsien, J. Z. (2013). Remote measurements of heart and respiration rates for telemedicine. *PLoS One, 8*(10). E71384. doi: 10.1371/journal.pone.0071384

Appendix A: Association between Age and weekly HIV counseling

Variables in the Equation

							95% C.I. for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Age	-.014	.010	2.160	1	.142	.986	.967	1.005
		.0 08	.005	2.220	1	.136	1.008	.998	1.018
	Weekly HIV Counseling sessions								
	Constant	.672	.305	4.850	1	.028	1.958		

a. Variable(s) entered on step 1: Age, Weekly HIV Counseling sessions.

Appendix B: Mobile Phone Use and Residential Location

*Mobile Phone Use * Residential Location Crosstabulation*

			Residential Location			
			Rural	Urban	29	Total
Mobile Phone Use	Yes	Count	788	671	0	1459
		Expected Count	824.5	633.9	.7	1459.0
		% within Mobile Phone Use	54.0%	46.0%	0.0%	100.0%
		% within Residential Location	62.6%	69.3%	0.0%	65.5%
		% of Total	35.4%	30.1%	0.0%	65.5%
	No	Count	471	297	1	769
		Expected Count	434.5	334.1	.3	769.0
		% within Mobile Phone Use	61.2%	38.6%	0.1%	100.0%
		% within Residential Location	37.4%	30.7%	100.0%	34.5%
		% of Total	21.1%	13.3%	0.0%	34.5%
Total		Count	1259	968	1	2228
		Expected Count	1259.0	968.0	1.0	2228.0
		% within Mobile Phone Use	56.5%	43.4%	0.0%	100.0%

	% within Residential Location	100.0%	100.0%	100.0%	100.0%
	% of Total	56.5%	43.4%	0.0%	100.0%

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.076	.002
	Cramer's V	.076	.002
N of Valid Cases		2228	

Appendix C: Grouped Weekly Attendance Sessions

Table C1

Weekly Counseling Attendance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-24	540	24.2	24.2	24.2
	25-34	804	36.1	36.1	60.3
	35-52	884	39.7	39.7	100.0
	Total	2228	100.0	100.0	

Table C2

Weekly HIV Counseling sessions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	14	8	.4	.4	.4
	15	24	1.1	1.1	1.4
	16	36	1.6	1.6	3.1
	17	43	1.9	1.9	5.0
	18	54	2.4	2.4	7.4
	19	61	2.7	2.7	10.1
	20	50	2.2	2.2	12.4

	21	65	2.9	2.9	15.3
	22	63	2.8	2.8	18.1
	23	62	2.8	2.8	20.9
	24	74	3.3	3.3	24.2
	25	60	2.7	2.7	26.9
	26	72	3.2	3.2	30.2
	27	64	2.9	2.9	33.0
	28	80	3.6	3.6	36.6
	29	86	3.9	3.9	40.5
	30	89	4.0	4.0	44.5
	31	86	3.9	3.9	48.3
	32	86	3.9	3.9	52.2
	33	92	4.1	4.1	56.3
	34	89	4.0	4.0	60.3
	35	98	4.4	4.4	64.7
	36	90	4.0	4.0	68.8
	37	77	3.5	3.5	72.2
	38	73	3.3	3.3	75.5
	39	86	3.9	3.9	79.4
	40	66	3.0	3.0	82.3
	41	73	3.3	3.3	85.6

	42	53	2.4	2.4	88.0
	43	49	2.2	2.2	90.2
	44	52	2.3	2.3	92.5
	45	41	1.8	1.8	94.3
	46	32	1.4	1.4	95.8
	47	24	1.1	1.1	96.9
	48	36	1.6	1.6	98.5
	49	14	.6	.6	99.1
	50	16	.7	.7	99.8
	51	4	.2	.2	100.0
	Total	2228	100.0		100.0

Appendix D: Marital Status and HIV Status

*Marital Status * HIV Status Crosstabulation*

			HIV Status		
			Positive	Negative	Total
Marital Status	Single	Count	538	573	1111
		Expected Count	453.8	657.2	1111.0
		% within Marital Status	48.4%	51.6%	100.0%
		% within HIV Status	59.1%	43.5%	49.9%
		% of Total	24.1%	25.7%	49.9%
	Married	Count	372	745	1117
		Expected Count	456.2	660.8	1117.0
		% within Marital Status	33.3%	66.7%	100.0%
		% within HIV Status	40.9%	56.5%	50.1%
		% of Total	16.7%	33.4%	50.1%
Total		Count	910	1318	2228
		Expected Count	910.0	1318.0	2228.0
		% within Marital Status	40.8%	59.2%	100.0%
		% within HIV Status	100.0%	100.0%	100.0%
		% of Total	40.8%	59.2%	100.0%

Correlations

			Age	Marital Status
Spearman's rho	Age	Correlation Coefficient	1.000	.431**
		Sig. (2-tailed)	.	.000
		N	2228	2228
	Marital Status	Correlation Coefficient	.431**	1.000
		Sig. (2-tailed)	.000	.
		N	2228	2228

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix E: Predicting HIV Status through Weekly HIV Counseling Attendance

Variables in the Equation

								95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Weekly HIV Counseling sessions	.016	.005	10.526	1	.001	1.016	1.006	1.026
	Constant	-.140	.163	.739	1	.390	.870		

a. Variable(s) entered on step 1: Weekly HIV Counseling sessions.

Appendix F: Model PCAT Questions

HIV-PCAT

Post-Counselling Aptitude Test

1. Kissing an HIV-positive individual can transfer infections
2. Lubricants in condoms reduce the chances of HIV infection
3. Multiple sex partners will increase the chances of HIV infection
4. Having sex with a virgin can cure HIV infection
5. The only way to get infected is through sexual intercourse
6. Spiritual intervention does not prevent HIV infection in unprotected sex
7. HIV can be prevented by drinking hot tea before and after sex
8. Urinating immediately after sex with an HIV infected person will prevent HIV infection
9. To avoid HIV infection, you can have anal sex instead
10. Using a new needle will not prevent HIV infection via intravenous access
11. A flushed needle will not prevent HIV transmission from a used needle
12. Using antibiotics will not prevent HIV infection
13. No vaccine can prevent HIV infection
14. Having sex during monthly period does not prevent HIV infection
15. Some herbal medicines can cure or prevent HIV
16. To prevent being infected, a woman can remain on top of a man during sex
17. Washing the penis with anti-septic soap can prevent HIV infection
18. HIV/AIDS is now a genetic disease and can be inherited
19. Living longer with HIV is possible with ARV compliance
20. Some tribes in Nigeria catch HIV faster than others

Marking grades: A: 18 – 20 /High; B: 15 – 17/Medium; C: <13/Low

Appendix G: PCAT Answers

HIV-PCAT

*Post-Counselling Aptitude Test Client ID No.*_____

Question No.	ANSWER
1	FALSE
2	FALSE
3	TRUE
4	FALSE
5	FALSE
6	TRUE
7	FALSE
8	FALSE
9	FALSE
10	FALSE
11	TRUE
12	TRUE
13	TRUE
14	TRUE
15	FALSE
16	FALSE
17	FALSE
18	FALSE
19	TRUE
20	FALSE

----------OFFICIAL: Do Not Write Below this Line----------

Score_____Date_____Week_____