HIV-RELATED DISABILITY: DEVELOPMENT OF A CONTEXTUALISED PHYSICAL ACTIVITY PROGRAMME

Temitope Seun Oladejo

1710755

A Thesis submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Doctor of Philosophy Johannesburg, South Africa.

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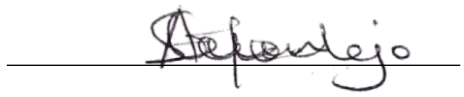
Declaration

I, Temitope Seun Oladejo, declare that this Thesis is my unaided work.

It is being submitted for the Degree of Doctor of Philosophy at the University of the Witwatersrand, Johannesburg.

It has not been submitted before for any degree or examination at any other University. I confirm lead authorship of the published articles included in this Thesis.

Temitope Seun Oladejo _____ 

Name of candidate Signature of candidate

On this day April 30, 2024

Dedication

This work is dedicated to my late mother, Saudat Ajibola Ojelade. I did it, Mum, I did it.

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All thanks, glory, and honour to God Almighty, my maker and helper

Family

- To my husband, Olaseni Oladejo, thank you for encouraging me all through this journey.
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List of Abbreviations

Acronyms	Full meaning
AIDS	Acquired Immune Deficiency Syndrome
FITT	Frequency, Intensity, Type, Time
HBM	Health Belief Model
HIV	Human Immuno-Virus
ICF	International Classification of Function, Disability, and Health
IPAQ	International Physical activity Questionnaire
MOS-HIV	HIV Medical Outcomes Survey
PLWH	People living with HIV
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-analysis
RE-AIM	Reach, Effectiveness, Adoption, Implementation, Maintenance
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNCRPD	United Nations Convention on the Rights of Persons with Disabilities
WHO	World Health Organisation
WHODAS	WHO Disability Assessment Schedule

Presentations arising from this Study

World Physiotherapy Congress, Dubai. Poster presentation (ABSTRACTS-WP2023-02038) A needs assessment for a context-sensitive physical activity intervention among people living with HIV-related disability. 4th June 2023

The 3rd Lagos University Teaching Hospital International Scientific Workshop and Conference (LUTH ISWC). Poster presentation (LUTH/ISWC/ABS/2023-002): Physical activity and disability level among people living with HIV in Lagos, Nigeria. 15th June 2023.

The 18th Annual Conference and Gathering of Faculty of Clinical Sciences, College of Medicine, University of Lagos. Oral presentation (ABS/IFD/022): Rehabilitation strategies in managing HIV-related disability among people living with HIV in sub-Saharan Africa. 26th July 2023.

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HIV-related disability: development of a contextualised physical activity program

Abstract

Background

This thesis investigated the status of physical activity and exercise use among people living with HIV (PLWH) in a Nigerian context. The literature on exercise and physical activity revealed that a considerable number of PLWH encounter several barriers that limit them from being sufficiently active, resulting in their failure to meet globally recommended levels of physical activity. Most of the studies done on intervention programs to improve physical activity level among PLWH were set in a western context. In sub-Saharan Africa, where HIV prevalence is highest, the prevalence of physical activity among PLWH is not well documented. Due to low resources and contextual barriers in sub-Saharan Africa, it is challenging to execute the physical activity intervention programs developed in well-resourced countries to resource-limited settings.

Being an effective, and safe strategy, physical activity has been recommended as non-pharmacological management for HIV, as it is beneficial to the physical, mental, and overall well-being of PLWH. However, despite these benefits, the prevalence of physical activity among PLWH in Nigeria is low. It has been suggested that a physical activity intervention program be developed taking into consideration contextual factors in Nigeria. Therefore, a contextualised physical activity program could improve the physical activity levels of PLWH in Nigeria.

Aim

This study aimed to develop a contextualised physical activity program that can be integrated into existing healthcare systems and community support networks for PLWH in Nigeria.

Method

This study used a mixed-method approach with four studies to address the study aim. The first study was a cross-sectional study which was conducted to determine the prevalence of HIV-related disability, the perceived health status and physical activity level among people living with HIV. The second study sought to explore the barriers and facilitators influencing physical activity participation among people living with HIV using a qualitative study. To improve health outcomes and create an effective rehabilitation plan, a scoping review was conducted as

the third study to identify rehabilitation strategies implemented in the management of HIV-related disability. The data from the studies were triangulated and integrated to guide the development of the physical activity program. The integration involves synthesizing findings from the three studies, identifying common themes and patterns, and reconciling any discrepancies. By combining insights from different sources, a more comprehensive understanding of the needs, preferences, and challenges faced by PLWH in relation to physical activity was achieved, and a draft physical activity program was designed. Finally, the fourth study was a Delphi study which was conducted to reach a consensus among a panel of experts on the content of the developed physical activity program.

Results

Study 1: Three hundred and eighty-five PLWH participated in this study. The results showed a 39.5% prevalence of HIV-related disability, with participants experiencing the most disability in the participation domain (31.75%). The health-related quality of life score was 55.8±5.3 and 56.3±6.7 for the physical health summary (PHS) and mental health summary (MHS) respectively. The prevalence of physical activity level was low in 45% of the participants. Most of the participants experienced multiple medical symptoms, especially headaches, weight loss, and muscular pain (36.6%, 27.8% and 16.9%, respectively).

Study 2: Twenty PLWH were interviewed in this study. The participants perceived physical activity as beneficial to their health. However, the factors influencing participation in physical activity are multifactorial and complex. The commonly reported barriers to physical activity were lack of time due to busy schedules, persistent feelings of fatigue associated with living with HIV, an environment that did not foster physical activity, financial limitations hindering access to resources or facilities, and competing social commitments that took precedence over exercise routines. The facilitators of physical activity included perceived benefits of exercise, such as improved physical and mental health outcomes, habitual behaviours that integrated physical activity into daily routines, encouragement and support from family, friends, or healthcare providers, and the recognition of the preventive and pain-relieving effects of physical activity in managing HIV-related symptoms.

Study 3: The scoping review included 22 articles, of which the majority (68.2%) were randomised control trial (RCT) study designs. Rehabilitation intervention strategies included

physiotherapy, occupational therapy, supportive psychotherapy, education programs, and other methods. Most of the studies reviewed used strategies related to

health promotion in exercise and health education. The scoping review highlights some knowledge gaps in the field of rehabilitation interventions such as the need to explore the long-term effectiveness of diverse rehabilitation strategies, and the bridge between interventions tailored to individual needs and a one-size-fits-all approach.

Study 4: The modified Delphi approach had twenty-eight (28) panel members from eight countries who were experts in the field of physical activity, HIV, and rehabilitation. The experts practised in research, academic and clinic settings. Consensus (>85%) was achieved for all sections (exercise information booklet, pre-screening questions, program structure, implementation strategy) of the developed exercise program for people living with HIV in Nigeria. The Delphi study involved two rounds of surveys aimed at integrating research findings and expert knowledge to create a feasible physical activity program for PLWH in Nigeria.

Conclusion

The overall aim of this study was to develop a contextualised physical activity program for people living with HIV in Nigeria. The findings from the studies shed light on the intricate interplay between HIV-related disability, health perceptions, and physical activity among PLWH in Nigeria. Despite relatively good Health-Related Quality of Life (HRQoL), participants faced challenges in the participation domain and reported poor general health perceptions. The majority did not meet WHO-recommended physical activity guidelines, citing various barriers such as lack of time, fatigue, and unsupportive environments. However, amidst these challenges, there exists a clear recognition of the benefits of physical activity among PLWH. The findings underscore the pressing need for tailored interventions that account for individual preferences and contextual barriers. Central to this study is the development of a tailored intervention program designed to bridge these gaps and empower PLWH to engage in regular physical activity. With insights from previous research, views from PLWH and opinions from experts, the developed physical activity program addresses individual preferences while navigating the unique challenges of the Nigerian context.

Chapter 1 Introduction

1.1 Introduction to chapter

This chapter gives a brief overview of HIV-related disability and the rationale for the study. The study's aims and objectives are outlined, and the conceptual framework is discussed.

1.2 Background

Global trends reveal that treatment and prevention strategies have been successful in significantly reducing HIV-related morbidity and mortality (Danforth et al., 2017; Kharsany et al., 2019). HIV infection and the side effects of the Antiretroviral treatments (ARTs) are both independently associated with increased risks of damage to the immune system (Zicari et al., 2019), cardiovascular system (Pinto and da Silva, 2018), central nervous system (Ellis, 2010) and musculoskeletal system (Walker-Bone et al., 2017). These compromised body systems make the individual prone to fatigue, joint pain, hypertension, dyslipidaemia, neuropathy, depression, opportunistic infections (e.g., pneumonia), and other non-communicable diseases (e.g., kidney disease, cardiovascular disease, and diabetes (Kiage et al., 2013; Kuti et al., 2015; Ibeneme et al., 2019) which contribute to poor Health-related Quality of Life (HRQoL) among people living with HIV (PLWH) (Yaya et al., 2019). Thus, PLWH are faced with the double burden of HIV and the emergence of disabilities attributed to the use of ART (Todowede et al., 2019).

Disability is described as "a complex phenomenon that manifests itself at the body, person and social level" (Hanass-Hancock, 2009), encompassing long-term physical, mental, and intellectual impairments which hinder individuals from effectively participating in society (Haines, 2015). The World Health Organisation's International Classification of Functioning, Disability and Health (ICF) provides a foundation for understanding the disability dimensions of HIV better. According to the ICF framework, interactions between health conditions, intrinsic (personal) and extrinsic (environmental) contextual factors influence an individual's functioning at three levels, namely, impairment, activity limitation and participation restriction (Cieza and Bickenbach, 2021). HIV and the use of ART may lead to the development of disability in an individual by causing impairments to the body structure or function, such as loss of sight, musculoskeletal weakness, activity limitations, such as an inability to climb stairs or dress independently, and consequently, participation restriction in such areas as parenting or employment (Banks et al., 2015). Hence, HIV-related disability is increasingly being

recognised as a public health concern, particularly in sub-Saharan Africa, where HIV has the highest prevalence (Granich et al., 2015).

Of the estimated 39 million (33.1-45.7 million) PLWH in the world in 2022, 67.5% are in Africa (UNAIDS, 2023). Despite the low prevalence of 1.4% (1.9 million PLWH), Nigeria has the highest burden of HIV in West and Central Africa sub-region (UNAIDS, 2023). The significance of HIV-related disabilities is particularly pronounced in sub-Saharan Africa, where the most impoverished and marginalized communities are disproportionately affected (Banks et al., 2015). Thus, there is an urgent need for a multi-disciplinary approach to address this health burden. Therefore, public health services should encompass both prevention or treatment of impairments and provision of rehabilitation services. To improve patients' health status and encourage healthy living, physical activity is a non-pharmacological alternative that has been recommended by health providers as a strategy to minimise the risk of developing these disabilities among PLWH (Dang et al., 2018). Studies have reported that physical activity increases functional capacity, muscle strength, joint flexibility and endurance among people living with HIV (Botros et al., 2013; Mashinya et al., 2015; Dirajlal-Fargo et al., 2017).

Engaging in physical activity helps to alleviate limitations in performing daily activities due to physical health issues and is relevant when considering the impact of HIV-related disability on function and quality of life (Ibeneme et al., 2019). A systematic review by O'Brien et al. (2016) reported positive cardiorespiratory, strength and body composition outcomes among PLWH who engaged in physical activity. Other benefits of engaging in physical activity by people living with HIV include lower blood pressure, improved lipid profiles, improved functional capacity, reduced risk of cardiovascular disease and overall cardio-metabolic effects (Batacan et al., 2017; Lorenzo et al., 2018). Furthermore, functional problems such as difficulty in walking, impairments and disabilities in people living with HIV can be partially remedied through participation in physical activity and community-based rehabilitation programmes (Cobbing et al., 2016).

According to the World Health Organisation (WHO), it is recommended that adults should engage in 30 minutes of moderate to vigorous physical activity daily to maintain good health (WHO, 2010), that is, 150 minutes per week of moderate-intensity physical activity (40-60% VO2 max.) or 75 minutes per week of vigorous-intensity physical activity (60-85% VO2 max.).

People living with HIV can engage in the same types of physical activity as those who do not have HIV, and compliance with at least one kind of physical activity in this guideline is recommended (CDC, 2017). Achieving this can be accomplished in a variety of ways, such as brisk walking or jogging for two miles (Moore et al., 2012), or more intermittently, at an equivalent intensity by engaging in short bouts of activity, such as dancing, frequent stair climbing and performing house duties (World Health Organisation, 2010).

However, despite the known health benefits of physical activity, evidence suggests that individuals living with HIV do not engage in sufficient physical activity (Schuelter-Trevisol et al., 2012; Frantz and Murenzi, 2013; Dang et al., 2018). Several barriers may be responsible for the limited participation in physical activity, particularly in Africa, where cultural, environmental, and socioeconomic factors play a significant role (Mabweazara et al., 2018). In sub-Saharan Africa, socioeconomic status influences physical activity participation among people living with HIV (Ramjee and Brod, 2013). Most people living with HIV/AIDS in Africa are from poor socioeconomic backgrounds, which are frequently associated with a low level of physical activity (Ogunmola et al., 2014; Mabweazara et al., 2019; Malete et al., 2019). In Nigeria, the prevalence of physical inactivity was 41%, with females being more likely to be inactive (Adegoke and Oyeyemi, 2011). Several sociodemographic variables and other complex factors were found to be correlates of physical inactivity in this population, particularly among those living with HIV. Some of the barriers to participation in physical activity among PLWH in Nigeria include intrapersonal factors, cultural factors, environmental factors, and government policies (Vancampfort et al., 2018)

A person living with HIV in Nigeria is likely to experience stigma if their status is known to the public thereby making the individual suffer the double burden of living with HIV and of facing the stigmatisation they experience from their community (Monjok et al., 2009). Dahlui et al. (2015) argue that this problem of stigmatisation experienced by people living with HIV is more widespread in sub-Saharan Africa, including Nigeria, because of the underdeveloped health system and the lax legal and ethical standards. The HIV stigma manifests itself mainly as negative attitudes and rejection against PLWH by individuals, community members and sometimes even by healthcare workers (Visser et al., 2009; Ehiri et al., 2019; Nyblade et al., 2019). One of the many ways in which the HIV stigma manifests itself is through negative perceptions of PLWH, which result in prejudice and discrimination against them. Stigma and

bias are common barriers to HIV treatment and prevention in Africa. As Fortwengel (2018) reported from a study conducted across 13 African countries, illiteracy, ignorance, and poor education are the major causes behind the High Stigma Index (HSI) in these countries. Thus, to achieve success in HIV treatment and prevention, it is essential to emphasise the importance of education and knowledge concerning HIV transmission, stigmatisation and HIV-related disability (Parsons, Bond, and Nixon, 2015).

The impact of HIV on disability in Nigeria has not been expansively researched, and there is a dearth of literature on disability, physical activity level, quality of life and stigmatisation of people living with HIV. Olaleye et al. (2017) reported that of the 360 participants living with HIV in a study conducted in Ibadan, more than two-thirds experienced at least one form of disability. Among this population, the participation domain represented the highest level of disability. Similarly, assessments with respect to participation restrictions and activity limitations among PLWH in British Columbia found that disability is commonly experienced as constraints in job activity and financial responsibilities (Rusch et al., 2004). Furthermore, social problems such as stigma, depression and poverty affect the quality of life among PLWH (Basavaraj et al., 2010). In examining the intersectionality of HIV, disability and stigma, research indicates that stigmatisation of PLWH affects their quality of life, health outcomes, and consequently, their attitude towards their participation in physical activities (Turan et al., 2017).

Given the diverse sociodemographic, economic, and sociocultural factors that could impact the psychosocial well-being of PLWH in Nigeria and the development of disability (Ogunmola et al., 2014), it is recommended that the barriers to and facilitators for exercise uptake be considered when designing physical activity programmes. Currently, public health physical activity recommendations use community or home-based rehabilitation methods to improve health outcomes (Dawad and Jobson, 2011; Cobbing et al., 2016), and interventions tailored to the needs of participants have produced effective results. In Nigeria, with the prevalent nature of stigmatisation, together with cultural beliefs and religious influences on the perception of HIV (Dahlui et al., 2015; Odimegwu et al., 2017), there is a need to consider all these factors in developing a physical activity-based programme. Since ignorance, illiteracy, and lack of education are contributory factors to HIV stigmatisation, it would be essential to explore the role of education in influencing behavioural change (Fortwengel, 2018). Thus, this study aims

to develop a physical activity-based intervention programme for people living with HIV in Nigeria.

1.3 Problem Statement

The prevalence of HIV in Nigeria is 1.4%, representing nine per cent (9%) of the global population of PLWH (NAC, 2019). Although there has been an increase in access to ART in Nigeria, the rate of new infections and opportunistic infections, such as tuberculosis, have risen in the past year (UNAIDS, 2019). This indicates that although mortality rates among PLWH may fall, they are prone to a diverse range of health-related challenges because of HIV infection and their use of ART. There is a paucity of data on the prevalence of disability among PLWH in Nigeria (Olaleye et al., 2017). It is, therefore, important to first determine the extent, nature, and range of HIV-related disability in Nigeria.

In the management of HIV-related disability, physical activity has been a practical, non-pharmacological approach to improve health outcomes and quality of life (Neff et al., 2019). However, participation in physical activity in sub-Saharan Africa is hindered by several factors, such as sociodemographic factors, lack of social support, poor education, poverty, and environmental factors (Okafor and Sekoni, 2017). Although few studies in Africa (Sovran, 2013; Mabweazara et al., 2018) have investigated the contextual problems often associated with the adoption of a physical activity intervention programme among PLWH, there has been no such study in Nigeria. It is, therefore, imperative to explore the development of a needs-based physical activity programme that takes into consideration the socio-cultural context of Nigeria to improve health outcomes among PLWH.

1.4 Significance of study

The goal of this study was to develop a context-sensitive physical activity program for PLWH in Nigeria. The significance of this study lies in addressing the critical gaps in understanding and addressing the barriers to physical activity participation and providing insights into effective interventions for improving the health outcomes of PLWH in the region. The results from this study have the potential to inform public health policies and interventions aimed at enhancing the overall well-being of PLWH and reducing the burden of HIV-related disability in Nigeria.

1.5 Research questions

1. What is the prevalence of disability and physical activity among people living with HIV in Nigeria, and how do these aspects affect their quality of life?
2. What are the factors influencing the participation of PLWH in physical activities in Nigeria?
3. What are the context-specific components to consider in developing a physical activity program for PLWH in low-resource settings such as Nigeria, and what is the opinion of experts on the content of the physical activity program developed?

1.6 Aims and Objectives

Aim 1: To determine the pattern and prevalence of disabilities among people living with HIV in Nigeria

Objectives of Aim 1:

- To determine the prevalence of disability among PLWH in Nigeria
- To understand the current physical activity level among PLWH in Nigeria
- To understand the perceived health-related quality of life of PLWH in Nigeria Aim 2:

To identify the facilitators and barriers to participating in physical activities.

Aim 3: To identify the rehabilitation strategies adopted in the management of HIV-related disability.

Aim 4: To develop an exercise-based intervention programme.

Objectives of Aim 4:

1. To triangulate data from the cross-sectional study, qualitative study, and the scoping review
2. To utilize insights and recommendations from experts through the Delphi method to identify priorities for the physical activity program

1.7 Conceptual framework

To develop interventions, health professionals need to understand the determinants of physical activity participation among people living with HIV (Rice and Sara, 2019). Several theories, such as the theory of planned behaviour, the self-efficacy theory, the trans-theoretical model of behavioural change and the health belief model, have been used to investigate the factors associated with physical activity (Biddle and Nigg, 2000; Buchan et al., 2012). The Health Belief Model has been applied in studies that explore the prevention of HIV/AIDS and is the

most commonly adopted theory in health education, illness prevention and health promotion (Tarkang and Zotor, 2015).

The health belief model (HBM) is grounded in the theory of "expectancy-value" and takes into consideration that individuals are rational decision-makers who weigh the advantages and disadvantages of performing an action. Thus, the theory proposes that a person's intention to engage in a physical activity is a function of the perceived vulnerability and probable severity of their health condition (Tarkang and Zotor, 2015). The Health Belief Model is used in this study to examine how individuals perceive the risk of HIV-related impairment, the advantages of taking preventative action by engaging in physical exercise, and how cultural, socioeconomic, and environmental factors influence the decision to act.

The Health Belief Model developed by a group of social psychologists in the 1950s was used to guide the process of this study (Rosenstock, 1974). This framework contributes to an understanding of human behaviour and comprises the following elements: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy. The effectiveness of the Health Belief Model in identifying critical decision-making points that impact health behaviour depends on each of the following vital components (Tarkang and Zotor, 2015):

1. Perceived susceptibility: Information is gathered by conducting a health needs assessment to determine which individuals in a selected population are at risk.
2. Perceived severity: The targeted parties understand the consequences of the health issues associated with risk behaviour that are conveyed to them.
3. Perceived benefits: This step involves enlightening the target population on the process and benefits of taking the recommended action.
4. Perceived barriers: Assistance is provided to identify and mitigate the factors that function as barriers to the recommended action.
5. Cues to action: Skill development activities and support are provided to encourage the target population to take the recommended action.
6. Self-efficacy: The targeted parties demonstrate the recommended actions and the likelihood of successful behavioural changes.

Thus, as shown in Figure 1.1 below, this framework guides the overall methodology of the needs-based rehabilitation programme.

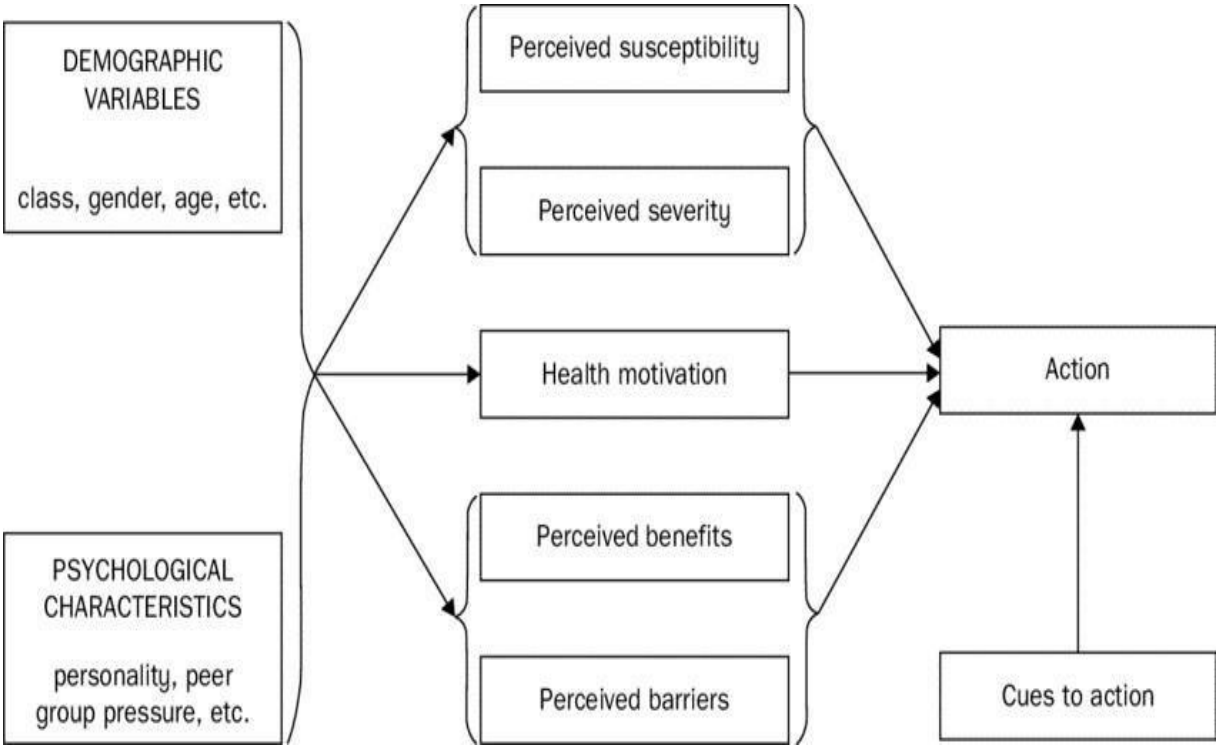

Figure 1.1: The Health Belief Model (Yen and Li, 2019).

The Health Belief Model (HBM) was applied to this study by examining how individuals' perceptions of the severity and susceptibility of HIV-related health issues influence their engagement in physical activity. The first phase of the study is guided by the individual's self-reported perception of HIV-related disability. If individuals perceive HIV as a severe threat to their health and believe they are susceptible to its negative effects, they may be more motivated to adhere to physical activity guidelines as a means of managing their condition and improving overall health outcomes. Additionally, the model considers cues to action, which could include recommendations from healthcare providers or public health guidelines, like those from the WHO, encouraging physical activity among PLWH. Finally, the HBM also considers perceived benefits and barriers to health behaviours.

The second phase is guided by the perceived barriers, facilitators, perceived benefits, and susceptibility of individuals to physical activity participation. PLWH may weigh the perceived benefits of physical activity for managing HIV against potential barriers such as fatigue or concerns about exacerbating symptoms. Understanding how these factors interact can inform

the development of interventions aimed at promoting physical activity among PLWH. The application of the Health Belief Model (HBM) to the overall thesis is described in Figure 1.2 below.

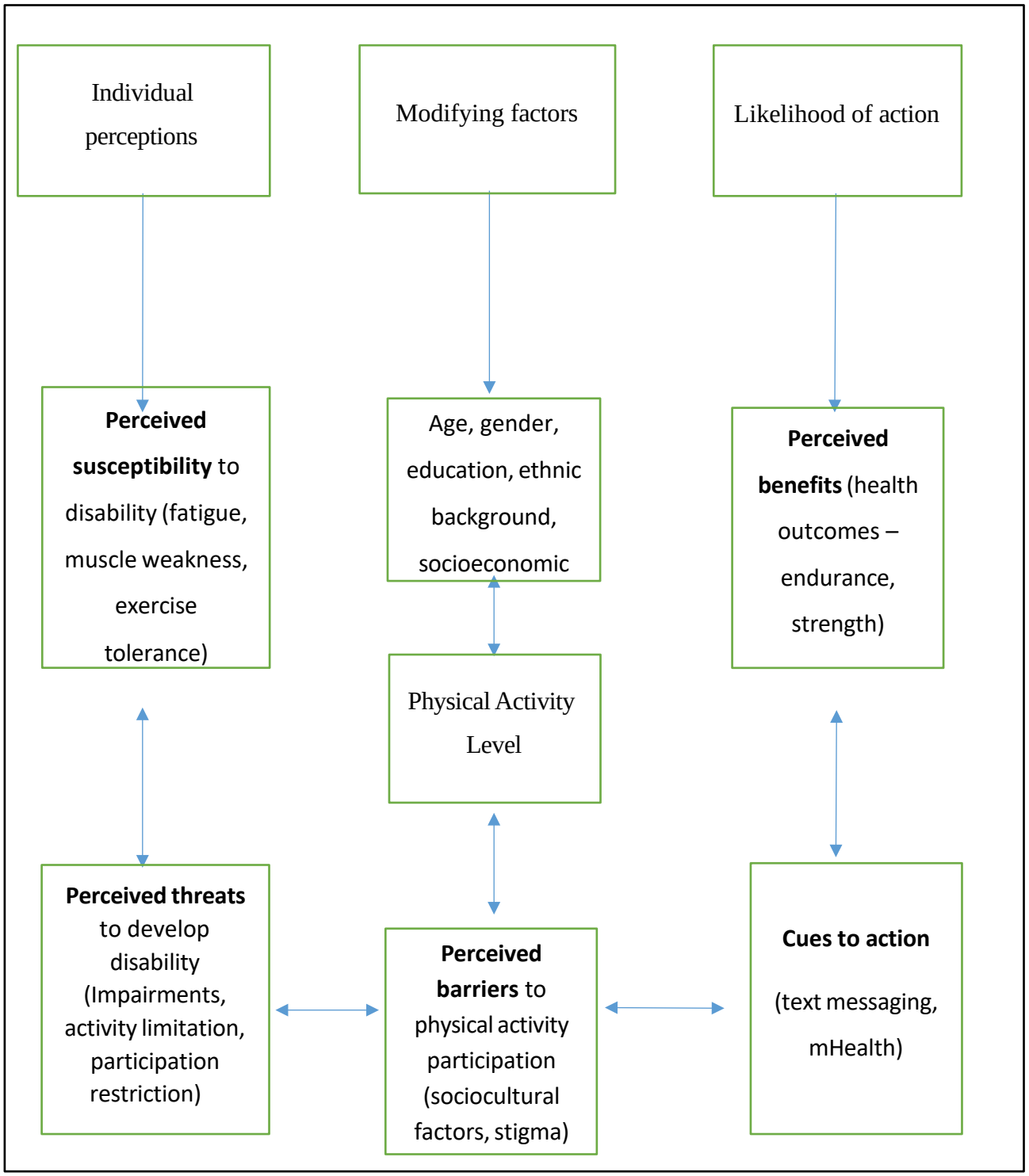

Figure 1.2: Application of the Health Belief Model to the study

1.8 Outline of Thesis

The Thesis structure follows the integrated format outlined in the University of the Witwatersrand's Faculty of Health Sciences guide for PhD thesis formats.

Chapter 1: The introduction gives the study's background information, conceptual framework, rationale, outline of the objectives, and significance.

Chapter 2: The literature review is divided into four sections. Section one presents the literature related to the burden of diseases in Nigeria to provide a contextualised background associated with HIV and HIV-related disability. In section two, information pertaining to the definition of HIV-related disability, the ICF classification, levels of disability and current management of HIV-related disability are discussed. This is done to provide the background of the research, in which the prevalence and pattern of disability were assessed in people living with HIV and current management for HIV-related disability was explored. Section three provides the framework for the research and is a discussion related to the forms, recommendations, benefits, barriers, and facilitators of physical activity. In section four, the health-related quality of life of people living with HIV is discussed.

Chapter 3: The instruments and outcome measures adopted in the data collection process are discussed in this chapter, highlighting the rationale for their selection. The project was a mixed-method research project that was made up of two phases. Phase one involved three studies: Study one was a cross-sectional study using questionnaires to determine the pattern and prevalence of disabilities among people living with HIV in Nigeria, their health-related quality of life and physical activity levels. Three manuscripts were produced from this study, each addressing the three objectives of the study, which looked at the prevalence of HIV-related disability, physical activity level, and perceived health status among people living with HIV.

Study two was a qualitative study that aimed to explore the experiences of disability among PLWH and investigate their perceived barriers and facilitators to physical activity participation. For study three, a scoping review of evidence was conducted to identify current rehabilitation strategies adopted in the management of HIV-related disability. Data from studies one to three was triangulated through direct content analysis to develop a context-sensitive physical activity

programme for people living with HIV-related disability, which experts then validated. The second phase of this study was the development of the physical activity program.

Chapter 4: This chapter presents the results of the cross-sectional study aimed at determining the prevalence of HIV-related disability among people living with HIV in Nigeria. The methods and findings are discussed in a manuscript titled "Prevalence and predictors of HIV- related disability among people living with HIV in Nigeria".

Chapter 5: This chapter presents the results of the cross-sectional study aimed at determining the health status of people living with HIV in Nigeria. The methods and findings are discussed in a manuscript titled "Health-related quality of life and associated factors among people living with HIV/AIDS in Lagos, Nigeria: a cross-sectional study".

Chapter 6: This chapter presents the results of the cross-sectional study aimed at determining the physical activity level of people living with HIV in Nigeria. The methods and findings are discussed in a manuscript titled "Physical activity levels among people living with HIV in Lagos, Nigeria: Evaluation of adherence to recommended guidelines".

Chapter 7: This chapter presents the results of the qualitative study aimed at exploring the barriers and facilitators to physical activity participation. The methods and findings are discussed in a manuscript titled "Factors influencing physical activity engagement among people living with HIV."

Chapter 8: The chapter presents the results of the scoping review aimed at exploring the range of rehabilitation strategies adopted globally in the management of HIV-related disability. The methods and findings are discussed in a manuscript titled "Rehabilitation programs for people living with HIV-related disability: a scoping review of intervention characteristics using the RE-AIM implementation framework".

Chapter 9: This chapter presents the proposed context-sensitive physical activity program and obtains the consensus in a modified Delphi study.

Chapter 10: The study's overall findings are discussed, and its limitations and strengths are outlined.

Chapter 11: Conclusion and recommendations from the study are outlined in this chapter.

1.9 Summary of Chapter One

This chapter provided an overview of the study aims, objectives and research questions. The "health belief model" was established as the conceptual framework for the study. The outline of the thesis was highlighted. Chapter two explores the literature review that forms the detailed background of the research.

Chapter 2 Literature Review

2.1 Introduction

This literature review consists of four sections. Section one presents the literature related to the burden of diseases in Nigeria to provide a contextualised background associated with HIV and HIV-related disability. In Section two, information pertaining to the definition of HIV-related disability, the ICF classification, levels of disability and the current management of HIV-related disability are discussed. This provides the background for studies one and two of the research, in which the prevalence of disability in people living with HIV and the patterns that it assumes are assessed, and the current management of HIV-related disability is explored. Section three provides the framework for study three of the research and is a discussion related to the forms, recommendations, benefits, barriers to and facilitators of physical activity. In Section four, the health-related quality of life of people living with HIV is discussed.

To generate the literature in this chapter, extensive reviews of journals, textbooks, abstracts, and publications were assessed on various research portals. The portals and websites perused included Google, Google Scholar, PubMed, Science Direct, PEDro and Scopus.

2.2 Section one: Burden of disease and epidemiology of HIV in Nigeria

The burden of disease and epidemiology of HIV in Nigeria are discussed in this section.

2.2.1 Burden of Disease in Nigeria

Nigeria's overall health system performance on health issues was ranked 163 among 191 member states by the World Health Organisation (WHO) (WHO, 2021). With life expectancy in Nigeria at 54.69 years (Angell et al., 2022), health loss in the country is driven by a poorly developed healthcare system, a insufficient access to water, sanitation, and hygiene (WASH) and non-existent medical emergency services (Abubakar et al., 2022). In descending order, the ten leading causes of death in Nigeria reported in 2019, measured in Disability-adjusted Life Years (DALYs), were as follows: neonatal disorders (12.255), malaria (12%), diarrheal diseases (11.36%), lower respiratory tract infections (10.85%), HIV/AIDS (5.18%), ischaemic heart disease (4.37%), stroke (3.98%), congenital disabilities (3.26%), tuberculosis (2.84%) and meningitis (2.82%) (Angell et al., 2022). The deteriorating state of health of the people of Nigeria can be attributed to two major causative categories, namely, 1. communicable, maternal, neonatal, and nutritional diseases (accounting for 69% of deaths in Nigeria) and 2.

non-communicable diseases (which account for 24% of deaths in Nigeria) (Vos et al., 2020). Thus, the country is currently experiencing a double burden of diseases, ranging from communicable to non-communicable diseases.

Despite a low HIV prevalence, the country's enormous population means that as many as 1.9 million people were living with HIV in 2020 (NACA, 2021). According to the National Agency for the Control of AIDS (NACA, 2021), an estimated 51,000 people died in the first half of 2020 from HIV/AIDS-related illnesses. HIV and AIDS were the leading causes of years of life lost (YLLs) in Nigerians aged 20–54 years, accounting for 41,136 (95%) YLLs per 100,000 people (Angell et al., 2022). This implies that the level of reduction in new HIV infections and AIDS-related illnesses/deaths required to meet the common objective of eliminating AIDS as a public health threat by 2030 has not been achieved. To control the HIV/AIDS epidemic and improve the health and well-being of individuals affected by the virus, the Joint United Nations Programme on HIV/AIDS (UNAIDS) set global goals to ensure that, by 2020, 90% of all people living with HIV know their HIV status, 90% of all people diagnosed with HIV receive sustained antiretroviral therapy (ART) and 90% of all people receiving ART achieve viral suppression, meaning that the level of HIV in their blood is undetectable (UNAIDS, 2020). To meet the 90-90-90 target, Nigeria needs a comprehensive and strategic plan that engages all sectors of society and overcomes every barrier to all who are concerned (UNAIDS, 2023).

One of the key areas affecting the delivery of quality healthcare to people living with HIV is the catastrophic health expenditure among PLWH in Nigeria (Eze et al., 2022). Despite the free roll-out of antiretroviral medications, patients must also foot other direct non-medical bills, including those for transportation, payments for their pre-existing medical condition, HIV co-morbidities, opportunistic infections, and other medical illnesses (Eze et al., 2022). In a country such as Nigeria, where people with disability typically receive no benefits and no financial support, it is of utmost importance that significant commitment be made to funding and to making facilities and resources available to HIV patients to enhance their access to therapy as a crucial preventive step (Onalu and Nwafor, 2021). However, the intersection of stigma and psychosocial challenges also pose significant barriers to accessing HIV-related healthcare services in Nigeria (Ogunyemi et al., 2022). Fear of discrimination and judgment often dissuades individuals from seeking HIV testing and treatment, leading to late diagnosis and delayed initiation of antiretroviral therapy.

Moreover, the reluctance to disclose one's HIV status can hinder adherence to medication regimens and engagement in care, exacerbating the risk of disease progression and transmission (Ahmed et al., 2022). Despite the Nigerian government's significant progress in raising awareness and dispelling myths about the virus (NACA, 2021), HIV-related stigma persists at various levels of society, fueling discrimination, fear, and prejudice against those affected (Ogunyemi et al., 2022). To address these challenges, Nigeria must adopt a comprehensive approach that tackles stigma at its roots, promotes psychosocial support services, and empowers communities to prioritize the human rights and dignity of PLWH. Furthermore, critical to the understanding of the prevalence of HIV is the need to increase HIV testing among Nigerians, as it ensures that individuals are aware of their HIV status, helps to prevent new infections and facilitates their access to antiretroviral therapy.

2.2.2 Prevalence and Incidence of HIV in Nigeria

Despite 30 years of innovative science and HIV research into developing a cure, HIV persists as a serious cause of death and a public health concern to millions worldwide (UNAIDS, 2019), an estimated 36.3 million lives have been lost to HIV so far. (WHO, 2021). While there is no vaccine for HIV, and no one is immune to acquiring HIV (Ng'uni, Chasara and Ndhlovu, 2020), the epidemic disproportionately impacts specific populations, communities, and geographic areas globally. It is the inequities in the social determinants of health between low and high-income countries across the world that are responsible for driving and exacerbating these global health inequalities. Two-thirds of all people living with HIV are in sub-Saharan Africa. Thus, sub-Saharan Africa bears the most significant disease burden of people acquiring and living with HIV (Jahagirdar et al., 2021).

According to the Nigeria National HIV/AIDS Indicator and Impact Survey (NAISS), the prevalence of HIV in Nigeria as of 2018 was 1.4% (UNAIDS, 2019). Estimates of the level of HIV epidemic trends in the Nigerian population (Figure 2.1) indicate that HIV prevalence among people aged 15 to 49 reached an all-time high of 5.8% in 2001 but has subsequently decreased remarkably (Awofala and Ogundele, 2018). Nigeria has one of the highest rates of new infections of any country in the world, with an estimated 107,112 new infections in 2019 (UNAIDS, 2020). Between 2010 and 2019, new infections decreased by approximately 10%, although progress has stalled in recent years (UNAIDS, 2020).

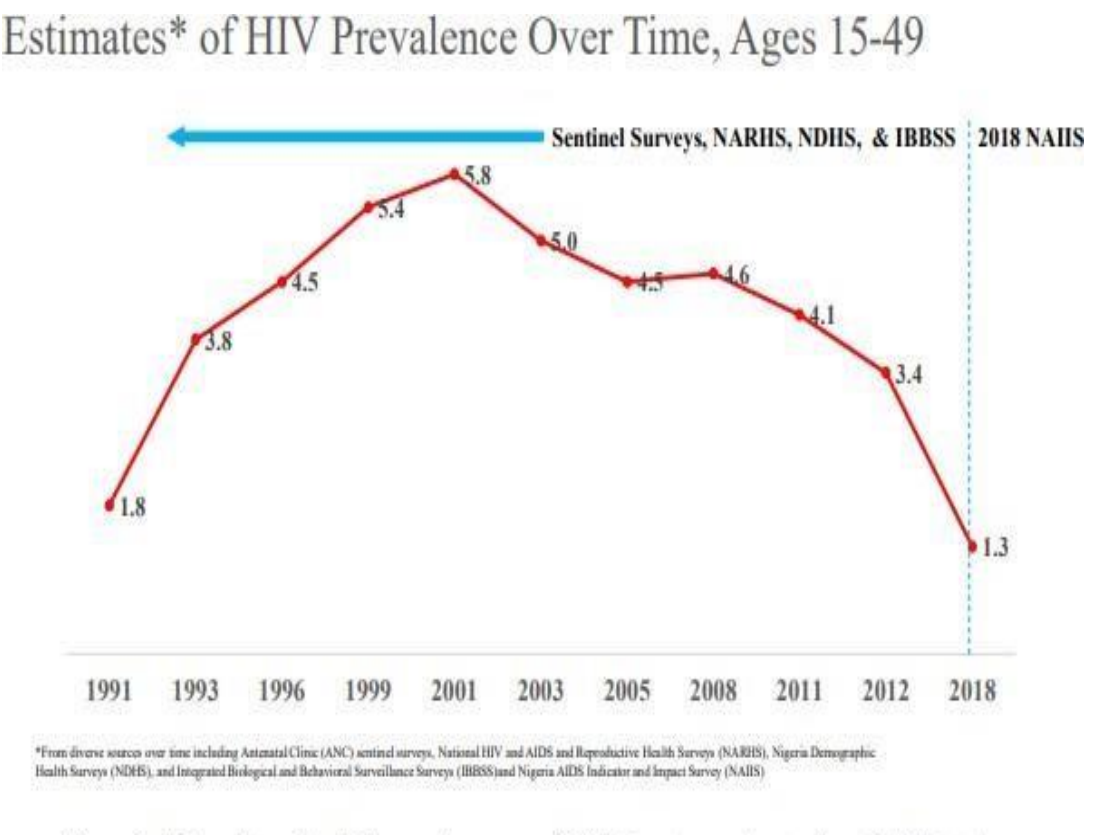

Figure 2.1: National trend in HIV prevalence, ages 15-49 (spectrum estimates from NAIIS data) (NACA, 2021)

Despite the Nigerian government's commitment to the enforcement of the rights and privileges of people living with disability, with the enactment of the Discrimination Against Persons with Disabilities (Prohibition) Act in 2019 (Arimoro, 2021), punitive legislation, such as the 2014 anti-homosexuality bill, has impeded development in respect of people's rights (Ajayi-Lowo, 2018). Indeed, as legislation for the consequences for homosexual acts has become more draconian, so do the punishments meted out: ─ ranging from 14 years imprisonment under the Nigeria penal code to death by stoning, according to the Shari'a law (Ostien and Dekker, 2010). Thus, to improve HIV-related services, it is critical to engage all stakeholders, particularly those who are most susceptible to HIV infections and who find it burdensome to access available HIV/AIDS healthcare and social care benefits. Homosexual men, female sex workers, drug users who inject, and women and girls are the main groups which should be targeted (Abubakar et al., 2022).

2.3 Section two: HIV-related disability

This section is discussed as follows: definition of HIV-related disability, episodic nature of HIV-related disability, patterns of HIV-related disability and management of HIV-related disability.

2.3.1 Definition of HIV-related disability

The occurrence of disability among people living with HIV has facilitated the conceptualisation of the term "HIV-related disability". In describing the experience of disability among people living with HIV, the International Classification of Functioning, Disability and Health (ICF) framework is applied in the context of HIV (WHO, 2013). The ICF model is a bio-psycho-social model that is described in terms of the following components: 1) impairment and morbidities (neurological, motor, and cognitive), 2) activity limitations (or functional limitations), 3) social participation restriction (Karlsson and Gustafsson, 2021).

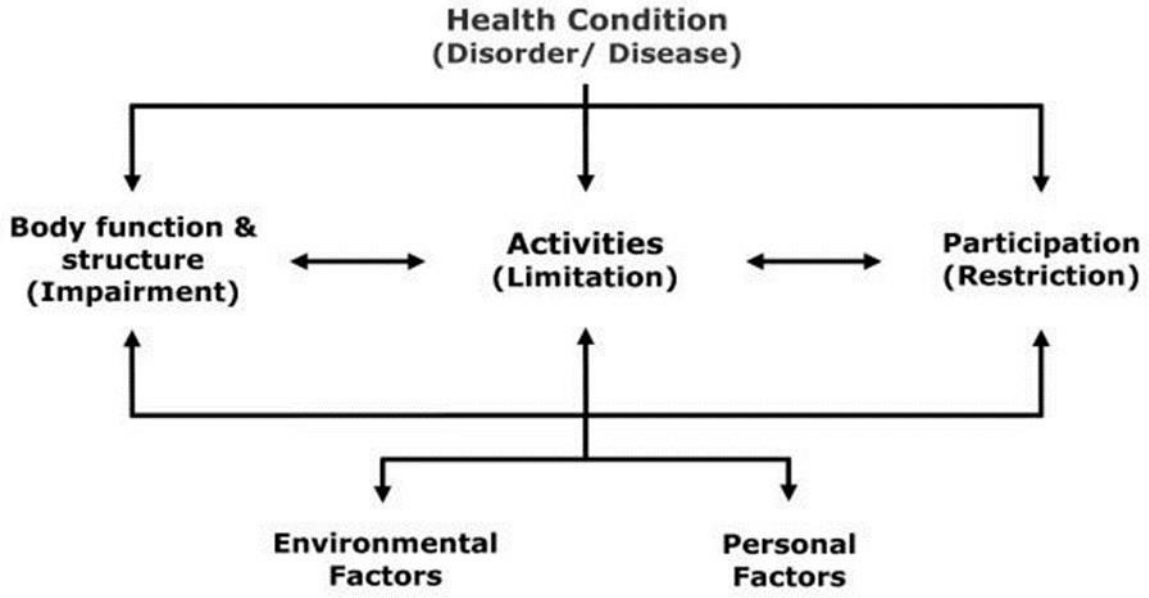

Figure 2.2: The ICF bio-psycho-social model of health (World Health Organisation, 2007)

With HIV being varied in its impact and disability being a multi-dimensional concept, the ICF model examines the dynamic interaction between HIV-related disability and the influence of contextual (environmental and personal) factors (Kietrys et al., 2019). Because the ICF offers a normative metric, there is a continuum of disablement and a non-specificity of conditions (Karlsson and Gustafsson, 2021). However, health conditions have a wide range of effects, which may be degenerative, temporary, permanent, or episodic. O'Brien et al. (2008)

developed the Episodic Disability Framework to conceptualise the experience of disability among people living with HIV. The Framework characterises disability as "a combination of symptoms and impairments (physical, cognitive, mental-emotional), difficulty in carrying out daily activities, challenges with social inclusion and uncertainty or worrying about future health that an individual can experience" (O'Brien et al., 2019, p.2).

2.3.2 Episodic nature of HIV-related disability

Unlike some chronic illnesses with consistent symptomatology, HIV can manifest in episodic bouts of illness characterized by periods of relative stability followed by sudden exacerbations of illness (Solomon et al., 2018). For PLWH, it can be difficult to predict when an episode will occur or how severe it will be, leading to uncertainty and anxiety about the future. This unpredictability can impact treatment adherence, as individuals may struggle to maintain medication regimens during periods of illness (Okonji et al., 2020). In their study, O'Brien et al. (2008) delved into the perspective of PLWH, leading to the development of the Episodic Disability Framework. This framework introduces a novel approach to understanding disability within the context of living with HIV. It comprises three main components: a) Disability dimensions, encompassing symptoms, impairments, challenges in daily tasks, barriers to social inclusion, and the fluctuating uncertainty inherent in the experience of living with HIV; b) Contextual factors, including both extrinsic (social support and stigma) and intrinsic (living strategies and personal attributes) elements that can either exacerbate or alleviate disability; c) Triggers, which denote significant life events related to disability, such as receiving an HIV diagnosis, initiating or adjusting medication, experiencing severe illness, or bereavement. Understanding an individual's episodic trajectory could facilitate the development of interventions aimed at fostering stability, mitigating a growing trajectory of disability, and lengthening the intervals between disability episodes.

2.3.3 Patterns of HIV-related disability

Studies have explored the diverse nature of impairments and their associated functional limitations that prevent people living with HIV from fully engaging in activities of daily living (Banda et al., 2019; Erlandson, 2020; Payne et al., 2022). Ailments such as cardiovascular diseases, associated neurocognitive disorders, osteoporosis, and renal failure, which are typically related to an ageing population, are now commonly seen among people living with

HIV (Erlandson, 2020). Although it is understood that PLWH could have pre-existing conditions that may contribute to the development of these conditions, other major causes include ART and the chain of chronic inflammatory disruptions caused by the HIV infection, which weaken the immune system and result in deficits in different body systems (Chauvin and Sauce, 2022). Thus, a combination of these factors may result in disability in the following dimensions (Figure 2.3).

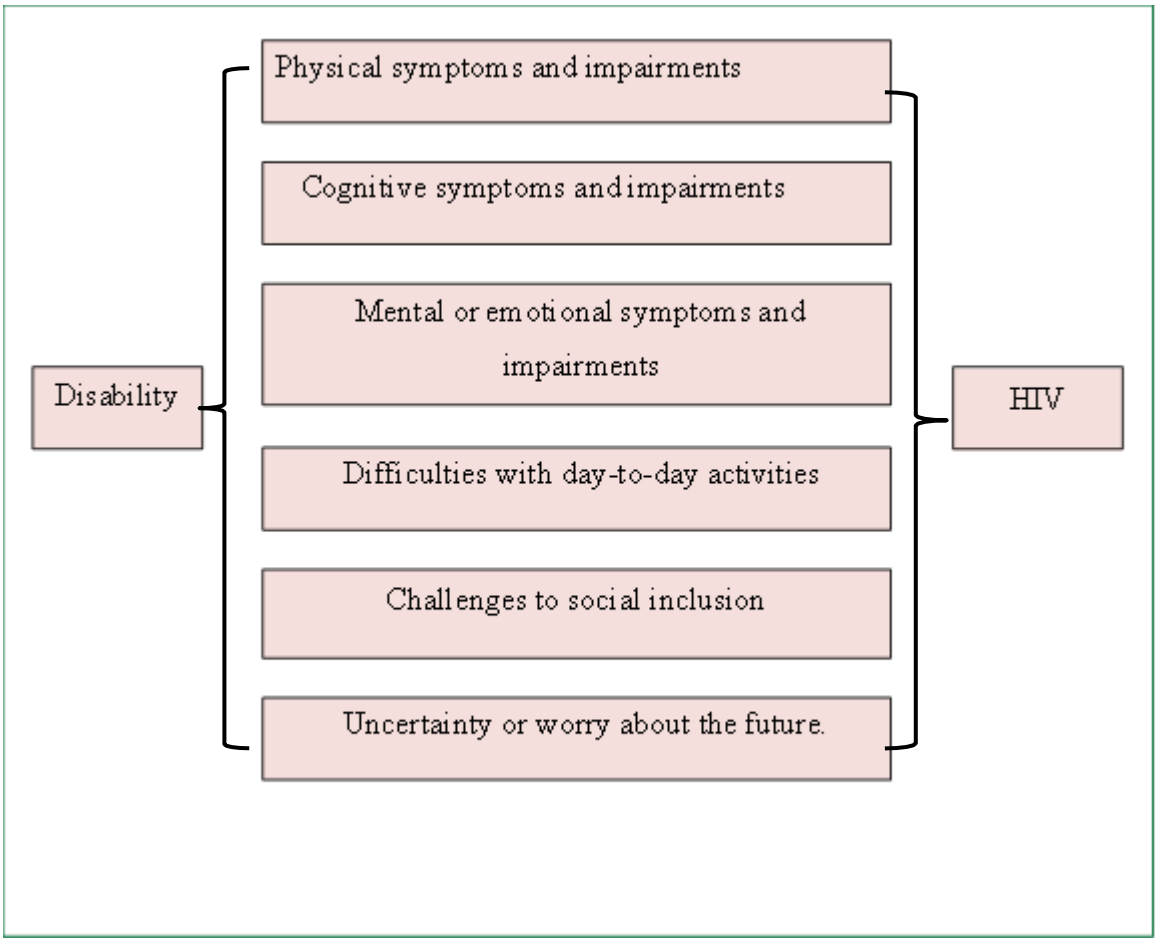

Figure 2.3: Dimensions of HIV-Related Disability

1. Physical symptoms and impairments

Following the initial infection of the human immune virus, there is a rapid multiplication and spread of the virus as it attacks the CD4+ memory T-cells, which are responsible for the functioning of the immune system (Zicari et al., 2019). While there may be no physical clinical manifestation in this acute phase, the progressive decline in the CD4+ cells, characterised by

immunosuppression, sets off a cascade of complex interactions that affect the body systems through several pathways namely (Chauvin and Sauce, 2022):

- Musculoskeletal: Musculoskeletal manifestations of HIV infection are evident in the bones, joints and muscles of people living with HIV. Evidence shows that a wide array of conditions, such as osteoporosis, arthralgia, avascular necrosis, HIV arthritis, osteopenia, and painful articular syndrome, are common comorbidities prevalent among people living with HIV (Walker-Bone et al., 2016) and cause increased disability and morbidity. However, evidence shows that musculoskeletal complaints and disabilities are recurrent reasons for referral and sometimes present as an underlying symptom of the viral illness (Jones, Stephens and Gatchel, 2018). A scoping review examining musculoskeletal conditions among people living with HIV revealed that there is no distinct location or frequency of the pain described and that estimates vary widely (Berg et al., 2022).

Existing literature suggests that seven out of ten people living with HIV would experience musculoskeletal and orthopaedic complications in their lifespan (Nelson et al., 2021). Being the predominant musculoskeletal disease, rising numbers of research studies in recent years have explored the incidence rate of low bone mineral density among PLWH, with a reported prevalence rate of osteoporosis ranging from three to thirty-three per cent (Berg et al., 2022), ultimately augmenting bone fragility and increasing fracture risk which collectively contribute to a decline in quality of life.

- Cardiac: Although HIV-related cardiac complications are well documented in the literature (Deeks et al., 2015; Erqou et al., 2019), the exact mechanism of this cardiac dysfunction is not well understood. Proposed pathophysiology includes chronic inflammation of the blood vessels, atherosclerosis, nutritional disorders, changes in lipid profiles and opportunistic infections (Hsue and Waters, 2019). Similarly, cardiac dysfunction presents in variable forms among people living with HIV (Choi et al., 2021). In a systematic review by Afshar et al. (2013) involving 54 studies, the results indicated that the incidence and prevalence of cardiomyopathy reported among people living with HIV is greater than the four to six per cent (4-6%) reported among the general population (Erqou et al., 2019).

• Endocrinal: The endocrinal system is not excluded when complications arise because of the HIV infection and the use of ART. HIV endocrinopathies may occur through several pathways, such as glandular infection, opportunistic disease infiltration, or the consequences of acute sickness and systemic inflammation on hormone function and metabolic equilibrium (Sinha et al., 2011). Before the availability of ART, endocrinal abnormalities, such as dyslipidaemia, hypogonadism, osteoporosis, and adrenal dysfunction, were prevalent biomarkers among people living with HIV (Rodés et al., 2022). Recent reports indicate that the scale of endocrinal and metabolic disorders has shifted dramatically, with significant systemic inflammations associated with ART use increasing the complexity of managing co-existing conditions in the endocrinal system and metabolic processes (e.g., type 2 diabetes, cardiovascular disease, hypogonadism, and osteoporosis) (Zaid and Greenman, 2019). Thus, it is critical to explore potential drug interactions and recent innovative approaches to suppressing residual inflammation in patients on antiretroviral treatments.

• Renal: While there is a substantial burden of renal disease among people living with HIV, the use of antiretroviral medications, particularly Tenofovir disoproxil fumarate (TDF), has been shown to increase the risk of developing renal dysfunction (Milburn et al., 2016). Most HIV public clinics do not routinely screen for kidney disease among people living with HIV who are on TDF antiretroviral medication (Estrella and Fine, 2010). Approximately 30% of people living with HIV experience abnormal kidney function, commonly characterised by significant proteinuria and classic HIV-associated nephropathy (Estrella and Fine, 2010).

Although chronic kidney disease is a co-morbidity of HIV infection and the use of ART, genetic predisposition is considered the primary risk factor in the development of kidney disease. According to several research studies, Black Africans have an 18 to 50- fold higher risk of acquiring HIV-related end-stage renal disease compared to Caucasians (Umeukeje and Young, 2019; Yalavarthy et al., 2008). This may help to explain why there is a higher prevalence of CKD in PLWH in Africa ─ the genetic factors accounting for the vulnerability of most kidney disease are probably carrying genetic variations that are connected to a severe form of HIV-associated nephropathy (HIVAN) (Nee and Agodoa, 2017).

• Immune: The immune system is damaged by HIV via two distinct processes, namely the depletion of the CD4+ T-cell pool (CD4 cells), which is a critical component of the immune

system, and widespread activation and inflammation of the immune system, subsequently presenting as immune exhaustion and culminating in immunological dysfunction with impaired cytolytic function (Aavani and Allen, 2019). A virus that weakens the immune system also tips the scale for all the other body systems and predisposes affected individuals to developing comorbidities, such as cardiovascular disease, renal dysfunction, musculoskeletal, and endocrinal disorders (Casper et al., 2017).

- Opportunistic infections: Owing to the multisystemic infectivity of HIV, the emergence of opportunistic infections (Casper et al., 2017) among people who were previously unaware of their diagnosis is sometimes the motivating factor towards testing for HIV (Kobrak et al., 2022). While there is no direct infective pathway for the human immunovirus to enter neurons (nerve cells), it affects the neurons by compromising their functionality and infecting the glia, which are cells that nourish and shield neurons (Borrajo et al., 2020). HIV can also induce inflammation, which can harm the central nervous system, including the brain and spinal cord, and result in symptoms such as disorientation and amnesia (Zicari et al., 2019).

Even though the range of neoplasms and opportunistic infections linked to HIV infection is widely known and has been consistent since the inception and spread of HIV/AIDS, a new group of significant multiple chronic conditions associated with HIV infection has developed in recent years and has surpassed opportunistic infections as the primary cause of mortality among people living with HIV (Deeks et al., 2015). For example, Nigeria ranks top in Africa for tuberculosis, with an incidence rate of 219 per 100,000 and is one of the 14 highly burdened nations scourged with this disease, TB/HIV and multidrug resistant tuberculosis (World Health Organization, 2021). There is a strong association between the HIV/AIDS epidemic and tuberculosis (TB) in Nigeria. The proportion of persons living with a co-infection of HIV and TB is high in Nigeria; it being the country with the fourth-largest TB pandemic in the world (4% of all TB cases worldwide). This contributes significantly to the health, emotional and financial burden of diseases in Nigeria (Ugwu, Agbo and Ezeonu, 2021).

2. Cognitive symptoms and impairments

Many individuals may be impaired by cognitive impairments that range from minor to severe. Among people living with HIV, the essential characteristics include debilitating cognitive impairment and changes in behaviour, speech, and motor function (Winston and Spudich,

2020). Cognitive impairment could have a noteworthy influence on a patient's ability to engage in everyday tasks, such as dressing, washing, moving, social interaction or functioning in the workplace (Mlinac and Feng, 2016). Even among people receiving antiretroviral therapy, there is a significant neurocognitive deficit causing mild to severe HIV-associated neurocognitive disorders (HANDs), such as problems with learning, memory, thinking, decision-making, and more severely, HIV-associated dementia (Winston and Spudich, 2020). In a cross-sectional study among PLWH in Nigeria, the duration since HIV diagnosis was found to be a significant predictor, and the prevalence of HAND in Nigeria was 21.5% (Yusuf et al., 2016). Although the prevalence of HANDs reported in Nigeria is lower than the pooled prevalence of 46.3% reported in Africa (Wang et al., 2020), the overall burden of neurocognitive impairment on the HRQoL of PLWH should not be underestimated.

3. Mental or emotional symptoms and impairments

Hellmuth et al. (2017) reported that major depression, anxiety, and delirium are common mental health affectations in seven to fifty-three per cent of people living with HIV. Collectively, by 2030, the human immunodeficiency virus (HIV) and mental disease are projected to be the leading drivers of illnesses worldwide (Memiah et al., 2021). Research into service provision in a hospital in Zambia (Munakampe, 2020) showed that the leading cause of referral to mental health services was HIV-induced psychiatric disorder (mania, psychosis, delirium, dementia), the alcohol-induced disorder and the substance-induced disorder (addiction to heroin, cocaine, and cannabis). Among PLWH in Nigeria, the prevalence for attempted suicide and major depression were reported as 2.9% and 28.2% respectively (Egbe et al., 2017).

Apart from the infection itself and other external or psychosocial factors, substance abuse has been a trigger for challenging behaviour and mental illness symptoms (Durvasula and Miller, 2014). In assessing the global burden of disease emanating from illicit drug use, hazardous behaviours, such as untreated substance addiction linked with bipolar illness or schizophrenia, may increase the prevalence of HIV among populations at risk (Remien et al., 2019). Psychiatric and behavioural problems, which can contribute to functional impairment and disability, are common co-morbidities among people living with HIV and with or without neurocognitive abnormalities.

4. Difficulties with day-to-day activities

PLWH face various physical and mental challenges which interact and impact their day-to-day activities in ways that are complex and multidimensional (de los Rios et al., 2020). Given the vulnerability to physical health issues like chronic fatigue among PLWH, managing daily activities can become increasingly challenging. Mental health struggles, such as depression and anxiety associated with daily dosing and lifestyle changes due to HIV treatment may also hinder the ability to carry out day-to-day tasks (Rajasuriar et al., 2022). Beyond the HIV-related stigma and associated psychological distress of living with HIV, PLWH in Nigeria, have limited access to consistent healthcare which further limits their ability to cope with the stress of living with HIV (Akoko et al., 2023).

The difference between the stressors experienced by people living with HIV and seronegative populations is that in addition to the daily challenges in conducting activities of daily living, PLWH must also deal with the extra burden of psychological stress as a result of HIV (Kulu, 2014). Results from Kulu's (2014) study in South Africa show that 90% of people living with HIV reported fear of the future and fear of death as their significant stressors. Other stressors highlighted from the survey include denial (55%), depression (55%), socio-economic issues (55%), guilt (45%), anxiety (35%), loss (25%), suicidal thinking (30%), low self-esteem (25%) and AIDS dementia (5%).

Furthermore, people living with HIV/AIDS consistently battle with stresses such as discrimination, stigma, despair, and a variety of psychological consequences. Akoko et al., (2023) reported that psychological distress and levels of overall stigma were higher in the Nigerian population compared to PLWH in similar settings in sub-Saharan Africa. Notably, stressors encountered by persons living with HIV/AIDS undoubtedly influence their daily activities, welfare, and medication management, all of which have an impact on their quality of life (Dake et al., 2023). The inability to independently execute a task as a result of a medical condition, the side effects of medications, mental health challenges and lifestyle factors contribute to a deterioration in physical functioning (Mokgethi et al., 2022)

5. Challenges to social inclusion

People living with HIV/AIDS encounter numerous barriers to social inclusivity and can face discrimination at various levels in society (Opoku et al., 2021). The challenges to social

inclusion among PLWH stem from a combination of stigma, misinformation, and societal attitudes toward the disease. The social stigma associated with HIV presents distinct social obstacles and discrimination in the family, prejudice in the community, workplace exclusion and even in healthcare settings (Ferguson et al., 2022). Despite healthcare professionals being trained to provide unbiased care, individuals with HIV may still experience stigma, such as being treated with fear, receiving inadequate care, or facing judgmental attitudes. In sub-Saharan Africa, where intimate sociocultural values prevail, the stigma and discrimination experienced by PLWH pose barriers to the prevention of the disease, intervention, and treatment (Opoku et al., 2021). The fear of rejection and negative self-image about one's HIV status are the two distinct stigma subtypes observed in a cohort of PLWH in Nigeria (Akoko et al., 2023). Akoko et al., (2023) reported that the most susceptible to psychological distress were unmarried women who reported high levels of overall HIV-related stigma.

The overwhelming effect of these factors is that they collectively affect PLWH in all aspects of life, sometimes causing marriage breakdowns, unemployment, social isolation, and inability to perform everyday chores and take on responsibilities. This results in substantial barriers towards achieving the prescribed national and global HIV prevention and treatment goals (Ferguson et al., 2022).

6. Uncertainty or worry about the future.

In a scoping review by Maulsby et al. (2020), findings show that the most often mentioned motive to contemplate employment in exploring return-to-work trends for persons with HIV/AIDS was financial need. Where financial burden outweighs the available resources, the inability to provide for oneself and one's household represents a persistent socioeconomic factor causing PLWH to worry during the various stages of their diagnosis (Poudel, Newlands and Simkhada, 2017). While there is national and global recognition of the economic burden of HIV/AIDS on individuals and households, not all countries assist, in the form of disability incomes or benefits, people living with HIV.

Where disability resources do not exist, the out-of-pocket expenses paid for healthcare constitute the single most significant cause of economic burden among people living with HIV in Nigeria (Mahal et al., 2008). Despite the availability of subsidised HIV/AIDS treatments in low- and middle-income countries, it is evident that ART subsidisation is not enough to cushion

the worry caused by the financial burden (Etiaba et al., 2016). Thus, a benefits package that takes into consideration the prohibitive cost of living, the high cost of transportation and the loss of income associated with sickness and caregiving must be explored to address the ongoing challenge of low income among people living with HIV (Etiaba et al., 2016). Oladunni et al., (2021) recommended that PLWH need to have better access to psychosocial support as 61.1% of participants in their study reported having anxiety and fear. Thus, context-sensitive coping strategies are required to improve the psychological wellbeing and overall health of PLWH.

2.3.4 Management of HIV-related disability

Pharmacologic management

Historically, the management of HIV and HIV-related disability has focused on the medical and pharmacological approach (Atta, De Seigneux and Lucas, 2018). In the initial stages of the HIV epidemic, researchers and physicians aimed to study and understand the nature of immunological deficiency attributed to the virus that causes AIDS, with the objective of developing a cure (Atta, De Seigneux and Lucas, 2018). In 1983, scientists discovered the human immunovirus as the causative agent of AIDS (Figure 2.4). In 1987, azidothymidine (AZT), a nucleoside derivative of zidovudine, was implemented as the first approved therapy for AIDS patients.

The production of combination therapy represents the cornerstone of HIV treatment, aiming to suppress viral replication, restore immune function, and prevent disease progression (Atta et al., 2019). Combination antiretroviral therapy drugs are classified into seven main categories, namely, non-nucleoside reverse transcriptase inhibitors (NNRTIs), nucleoside reverse transcriptase inhibitors (NRTIs), protease inhibitors (PIs), fusion inhibitors (FIs), CCR5 antagonists, integrase strand transfer inhibitors (INSTIs), post-attachment inhibitors (Cunha et al., 2021). By attaching to viral envelope proteins and blocking attachment and entry into CD4 cells during chemokine receptor 5 binding and membrane fusion, entry inhibitors stop viruses from infecting host cells. HIV-1 reverse transcription is inhibited by NRTIs, which stop chain elongation following incorporation into developing DNA strands. Although they bind to a different location on reverse transcriptase than NRTIs, NNRTIs prevent cross-resistance while still inhibiting reverse transcription. PIs prevent the protease enzyme from acting, which is necessary to produce viral particles, whereas INSTIs prevent the insertion of viral DNA into the genome of the host cell (Atta et al., 2008).

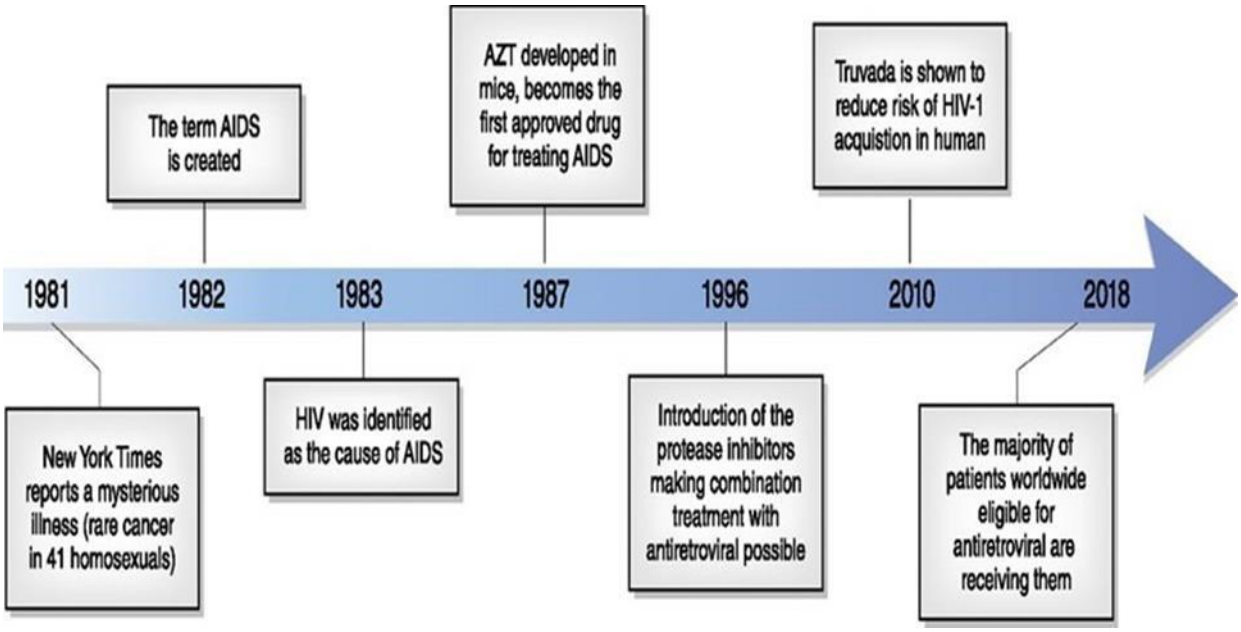

Figure 2.4: Timeline of noteworthy events from the discovery of HIV-1 through to the development of its treatment (Atta, De Seigneux and Lucas, 2018).

Although there is no definitive gold-standard cure for HIV, the progress in the world of HIV prevention, care, and treatment has been phenomenal, particularly concerning the development of the highly active antiretroviral therapy (HAART), which succeeded AZT as the globally recognised medication regimen for HIV (Günthard et al., 2016). Scientific advances in early detection and testing techniques, antiretroviral access and public health recommendations on counselling and awareness have played an important role in reducing HIV discrimination, transmission, and mortality, respectively (Feyissa et al., 2019).

Despite this, there is widespread debate and data on the disproportionate access to testing and antiretroviral therapy between developed and developing countries, birthing the "90-90-90 strategy" initiative by the United Nation's programme on HIV/AIDS (Jamieson and Kellerman, 2016). In 2014, the Joint United Programme on HIV/AIDS (UNAIDS) set as its goal that by 2020, 90% of people living with HIV would know their status, 90% of PLWH who know their status would be on antiretroviral therapy, and 90% of people on antiretroviral therapy would have achieved viral suppression (UNAIDS, 2018). Currently, based on the UNAIDS 2023 report, the global figures stand at 82%, 81% and 88%, respectively (UNAIDS, 2023), while in Nigeria, national figures stand at 67%, 63% and 74.6% respectively (UNAIDS, 2020). Compared to the 2010 report, which revealed that only 47% of those in need of treatment were receiving ART (UNAIDS, 2010), the figures hit close to the target and reflect improvement.

Thus, the ambitious 95-95-95 strategy was created to make significant progress in the global fight against HIV. It focuses on improving diagnosis, treatment, and viral suppression, with the goal of curbing the epidemic and reducing new infections by the year 2030 (UNAIDS, 2023b). Whilst remarkable progress is noted, barriers such as the inter-regional barrier to care, funding shortfalls, inequality in access to healthcare and HIV co-infections serve as limitations to ending the HIV epidemic by 2030, making some researchers argue that the 90-90-90 and 95-95-95 strategy will probably have more of an effect on mortality rates and less of an impact on establishing a long-lasting reversal of HIV infections (Haber et al., 2020; Fogarty et al., 2021).

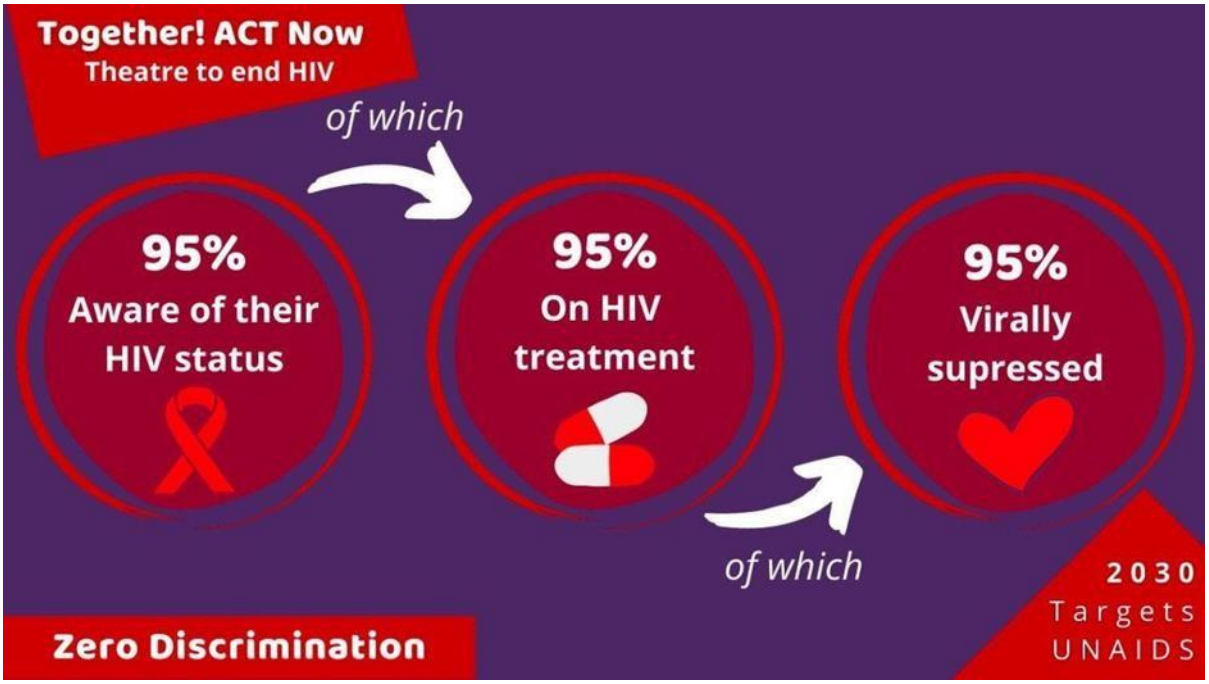

Figure 2.5: UNAIDS 95-95-95 strategy (UNAIDS, 2023)

Recent research and future directions in HIV research are primarily focused on therapeutic vaccines and long-acting therapies (unlike the current ARTs, which have to be taken daily). (Chandiwana et al., 2021). This innovation is driven by the fact that people living with HIV continue to experience disability because of their poor adherence to ART regimens, lack of access to optimum healthcare, the increasing prevalence of co-infections, chronic pain, the effects of drug resistance and interactions (Flexner et al., 2021). For example, HIV-related chronic pain is one of the most common symptoms and causes of disability among people living with HIV (Addis, DeBerry and Aggarwal, 2020). Thus, to effectively manage HIV-

related disability, healthcare stakeholders should consult with the rehabilitation team and explore the adoption of a non-pharmacological approach.

Non-pharmacological management of HIV-related disability

To improve health outcomes, non-pharmacological interventions towards the management of HIV and HIV-related disability are being implemented in many HIV/AIDS treatment and testing centres (O'Brien et al., 2020). The prospects for rehabilitation are based on individual functional deficits and must be geared towards providing person-centred interventions (Bristowe et al., 2019). Non-pharmacologic approaches to HIV management play a vital role in addressing the multifaceted challenges of living with HIV/AIDS. From psychosocial support and nutritional counselling to exercise programs and community engagement, these interventions contribute to the holistic care and well-being of individuals affected by HIV.

There is growing evidence that rehabilitation services, such as physiotherapy, occupational therapy, and those for promoting physical activity and exercise interventions, are essential components of treatment plans for several chronic conditions, such as cardiovascular diseases, neurological complaints, auto-immune diseases, musculoskeletal diseases, and HIV-related disability (O'Brien et al., 2020).

2.4 Section three

The discussion in this section progresses as follows: definition of physical activity, prevalence of physical activity, global recommendations for physical activity, barriers to and facilitators of physical activity, and the benefits of physical activity.

2.4.1 Definition of physical activity

According to the World Health Organisation, physical activity is defined as "any bodily movement produced by skeletal muscles that requires energy expenditure" (WHO, 2020, p.2). This refers to all movement, including leisure time, transportation, occupation, and housework. Although this definition is clear, it is commonly used interchangeably with the terms "exercise" and "physical fitness". To distinguish between these terms, exercise is described as a form of physical activity that is pre-planned, organised, and involves repeated bodily motions to maintain or enhance one or more aspects of physical fitness, while physical fitness refers to the

ability to engage in physical activity through the possession of specific physical characteristics (Caspersen et al., 1985; ACSM, 2010)

2.4.2 Health benefits of physical activity

There is an established body of research that shows the advantages of regular physical activity to enhance short and long-term results across a range of chronic health issues in people of all ages (Anderson and Durstine, 2019; Lee et al., 2021). A systematic review of studies shows that physical activity not only enhances health and improves the quality of life and well-being but also prevents or delays morbidity and death (Warburton and Bredin, 2017). Thus, it is one of the four major modifiable risk factors (physical activity, diet, tobacco use and alcohol consumption) for non-communicable diseases (Gbadamosi and Tlou, 2020). Physical inactivity or lack of physical activity contributes to an estimated 13.4 million disability-adjusted life years globally and has been linked to a variety of chronic conditions, such as heart disease, diabetes mellitus, stroke, obesity, hypertension, depression, and several cancers (Schreiner et al., 2020)

In sub-Saharan Africa, non-communicable diseases relating to low physical activity caused an estimated three million deaths (Mudie et al., 2019). Mudie et al., (2019) noted that hypertension, diabetes, and obesity were the most significant contributors to the death and disability burden in SSA, with physical activity and diet identified as core risk factors. The physiological health benefits of physical activity are evident in conditions such as obesity, in which regular PA causes a decrease in fat mass; in sarcopenia, where regular PA improves muscle mass and function in osteoporosis, where regular PA enhances bone health, thus reducing frailty, the risk of falls and predisposition to fracture (Ibeneme et al., 2019). Furthermore, studies conducted on mental health, cognition and memory have reported that there is an increase in blood flow to the brain and the promotion of neurogenesis when individuals engage in exercise (Bernard et al., 2018), thus supporting the theory that physical exercise is beneficial to both body and mind.

In the clinical setting and commonly among physiotherapists, regular physical activity is recommended in the management regimen for many conditions, except when contraindicated, in which case the prescribed physical activity may be modified (Luan et al., 2019). For example, the most common reason for individuals to consult healthcare providers is pain, as it remains a vital medical problem affecting individuals of all ages. Exercise is widely acknowledged as an effective therapy for reducing pain and improving function in the case of

several pain problems (Ambrose and Golightly, 2015). With chronic pain being a common symptom among PLWH, regular PA, that is, engaging in frequent movement, is vital in the prevention and treatment of pain and contributes to increased physical function (Montoya et al., 2019). To achieve these benefits, physical activity can be performed in several ways and at different intensity levels, such as through aerobic exercises, balance training, strength and resistance training, tai chi, and yoga, all of which can be engaged in at moderate to vigorous intensity levels (Montoya et al., 2019).

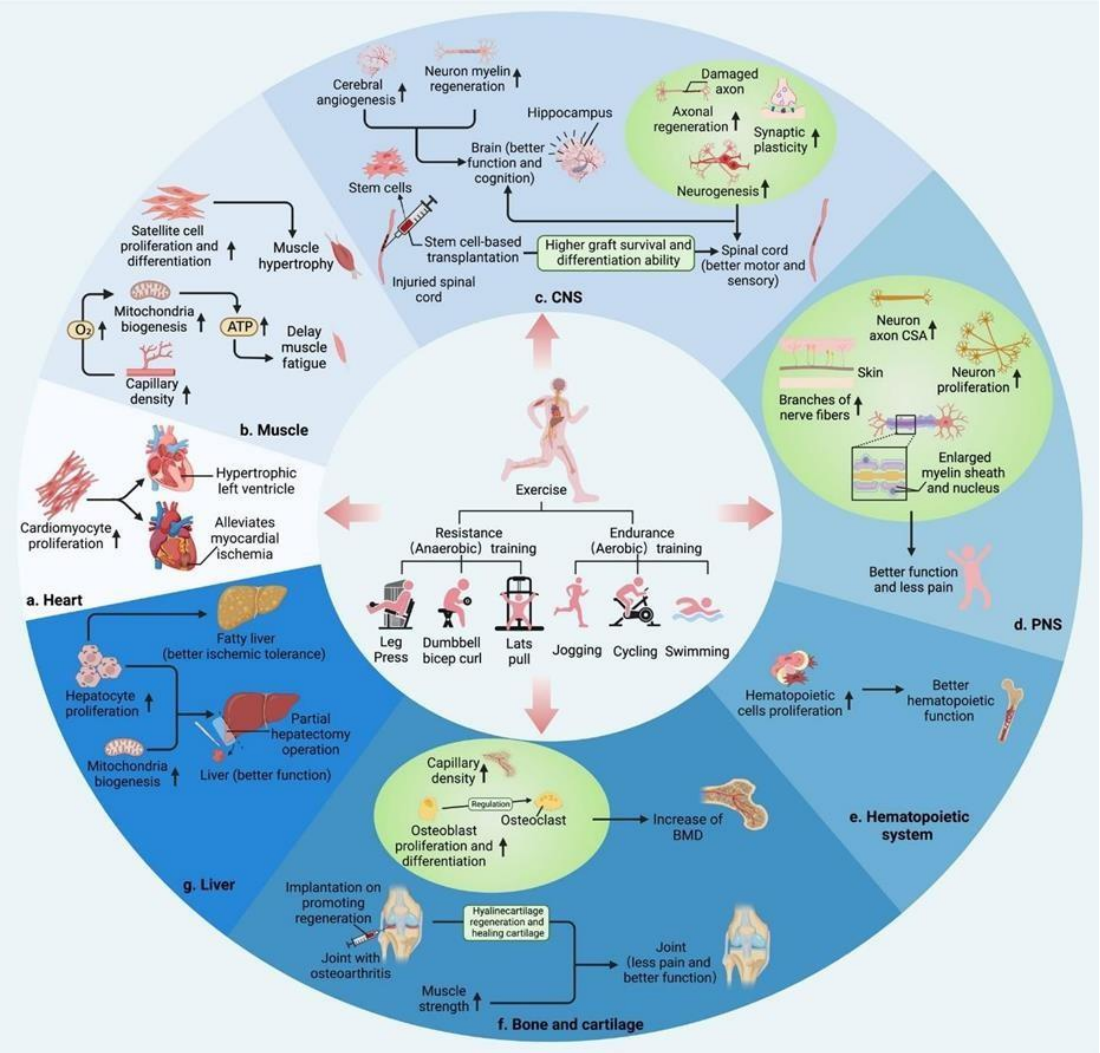

Figure 2.6: Molecular mechanisms of tissue generation induced by exercise (Chen et al., 2022)

2.4.3 Physical activity recommendations for people living with HIV

While global physical activity recommendations aim to reduce sedentary time, evidence based on the physical activity guidelines is that "adults between the ages of 18 and 64 should engage

in 150 to 300 minutes of moderate-intensity aerobic exercise, 75 to 150 minutes of vigorous-intensity aerobic activity, or an equivalent combination of both throughout the week" (Bull et al., 2020). The duration and intensity may be increased for additional benefits and modified across age groups and various conditions. People living with chronic conditions (hypertension, type 2 diabetes, HIV) and cancer survivors are encouraged to engage in PA at the recommended levels, except when contra-indicated (Bull et al., 2020). Similarly, adults living with a disability may engage in resistance exercises, aerobic exercises, flexibility training and other multi-component physical activity forms for added health advantages. With advances in research and substantiated findings, public health guidelines on physical activity have developed over the years to address the needs of individuals at various stages and with multiple conditions.

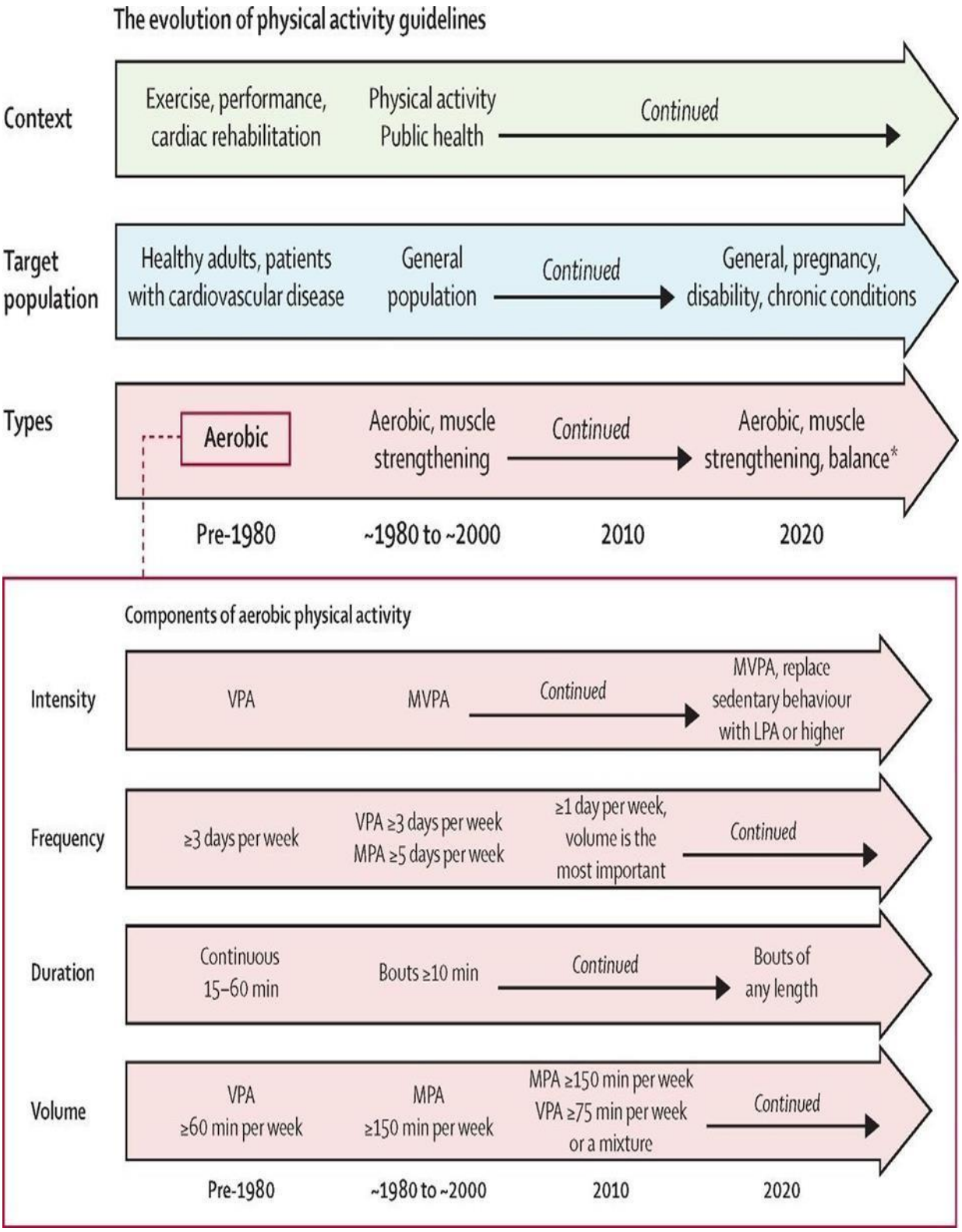

Figure 2.7: The evolution of physical activity guidelines (Ding et al., 2020)

2.4.4 Barriers to and facilitators of physical activity participation

The barriers to physical activity are described as factors that limit individuals from engaging in physical activity, while the facilitators refer to factors that enable or motivate an individual to participate in physical activity (Roos, Myezwa and van Aswegen, 2015). A systematic review evaluating the physical activity correlates in people living with HIV indicated that bodily pain, depression, and opportunistic infections are essential barriers in most studies, while higher levels of cardiorespiratory fitness, a more self-efficacious attitude, perceived benefits, and improved health motivation were identified as facilitators of physical activity participation (Vancampfort et al., 2017).

In Nigeria, the barriers to physical activity participation are majorly mediated by socioeconomic and environmental variables (Adeloye et al., 2022). According to Kitilya et al. (2023), constraints hindering physical exercise involvement include, amongst other environmental factors, a lack of access to exercise facilities, being uncomfortable working out, financial implications, a lack of time and self-motivation, poor well-being, family demands, lack of social support and a physically active partner. Numerous environmental issues that impact healthy behaviours have been brought on by the country's rapid urbanisation and its vast amount of industrial activity. Many cities have elevated levels of traffic, dangerous topography, and poor road designs, making leisure walking and cycling unattractive to many (Giles et al., 2021). Many people believe that walking or cycling is a sign of low socioeconomic standing, hence the desire to possess a vehicle to gain greater societal acceptance and respect (Adeloye et al., 2022).

2.5 Summary of Chapter Two

This chapter reviewed literature related to HIV burden, epidemiology, and non-pharmacologic management. The background and focus area for the research are established. A summary of physical activity as an intervention in managing HIV-related disability is discussed as it relates to prevalence, recommendations, influencing factors and benefits.

Chapter 3 Study Protocol

3.1 Introduction

This chapter describes the methodology of this thesis and is presented as a published paper. The paper introduces the study protocol and overall methodology of the thesis. This chapter has been published by the Journal of the Nigeria Society of Physiotherapy.

3.2 Publication reference

Oladejo, T., Myezwa, H, Ajidahun, A., & Ibeneme, S., (2024). Development of a contextualised physical activity programme to improve health outcomes among people living with HIV-related disability in Nigeria: A study protocol. Journal of the Nigeria Society of Physiotherapy, 23(1), 1-7. DOI: 10.5897/JNSP2023.0028

3.3 Details of author contribution

The Contributor Roles Taxonomy (CRediT) (Allen et al., 2019b) was used to outline the authors' contribution to the study. The full explanation of the terms is in Appendix 10.

Table 3.1: Details of author contribution

	Oladejo	Myezwa	Ajidahun	Ibeneme
Conceptualization	√	√	√	√
Method	√	√	√	√
Resources	√			
Manuscript writing draft	√			
Manuscript writing review and editing	√	√	√	√
Supervision		√	√	√

3.4 Copyright and permission

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3.5 Published article: Development of a contextualised physical activity programme to improve health outcomes among people living with HIV-related disability in Nigeria: A study protocol

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Full Length Research Paper

Development of a contextualised physical activity programme to improve health outcomes among people living with HIV-related disability in Nigeria: A study protocol

Temitope Oladejo[1]*, Hellen Myezwa[1], Adedayo Ajidahun[1] and Sam Ibeneme[2]

[1]Department of Physiotherapy, Faculty of Health Sciences University of the Witwatersrand, South Africa.
[2]Department of Medical Rehabilitation, Faculty of Health Sciences, University of Nigeria Nsukka, Nigeria.

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Transitioning from a life-threatening infection resulting in acute illness to a long-term manageable condition implies that HIV management requires collaboration between primary care clinicians and rehabilitation teams. Recognized as an effective, safe, and beneficial health strategy, physical activity has been recommended in HIV management. However, despite its numerous benefits, there remains a low prevalence of physical activity in sub-Saharan Africa. It has been reported that individuals living with HIV-related disability often do not engage in sufficient physical activity. This study aims to explore the extent and nature of HIV-related disability in Nigeria, its impact on quality of life, and how certain factors may influence participation in physical activity. The goal is to develop a context-specific physical activity program to address rehabilitation needs. Employing a mixed-methods approach in three phases, the study will conduct a cross-sectional survey, one-on-one interviews, and a scoping review in the first phase. Data from phase one will be integrated using a clinical reasoning approach. The second phase involves a modified Delphi study to evaluate the developed physical activity program, while the third phase assesses program feasibility. The study population includes individuals aged 18 and above living with HIV/AIDS in Lagos State, Nigeria. The findings will contribute valuable insights into the extent of HIV-related disability, its impact, and the factors influencing physical activity engagement, ultimately informing the development of effective rehabilitation interventions.

Key words: HIV, disability, physical activity.

INTRODUCTION

In 2022, it was estimated that approximately 67.5% of the approximately 37.9 million people living with HIV globally are located in Africa (UNAIDS, 2023). Consequently, the implications of HIV-related disabilities hold particular significance in sub-Saharan Africa (Banks et al., 2015). Despite a low prevalence of 1.4%, Nigeria has the second-largest HIV epidemic globally, with 1.9 million people living with HIV in the country (UNAIDS, 2023). Olaleye et al. (2017) reported that among the 360 participants living with HIV in a study conducted in Ibadan, more than two-thirds experienced mild to extreme disabilities. However, the impact of HIV on

*Corresponding author. E-mail: temi.oladejo@yahoo.com.

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disability in Nigeria has not been extensively researched, and there is a dearth of literature on the prevalence of HIV-related disability and the rehabilitation strategies currently being implemented in its management (Olaleye et al., 2017).

Disability is a multifaceted phenomenon that manifests at three levels: the corporal (body), person, and social level, encompassing long-term physical, mental, and intellectual impairments that impede individuals from effectively participating in society (Palmer and Harley, 2012). Disability may arise due to the progression of HIV infection and side effects of highly active antiretroviral therapy (HAART) drugs. Both HIV and HAART have been reported to adversely affect overall health, impacting the immune system (Zicari et al., 2019), cardiovascular system (So-Armah et al., 2020), central nervous system (Spudich and Clements, 2019), and musculoskeletal system (Walker-Bone et al., 2017). These compromised body systems make individuals prone to fatigue, joint pain, hypertension, dyslipidemia, neuropathy, depression, opportunistic infections such as pneumonia, and non-communicable diseases such as kidney disease, cardiovascular disease, and diabetes (Ibeneme et al., 2019; Achwoka et al., 2020; Gabuzda et al., 2020). These symptoms contribute to poor Health- Related Quality of Life (HRQoL) in people living with HIV (Seguiti et al., 2022), posing a significant global health challenge. Public health services encompass prevention or treatment of impairments and provision of rehabilitation services (Bright et al., 2018). To enhance patients' health and promote healthy living, physical activity, a non- pharmacological alternative, has been recommended by health providers as a strategy to mitigate the risk of developing disabilities among people living with HIV (PLWH) (Dang et al., 2018). Studies have shown that physical activity enhances functional capacity, muscle strength, joint flexibility, and endurance among PLWH (Voigt et al., 2018; Ibeneme et al., 2019; Martin et al., 2019; Enichen et al., 2022). A systematic review by O'Brien et al. (2016) reported positive cardiorespiratory, strength, and body composition outcomes resulting from physical interventions among PLWH. Furthermore, functional issues such as difficulty in walking, impairments, and disabilities among PLWH can be ameliorated through participation in home-based and community-based rehabilitation programs (Cobbing et al., 2017a).

Despite the recognized health benefits of physical activity, evidence suggests that individuals living with HIV often do not engage in sufficient physical activity (Vancampfort et al., 2018). Various barriers may contribute to this low participation, particularly in Africa, where cultural, environmental, and socioeconomic factors play significant roles (Mabweazara et al., 2018). Stigma and discrimination are prevalent barriers to HIV therapy and prevention in Africa, including Nigeria (Tesfay et al., 2020). For instance, individuals living with HIV in Nigeria may experience stigma if their status becomes public knowledge, facing the dual burden of living with HIV and enduring community stigmatization (Saeed and Ayuwat, 2020; Ogunyemi et al., 2022). Perceived stigmatization may subsequently impact their motivation to engage in physical activity, as evidenced by a cross-sectional study conducted in Uganda linking higher internalized HIV-related stigma to lower levels of physical activity (Kalichman et al., 2020).

Presently, public health physical activity recommendations in Nigeria focus on utilizing community or home-based rehabilitation methods to enhance health outcomes among people living with HIV (Cobbing et al., 2017b; Mabweazara et al., 2019). Social determinants of health, such as the opportunity cost of exercise engagement, individuals' socioeconomic status, and susceptibility to stigma, have been identified as influential factors in understanding physical activity participation among people living with HIV in Nigeria (Safa et al., 2022). Thus, the aim of this study, conducted over three phases, is to determine the pattern and prevalence of disabilities among people living with HIV in Nigeria and develops a context-specific physical activity program to address these disabilities.

MATERIALS AND METHODS

Table 1 provides a summary of the methodology for the study across three phases, outlining the study design and procedures. This study adopts a mixed-methods approach with five studies conducted. In phase one, study one is a cross-sectional study utilizing questionnaires to determine the pattern and prevalence of disabilities among people living with HIV in Nigeria, as well as their health-related quality of life and physical activity levels. Study two of phase one is a qualitative study aiming to explore the experiences of disability among PLWH and investigate their perceived barriers and facilitators to physical activity participation, utilizing one-on-one interviews. Study three of phase one involves conducting a scoping review of evidence to identify the range of implementation strategies in the rehabilitation of HIV-related disability.

For the second phase of the study, data from studies one to three will be triangulated through direct content analysis to develop a context-sensitive exercise program for people living with HIV- related disability. This program will be validated by experts in study four, which is a Delphi study. The third phase of the study is a feasibility study aimed at testing the feasibility and acceptability of the developed physical activity program. Figure 1 shows the sequential process for the development of physical activity intervention programme.

Instruments

Study one: the following self-administered questionnaires will be used for data collection: Socio-demographic questionnaire, Medical Symptoms Questionnaire (MSQ), World Health Organization Disability Assessment Schedule 2.0 (WHODAS), Medical Outcomes Survey (MOS)-HIV Instrument and the International Physical Activity Questionnaire (IPAQ).

Questionnaire: The sociodemographic questionnaire shall provide information on the age, gender, marital status, educational qualifications, and income range of the participants.

Table 1. Summary of the study.

Section	Phase one			Phase two	Phase three
	Study one	**Study two**	**Study three**	**Study four**	**Study five**
Objectives	To determine the pattern and prevalence of disabilities among people living with HIV in Nigeria	To determine the barriers and facilitators of physical activity participation among PLWH in Nigeria	To identify the various implementation strategies adopted in the rehabilitation of disability experienced by PLWH	To develop the exercise-based intervention program	To test the feasibility and acceptability of the developed exercise program
Data needed	The pattern of disability, symptoms, physical activity level, health status	Experiences on factors influencing physical activity participation	Rehabilitation programs for people living with HIV-related disability	Triangulated results from phase one to three	Pre- and post-test feasibility study
Study design	Cross-sectional study	Qualitative study	Scoping study	Modified Delphi study.	Qualitative study
Location	HIV/AIDS Testing and Treatment Centres in Lagos	HIV/AIDS Testing and Treatment Centres in Lagos	Virtual	Virtual	HIV/AIDS Testing and Treatment Centres in Lagos
Source of data	Medical Symptoms Questionnaire (MSQ), World Health Organization Disability Assessment Schedule 2.0 (WHODAS), Medical Outcomes Survey (MOS)-HIV Instrument and the International Physical Activity Questionnaire (IPAQ)	One-on-one interview	Relevant data (published and unpublished). All study designs	Expert panel	One-on-one interview
Sample size	384 participants	Minimum of 15 participants	No limit on number of studies to be included	Minimum of 30 participants	Minimum of 15 participants
Inclusion criteria	Participants must be adults (18 years and above) and must have commenced ART at least six months before the commencement of the study.	Participants must be adults (18 years and above) and must have commenced ART at least six months before the commencement of the study.	Population: studies that include people living with HIV, who are 18 years and over. Concept: Different implementation strategies in the management of HIV-related disability, rehabilitation strategies include physical activity or exercise therapy. Context: studies on implementation strategies for rehabilitation of disability among PLWH conducted in a clinical (hospital and primary health care facility), home, or community-based setting.	Participants need to meet at least one of the following requirements: stakeholder in clinical decision-making role, experts who work closely for and with people living with HIV, affiliation to HIV/AIDS clinic, membership in physical activity organizations, government entities or universities.	Participants must be adults (18 years and above) living with HIV and attending HIV/AIDS testing and treatment centres in Lagosa
Procedure and instrumentation	Questionnaires will be used to collect information on the demographic data, medical symptoms experienced, the pattern of HIV-related disability, health-related quality of life and physical activity level.	People living with HIV will be interviewed to explore their experiences of disability, strategies used to manage the HIV-related disability, and investigate their perceived barriers and facilitators to physical activity participation. The interviews will be audio-recorded and transcribed verbatim.	The Joanna Briggs Institute Reviewers Manual 2020: Methodology for JBI Scoping reviews will be adopted	The Delphi study will be used to obtain consensus among purposively sampled experts in the field of physical activity, HIV, rehabilitation, and implementation.	People living with HIV will be interviewed to seek their opinion on the potential usefulness of the developed physical activity program. The interviews will be audio-recorded and transcribed verbatim.

Table 1. Contd.

Data analysis	Descriptive statistics of mean, standard deviation, and frequency. Inferential statistics	Thematic content analysis will be used to identify themes from the qualitative data. The data will be analysed and managed using MAXQDA software	A narrative review of the number of studies found that addressed the research topic, study designs, and the variety of secondary health condition prevention strategies	Data from the online questionnaire will be exported to Microsoft Excel for descriptive analysis (frequencies and percentages). Answers to open-ended questions will be coded through a content analysis approach. Based on the feedback and analysed results, the final output for each round shall be compiled.	Demographic characteristics of the participants will be described using descriptive statistics. Thematic content analysis will be used to identify themes from the qualitative data. The data will be analysed and managed using MAXQDA software
Outcome	Physical activity level and perceived health status would provide information on the causative relationship between their current health state and their rehabilitation needs.	Understanding the factors associated with physical activity participation would be used to design a need-based rehabilitation programme.	Data from this phase will identify and provide knowledge on the research gaps that exist in the literature regarding the implementation of rehabilitation strategies in the management of HIV-related disability	Consensus agreement on the developed context-sensitive physical activity program for PLWH	The feasibility and acceptability of the intervention programme will be understood

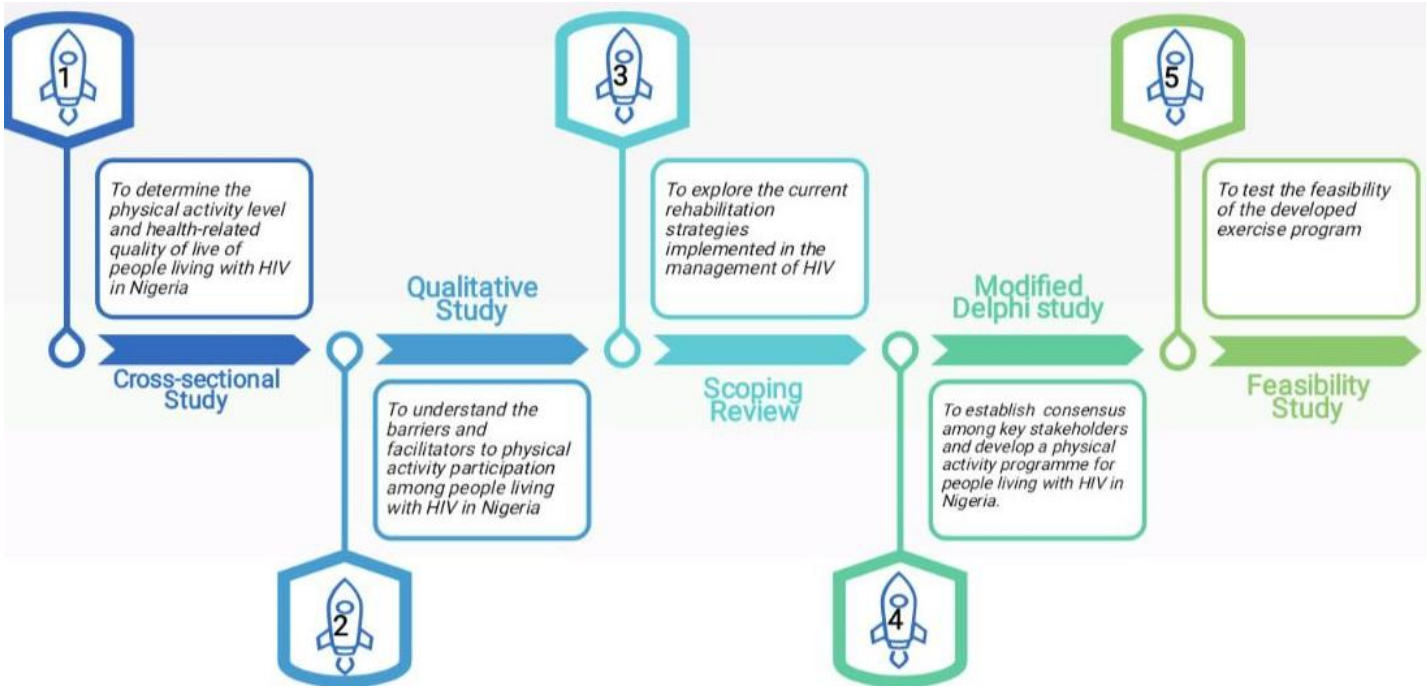

Figure 1. Sequential process for the development of physical activity intervention programme.

Medical Symptoms Questionnaire (MSQ): Shall be modified from the Medical Symptoms Questionnaire compiled by the Institute for Functional Medicine (2020). It identifies symptoms that help diagnose underlying illness and tracks progress over time. Each symptom is based on the health profile of the patient over the previous three months. The scoring system is organized into 15 symptom-specific domains covering the head, eyes, ears, nose, mouth/throat, skin, heart, lungs, digestive tract, joints/muscles, weight, energy/activity, mind, emotions, and others. Respondents are required to assign a score ranging from 0 to 14 for 71 symptoms observed over the previous 14 days. A score of 0 means never having experienced such symptoms; 1 to 2 means occasional symptoms, not severe ("1") or severe ("2") effects; 3 and 4 mean frequent symptoms and not severe ("3") or severe ("4") effects. Therefore, a lower score means a lower symptom burden (Institute for Functional Medicine, 2020).

WHO Disability Assessment Schedule (WHODAS 2.0): Shall be used to assess functioning and disability in various core activities essential in daily life. The 12-item version is used for a brief assessment of overall functioning and asks questions about six domains: cognition (learning, concentrating), mobility (standing, walking), self-care (washing, dressing), getting along (keeping friendships, dealing with people), life activities (work/school), and participation (joining community activities, emotional effects). The scores, considering the various levels of disability for each item in the questionnaire, will be determined using the "item-response- theory". They will subsequently be summarized and converted into a metric ranging from 0 to 100 for each domain. The average scores are comparable to the WHODAS five-point scale, which allows the clinician to assess the individual's disability in terms of none (0-0.49), mild (0.5 to 1.49), moderate (1.5-2.49), severe (2.5- 3.49), or extreme (3.5-4) (Üstün et al., 2010). The tool has been validated and demonstrated to be effective for screening functionality and disability among PLWH (Barbosa, 2018). Furthermore, the internal reliability of the entire WHODAS 2.0 using Cronbach α is 0.89 (Holmberg et al., 2021).

HIV Medical Outcomes Survey (MOS-HIV)*:* Shall be used to measure health-related quality of life among the participants. It is a 35-item questionnaire that assesses 10 dimensions of health, including general health perceptions, pain, physical functioning, role functioning, social functioning, mental health, energy/fatigue, cognitive function, and quality of life. The Cronbach's α coefficient is > 0.7 for group comparisons, indicating adequate reliability. Wu et al. (1997) also reported the validity of the physical and mental health summary scores of the MOS-HIV. The scoring of this scale involved a two-step process. First, numerical values will be re- coded, and then each item scored from 0 to 100, with a high score indicating good health. To estimate the 10 domains of patient functioning, items from the same scale will be averaged.

The International Physical Activity Questionnaire (IPAQ-SF)*:* This is a self-reported measurement tool for physical activity suitable for assessing physical activity and inactivity in a population (Stelmach, 2018). The IPAQ-SF measures the physical activity levels of people aged 15 to 69 years and was adapted from the long form IPAQ, which assesses activity levels across five domains (job-related, transportation, housework, recreation, and time spent sitting), contains four generic items, and can be self-administered or administered via the telephone (Craig et al., 2017). The questionnaire requires information on the time spent on physical activities over the past seven days and has acceptable measurement properties for developed and developing nations. It has been previously used in the Nigerian population, where the overall PA (ICC = 0.79, 95 % CI 0.65 to 0.82) showed moderate test-retest reliability (ICC > 75, intraclass correlation coefficient) (Oyeyemi et al., 2014). The IPAQ-SF measures three specific types of activity: walking; moderate physically intense activity; and vigorous physically intense activity (Craig et al., 2017).

The IPAQ scoring protocol will be used to report the collected data in terms of categorical and continuous measures (Cleland et al., 2018). For continuous data, one measure of the volume of activity will be computed by weighting each type of activity in terms of its energy requirements, as defined in METs. Thus, walking = 3.3 METs; moderate physical activity = 4.0 METs; and vigorous physical activity = 8.0 METs.

Study two: A qualitative research method shall be adopted to achieve the objectives of this study which were to determine the barriers to and facilitators of physical activity participation among PLWH. The qualitative research method is now commonly used in HIV/AIDS research as it is essential to providing insights into the socio-behavioural elements of HIV (Doyal, 2014; Syed et al., 2014). In the methodology, the HBM (Yen and Li, 2019) will be considered in understanding the barriers to and facilitators of physical activity among PLWH.

The interviews will be conducted by the principal investigator in English language. The interviews will be conducted using a Philips DVT digital dictaphone, and the recordings saved in MP3 format. In addition to the audio recordings, the interviewer shall write additional notes, with reflective comments also being added at appropriate times during the interviews. The duration of each interview shall be between 30 and 45 min.

Study three: A scoping review shall be conducted to achieve the objectives of this study. A comprehensive literature search shall be conducted to identify studies that report on the methodology of physical activity intervention programs for PLWH. PubMed, Web of Science, and EBSCO databases will be searched for publications from January 2003 (when ART became increasingly available and accessible to PLWH in sub-Saharan Africa) using the keywords: HIV, exercise, physical activity, rehabilitation/therapy, physiotherapy, and home-based, community-based, clinic-based. The following terms will be included in the given combination to create relevant search strings for the review:

1) Condition-related terms: HIV, human immunodeficiency virus, HIV/AIDS
2) Intervention-related terms: physical activity, exercise, aerobic, resistance, strengthening, physiotherapy, physical therapy, flexibility, balance, rehabilitation, and therapy.
3) Guideline-related terms: intervention, reach, effectiveness, adoption, implementation, maintenance, compliance, adherence, and uptake.

Identified records will be exported to EndNote software for de-duplication and then Microsoft Excel Spread sheet for screening. After duplicates are removed, titles and abstracts will be screened against the inclusion criteria by two independent reviewers. Studies that meet the inclusion criteria will be retrieved and assessed against the review's eligibility criteria.

Study four: This shall commence the second phase of the study. Findings from studies one to three will be synthesized using a methodological triangulation approach. From the results, contents of a contextualized physical activity program will be developed. A consensus-based strategy shall be used, based on a modified Delphi procedure. The Delphi study shall be conducted online to address the barrier of logistics challenges posed by physical meetings.

Study five: Semi-structured interviews will be used to assess the feasibility of the implementation of the developed physical activity program by exploring the opinion of PLWH on its usability, facilitators, barriers, and other issues they might envisage in implementing the physical activity program in their context.

Sample size and inclusion/exclusion criteria

For the first study, the sample size was calculated using the sample size formula for an unknown population in a prevalence study (Naing et al., 2022).

$$\boldsymbol{n} = [\boldsymbol{NZ}^2\mathrm{P}(1-\mathrm{P})] \div [\mathrm{d}^2(\mathrm{N}-1) + \mathrm{Z}^2\mathrm{P}(1-\mathrm{P})]$$

An estimated sample size of 384 participants would be deemed sufficient to minimize Type 1 and 2 errors in this study, considering a margin of error of 0.05 at a 95% confidence interval and an estimated prevalence of disability of 51.9% (Myezwa et al., 2018). The inclusion criteria for studies one and two will encompass adults living with HIV/AIDS (18 years and above) who have initiated ART at least six months prior to the study's commencement. For study two, a minimum of 15 one-on-one interviews will be conducted with individuals living with HIV-related disability, with data collection continuing until saturation is achieved. Regarding study three, there will be no set limit on the number of studies to be included in the review. Studies of any design conducted in any setting (such as home-based, clinic-based, or community-based) with a clearly defined structure will be selected. The inclusion criteria for the scoping review will be guided by the population, concepts, and context (PCC) approach:

Population

This review will consider studies that include people living with HIV, who are 18 years and over.

Concept

Different implementation strategies in the management of HIV-related disability, rehabilitation strategies include physical activity or exercise therapy.

Context

The review will consider studies on implementation strategies for rehabilitation of disability among PLWH conducted in a clinical (hospital and primary health care facility), home, or community-based setting.

For study four, to provide rigour for statistical analysis, a minimum number of 30 experts will be included in the Delphi study. The inclusion criteria for the Delphi study shall be participants who meet at least one of the following requirements: stakeholder in clinical decision-making role, experts who work closely for and with people living with HIV, affiliation to HIV/AIDS clinic, membership in physical activity organizations, government entities or universities. For study five, a purposive sampling of minimum of 15 PLWH attending HIV/AIDS testing and treatment centres in Lagos will be invited to participate in the study.

Data analysis

Data from the questionnaires in study one will be analyzed using the Statistical Package for the Social Sciences (SPSS) version 22, with significance set at a p-value of ≤ 0.05. Descriptive statistics including mean, standard deviation, and frequency will be utilized to analyze demographic characteristics and health outcomes. Inferential statistics will be employed as appropriate to determine the relationship between the dependent and independent variables. Thematic content analysis will be applied to identify themes from the qualitative data in study two, with data quality ensured through member checking. Coding will be performed by the principal investigator, and a second coder will verify the coding for authenticity. MAXQDA software will be used to manage and analyze the data. Debriefing sessions will be conducted with research supervisors to review the research process, findings, and data interpretation.

For the scoping review in study three, findings will be presented in tabular format to map available information on the types of HIV-related disability interventions. A summary report will describe and integrate the tabulated results with reference to the review's objective and question. In the fourth study, data will be analyzed by summarizing using measures of central tendency (mean, median, and mode), frequencies, and percentages to present information relating to descriptive statistics and the collective judgments of participants. Thematic content analysis will be utilized to summarize the suggestions from experts and present them in a tabular form.

In the fifth study, demographic characteristics of participants will be described using descriptive statistics. Data will be transcribed manually by the researcher from audio recordings. Deductive analysis will then be conducted on the transcripts, with similar codes grouped into subcategories and categories.

Ethics statement

This study has been approved by the Human Research Ethics Committee of the University of the Witwatersrand (M200906) and the Lagos State University Teaching Hospital Health Research Ethics Committee (LREC/06/10/1547). Permission has been granted by the hospitals. Written, informed consent will be obtained from all the participants.

RESULTS AND DISCUSSION

The increasing recognition of the importance of social and cultural aspects of disability among people living with HIV underscores the relevance of considering sociocultural factors in the development of exercise programs. Findings from this study will contribute to the body of knowledge on HIV-related disability, providing insight into the patterns and prevalence of HIV-related disability and factors influencing rehabilitation care. This study aims to develop a need-based exercise program that takes into account environmental, sociocultural, and socioeconomic factors to effectively manage disability among people living with HIV. Ultimately, policymakers can utilize the results of this study to inform health- promoting policies and develop treatment models for individuals living with HIV-related disability.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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3.6 Summary of Chapter Three

This chapter describes the overall methodology of the thesis titled: HIV-Related Disability: development of a contextualised physical activity programme. The thesis comprised of four studies which aims to explore the extent and nature of HIV-related disability, its impact on quality of life, and factors influencing physical activity participation. It highlights the low prevalence of physical activity among people living with HIV in sub-Saharan Africa and the barriers they face, such as stigma, discrimination, and socioeconomic factors. The sample size, sample population, instrumentation, procedure, and data analysis protocol for each study are highlighted. Findings from this study will contribute to the body of knowledge on HIV-related disability and provide insight into the pattern and prevalence of HIV-related disability and factors influencing rehabilitation care. By developing a tailored rehabilitation program, healthcare professionals can potentially improve health outcomes, address stigma, inform policy development, and enhance professional practices for individuals living with HIV-related disability.

Chapter 4 Prevalence and predictors of HIV-related disability among people living with HIV in Nigeria

4.1 Introduction

Chapter four is presented as a published article, according to the journal guidelines. The paper aims to identify the prevalence and predictors of HIV-related disability among people living with HIV in Nigeria. The paper has been published by the South African Journal of Physiotherapy.

4.2 Publication reference

Oladejo, T., Myezwa, H, Ajidahun, A., & Ibeneme, S., (2024). Prevalence and predictors of HIV-related disability among people living with HIV in Nigeria. South African Journal of Physiotherapy, 80 (1), 1-9. DOI: 10.5897/JNSP2023.0028

4.3 Details of author contribution

The Contributor Roles Taxonomy (CRediT) (Allen et al., 2019b) was used to outline the authors' contribution to the study. The full explanation of the terms is in Appendix 10.

Table 4.1: Details of author contribution

	Oladejo	Myezwa	Ajidahun	Ibeneme
Conceptualization	√	√	√	√
Method	√	√	√	√
Resources	√			
Manuscript writing draft	√			
Manuscript writing review and editing	√	√	√	√
Supervision		√	√	√

4.4 Copyright and permission

The article is presented as published in the South African Journal of Physiotherapy with no changes to the style of the paper. According to the Creative Commons Attribution License 4.0 International License, authors can grant permission to use the article as long as the authors are acknowledged, and the article style and information is maintained.

4.5 Published article: Prevalence and predictors of HIV-related disability among people living with HIV in Nigeria

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Prevalence and predictors of HIV-related disability among people living with HIV in Nigeria

Authors:
Temitope S. Oladejo[1]
Hellen Myezwa[2]
Adedayo T. Ajidahun[1]
Sam Ibeneme[3]

Affiliations:
[1]Department of Physiotherapy, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

[2]School of Therapeutic Sciences, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

[3]Department of Medical Rehabilitation, Faculty of Health Sciences, University of Nigeria, Enugu, Nigeria

Corresponding author:
Temitope Oladejo,
temi.oladejo@yahoo.com

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Background: People living with human immunodeficiency virus (PLWH) live longer, but experience human immunodeficiency virus (HIV)-related comorbidities and disabilities that lower their quality of life. Understanding the prevalence, risk factors, and disability patterns is crucial for tailored interventions.

Objectives: To explore the prevalence and predictors of HIV-related disability among PLWH in Nigeria.

Method: This cross-sectional survey involved 385 PLWH, exploring demographic data, HIV history, recent symptoms, disability (measured by the WHO Disability Assessment Schedule–WHODAS 2.0). Descriptive statistics summarised the data, all variables were entered into univariate and multivariate regression models. IBM SPSS 25® was used for all analyses at a 95% confidence level.

Results: The prevalence of disability among PLWH was 39.5%, the mean age was 42.2 ± 10.43 years, and 73% of the participants were females. Factors significantly associated with disability were marital status ($p = 0.009$) and level of education ($p = 0.001$).

Conclusion: The study reveals a prevalence of disability (39.5%) among PLWH on antiretroviral therapy (ART), emphasising the need for tailored interventions considering socio-demographic factors. Continuous screening, risk identification, and effective management strategies are imperative, recognising disability as an indicator of health and quality of life.

Clinical implications: With PLWH experiencing increased life expectancy, the study underscores the need for an informed patient-centred approach to care, recognising the specific challenges faced by PLWH in Nigeria and guiding the development of targeted interventions to enhance both functional outcomes and overall well-being.

Keywords: HIV; disability; activities of daily living; health-related quality of life; prevalence; predictors.

Introduction

The development of disability among people living with human immunodeficiency virus (PLWH) has become an increasingly significant global health problem. Of the 38.4 million PLWH globally, 67% live in sub-Saharan Africa (Joint United Nations Programme on HIV/AIDS [UNAIDS] 2021). Nigeria has an estimated human immunodeficiency virus (HIV) prevalence of 2.1% (Onovo et al. 2023), accounting for two million of the nation's population. Of Nigeria's estimated population of 200 million, approximately 25 million live with one or other form of disability (Haruna 2017). Human immunodeficiency virus and/or acquired immunodeficiency syndrome (AIDS) ranks among the top causes of disability-adjusted life years (DALYs), second only to malaria (The Lancet 2022). In line with the 95-95-95 vision of UNAIDS (Frescura et al. 2022), Nigeria's proportion of people with access to antiretroviral therapy (ART) has increased over the years; this implies that PLWH have an extended life expectancy, thereby living longer lives (Federal Ministry of Health, Nigeria & Nigeria HIV/AIDS Indicator and Impact Survey [NAIIS] 2019). However, the combination of HIV infection and the side effects of ART contributes to the increased emergence of disabilities among PLWH owing to ageing in the long-term survivors of HIV.

As people age with HIV, there is an increased likelihood of developing comorbidities, such as cardiovascular diseases, osteoporosis, chronic obstructive pulmonary disease, chronic kidney disease, and certain cancers (Crane & Drumright 2022; Pelchen-Matthews et al. 2018; Roomaney et al. 2022). The sequelae of the above comorbidities involve disabilities related to

Note: Additional supporting information may be found in the online version of this article as Online Appendix 1 and Online Appendix 2.

functional limitations and social participation restrictions, the types, and patterns of which may vary across socio-cultural boundaries, but these need to be properly elucidated to inform relevant rehabilitation interventions. The International Classification of Functioning, Disability, and Health offers a normative metric and conceptualises that disability may be related to impairments (fatigue, pain), functional capacities, activity limitations, and participation restrictions (WHO 2013). With HIV being varied in its impact, and disability being a multi- dimensional concept, the International Classification of Functioning, Disability and Health (ICF) (World Health Organization, 2001) model examines the dynamic interaction between HIV-related disability and the influence of contextual (environmental and personal) factors (Kietrys et al. 2019).

At the individual level, determining the specific disability caused by HIV versus the disability caused by social determinants influencing HIV exposure can be difficult and intertwined (UNAIDS 2017). Thus, to detangle this intersectionality of HIV and disability, a comprehensive approach that considers both the physiological consequences of HIV infection and the broader social context in which PLWH live should be considered. Brown et al. (2022) highlighted that the risk factors for HIV-related disability can be classified into three categories: socio- demographic factors, social determinants of health, and HIV features such as late diagnosis. These factors may cause PLWH to experience greater limitations in performing basic activities.

Numerous studies (Banda et al. 2019; Erlandson 2020; Payne et al. 2022) have explored the diverse nature of impairments and their associated functional limitations that prevent PLWH from fully engaging in activities of daily living. The severity of HIV-related disability ranges from mild to moderate to severe. The prevalence of moderate and severe disability among people living in the United Kingdom (UK) was recently reported as 70.5% and 39.5%, respectively (Brown et al. 2022). A systematic review of data among PLWH from sub-Saharan Africa reported that the prevalence of disability was high across a range of body functions and/or structures (Banks et al. 2015). According to Olaleye, Adetoye, and Hamzat (2017), 71.1% of PLWH in Ibadan, Nigeria, were found to have a mild to moderate level of disability, as measured by the WHO Disability Assessment Schedule (WHODAS 2.0). Similarly, 51.9% of the participants in a South-African study scored 2 or more on the WHODAS 2.0 scale indicating the presence of moderate level disability.

Although sub-Saharan Africa bears the greatest disease burden of people acquiring and living with HIV (Jahagirdar et al. 2021), the impact of HIV on disability in sub-Saharan Africa has not been expansively researched, and there is a dearth of literature from Nigeria. Given the diverse socio-demographic, economic, and socio-cultural factors that could impact the psychosocial wellbeing of PLWH in Nigeria and the development of disability (Ogunmola, Oladosu & Olamoyegun 2014), understanding the prevalence and patterns of HIV-related disabilities and their associated factors would help develop a contextualised management approach. Hence, the aim of our study is to determine the prevalence and associated factors of HIV-related disability among PLWH in Nigeria.

Research methods and design

A cross-sectional descriptive study design was used in our study. The study involved PLWH recruited from seven HIV and AIDS Testing and Treatment Centres in Lagos. Eligibility for the study included being 18 years old and above, living with HIV, and attending the outpatient HIV and AIDS clinic.

Study setting

The study was multicentred and conducted in Lagos State. This state was selected in the light of the availability of resources, the size of the country's total population, and because it is one of the major population hotspots with evidence of a high HIV burden and unmet needs for HIV and AIDS treatment services (Lo et al. 2021). Lagos, with over 24 million residents (Obilaonu, Mohd & Norhuzailin 2023) has 31 HIV/AIDS (Lo et al. 2021) Testing and Treatment Centres spread across 20 Local Government Areas.

Sample size

Of the estimated 2 million PLWH in Nigeria, 24 000 live in Lagos (Onovo et al. 2023). The sample size was determined by using the single population proportion formula (Bujang 2021), where the following assumptions were considered: 95% confidence interval, 51.9% prevalence of disability among PLWH (Myezwa et al. 2018) and 5% margin of error. Thus, a final sample size of 385 was calculated.

Sampling method

For this study, seven facilities were randomly selected. Study participants were recruited using systematic random sampling at the HIV clinics.

Data collection

Data were obtained through self-administered formats. The standardised questionnaires listed below were employed for collecting data according to the specific study objectives.

Socio-demographic questionnaire

The socio-demographic questionnaire used in our study provided information on the age, sex, educational qualifications, income range, year of HIV diagnosis, and ART information (Online Appendix 1).

Health symptoms

The Medical Symptoms Questionnaire (MSQ) used in our study was modified from the MSQ compiled by the Institute for Functional Medicine (2020). It identifies symptoms that help diagnose underlying illness and tracks progress over time. Each symptom is based on the health profile of the patient over the previous 3 months. The scoring system is organised into 15 symptom-specific domains covering the head, eyes, ears, nose, mouth and throat, skin, heart, lungs, digestive tract, joints and muscles, weight, energy and activity, mind, emotions, and others. Respondents are required to assign a score ranging from 0 to 4 for 71 symptoms observed over the previous 14 days. A score of 0 means never having experienced such symptoms; 1–2 means occasional symptoms, not severe ('1') or severe ('2') effects; 3 and 4 mean frequent symptoms and not severe ('3') or severe ('4') effects. Therefore, a lower score means a lower symptom burden (Institute for Functional Medicine 2020). Although, the MSQ has yet to be validated and has inconsistent categorisation of items (Williams, Steinberg & Berzin 2021), a modified version, which is used in routine monitoring and evaluation at the study sites is adapted for the purpose of our study. This questionnaire asks participants to respond in 'yes' or 'no' to symptoms they have experienced over the last 14 days (Online Appendix 1).

Disability

The WHO Disability Assessment Schedule (WHODAS 2.0) tool was used to assess functioning and disability in various core activities essential in daily life (Üstün et al. 2010). The 12-item version is used for a brief assessment of overall functioning and asks questions about six domains: cognition (learning, concentrating), mobility (standing, walking), self-care (washing, dressing), getting along (keeping friendships, dealing with people), life activities (work and school), and participation (joining community activities, emotional effects). Individuals complete the WHODAS by answering each question on a 5-point Likert scale (range: 0–4), with higher scores indicating increasing difficulty in completing the task (Online Appendix 1). The WHODAS calculates 'simple' and 'complex' sum scores. The scores assigned to each item are summed (range: 0–48) in 'simple' scoring, with higher scores indicating greater disability (Paton & Lane 2020). Multiple levels of difficulty are factored for each item in 'complex' or item response theory-based scoring using a downloadable scoring sheet from the WHODAS website, providing a disability range of 0 (no disability) to 100 (total disability) (Paton & Lane 2020). The tool has been validated and demonstrated to be effective for screening functionality and disability among PLWH (Barbosa 2020). Furthermore, the internal reliability of the entire WHODAS 2.0 using Cronbach α is 0.89 (Holmberg et al. 2021).

The first author and two research assistants collected participant data according to the study protocol requirements. All questionnaires were in English language, and participants who required additional help were assisted in completing the questionnaire.

Operational definitions

Human immunodeficiency virus-related disability was defined as any PLWH with a score of one or more on the WHODAS 2.0 (Kietrys et al. 2019). The term, 'HIV-related disability', used in our study refers to the physical, mental, social, and functional limitations experienced by PLWH (O'Brien et al. 2008). This term is commonly used in rehabilitation contexts to distinguish between individuals with milder challenges who can be treated simplistically and those with more severe conditions that require advanced rehabilitative therapy (Brown, 2022).

Data analysis

The data from the completed questionnaires were captured in Microsoft Excel and imported into IBM® Statistical Package for the Social Sciences (SPSS®) 25 (IBM Corp. 2017) for analysis. Descriptive statistics were applied to all the demographic variables. Quantitative data and the categorical variables were described in terms of mean ± standard deviation ($M \pm$ s.d.) and frequency or percentage, respectively. Odds ratio (OR) and confident interval (CI) were used to determine the strength of association between dependent and independent variables. Binary logistic regression analysis was performed to rank the relative importance of exposure variables with outcome variables. The level of significance was set at $p < 0.05$ for all the analyses. To determine which variables were independently associated with the main outcomes of WHODAS disability, all variables were entered into the univariate and multivariate regression models. Variables with p value less than 0.25 in the final model were considered as statistically significant.

Ethical considerations

Approval was obtained from the Human Research Ethics Committee of the University of the Witwatersrand (M200906) and the Lagos State University Teaching Hospital Health Research Ethics Committee (LREC/06/10/1547). The clinical director of the participating testing and treatment centres granted permission. Written informed consent was obtained from the participants.

Results

Socio-demographic characteristics

The socio-demographic characteristics of the participants are presented in Table 1. The mean age of the participants was 42.2 ± 10.43 years, with a range of 22 to 70 years. Majority of the participants were females ($n = 281$; 73%), married ($n = 219$; 56.9%), had a secondary education ($n = 194$, 50.4%), and earned less than the national minimum wage of ₦30 000 ($n = 221$; 59.3%).

Human immunodeficiency virus profile and medical symptoms

Table 2 outlines the years since diagnosis, and their current medical symptoms. All participants were on ART (100%).

TABLE 1: Socio-demographic characteristics of the participants (N = 385).

Socio-demographic characteristics	*n*	%
Age (years)		
18–30	52	13.5
31–50	252	65.5
51 and above	81	21.0
Gender		
Men	104	27.0
Women	281	73.0
Marital status		
Married	219	56.9
Single	101	26.2
Widowed or Divorced or Separated	65	16.9
Education		
No formal education	24	6.3
Primary school	51	13.3
Secondary school	194	50.4
Post-secondary	115	29.9
Income per month (₦)		
Less than ₦18 000	113	29.4
₦18 001 – ₦30 000	115	29.9
₦30 001 – ₦70 000	108	28.1
Above ₦70 000	49	12.7

TABLE 2: Human immunodeficiency virus information and medical symptoms (N = 385).

Variables	*n*	%	Mean	s.d.
HIV information				
Year since diagnosis	-	-	7.52	4.57
Medical symptoms				
Confusion	26	6.7	-	-
Breathlessness	17	4.4	-	-
Fatigue	61	15.8	-	-
Diarrhoea	26	6.8	-	-
Nausea and vomiting	16	4.2	-	-
Headache	141	36.6	-	-
Stomach pain	34	11.2	-	-
Change in taste, sore mouth	23	6.0	-	-
Skin itching or changes	65	16.9	-	-
Muscular pain	107	27.8	-	-
Fever	66	16.9	-	-
Weight loss	125	32.5	-	-

Note: Owing to a poor CD_4 cell count and viral load monitoring, most participants did not know their actual CD_4 cell count and viral load. Thus, on account of so much missing data, the CD_4 cell count was not analysed.
HIV, human immunodeficiency virus; s.d., standard deviation.

With regards to HIV diagnosis, the mean (s.d.) years since diagnosis was 7.52 ± 4.57 with 80% people being diagnosed in the second decade of the 2000s (2011–2020). All participants were on ART. Most respondents experienced headaches, weight loss, and muscular pain in the last 14 days (36.6%, 27.8% and 16.9% respectively).

Human immunodeficiency virus-related disabilities of the participants

Disability in this sample of PLWH stayed below what was expected based on previous literature. Figure 1 provides information on the pattern of disability grouped by domain and the frequency as measured by the WHODAS 2.0 questionnaire. Overall, 152 (39.5%) of the participants scored 1 or more on the WHODAS 2.0 questionnaire. Participants

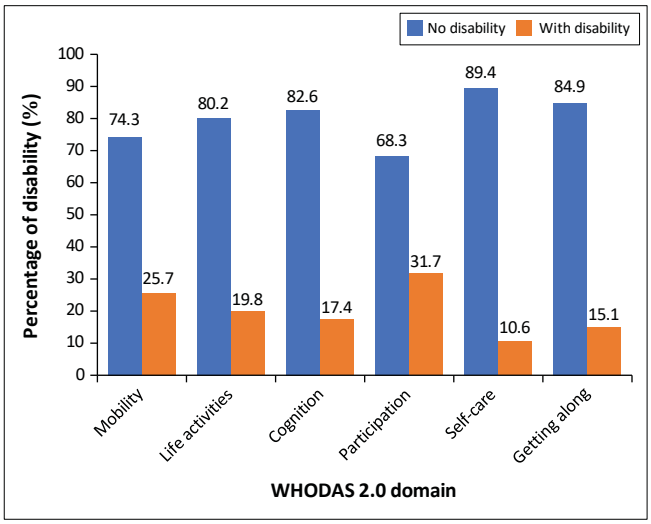

FIGURE 1: Human immunodeficiency virus-related disability of the participants by WHODAS 2.0 domain (N = 385).

experienced the most disability in the participation domain (31.75) and had the least disability in self-care domain (10.6%) experiencing disability with functioning and participation in activities of daily living (see Online Appendix 2, Table 1-A2).

Socio-demographic characteristics of participants with and without disability

Table 3 shows the association between the socio-demographic characteristics of PLWH and their disability status (i.e. with or without disability). The result shows that only marital status ($\chi^2 = 9.467$, $p = 0.09$) and education level ($\chi^2 = 15.669$, $p = 0.01$) had significant association with disability status.

Associated factors of HIV-related disability among people living with HIV

All socio-demographic variables in the univariable analysis whose chi-square significant level is ≤ 0.25 are included in the multivariable analysis (binary logistic) (Table 4). The results show that individuals aged 51 and above have statistically significantly higher odds of HIV-related disability compared to those aged 18–30 years (AOR: 1.6 [1.4, 3.5]). Single and widowed or separated individuals (AOR: 2.2 [1.1, 4.2]; AOR: 3.4 [1.5, 7.7]), and individuals with an income of ₦18 000 or less (AOR = 3.9, 95% CI [1.7, 8.9]) have statistically significantly higher odds of HIV-related disability compared to those with income above N70 000.

Discussion

Our study showed that the prevalence of disability among PLWH in Nigeria is 39.5%. This figure is notably lower than the 51.9% (South Africa) and 79.5% (United Kingdom) reported by Brown et al. (2022), utilising the same outcome measures. While the reason for this large disparity is unclear, one potential explanation, as discerned in studies employing self-reported measuring techniques, could be the inclination for overestimating one's abilities (Akashi- Ronquest et al. 2011; Mactaggart et al. 2016). Additionally,

TABLE 3: Association between socio-demographic profiles and disability level.

Socio-demographic characteristics	With disability (N = 152)		Without disability (N = 233)		χ^2	p
	n	%	*n*	%		
Age (years)					6.104	0.191
18–30	27	17.8	25	10.7		
31–50	89	58.6	162	69.5		
51 and above	36	23.7	46	19.7		
Gender					0.234	0.629
Men	39	25.7	65	27.9		
Women	113	74.3	168	72.1		
Marital status					9.467	0.009*
Married	87	57.2	132	56.7		
Single	49	32.2	52	22.3		
Widowed or separated	16	10.5	49	21.0		
Education					15.669	0.001*
No formal education	8	5.3	16	6.9		
Primary school	20	13.2	31	13.3		
Secondary school	61	40.1	133	57.1		
Post-secondary	62	40.8	53	22.7		
Income per month (₦)					4.523	0.210
Less than ₦18 000	50	32.9	56	24.0		
₦18 000 – ₦30 000	41	27.0	74	31.8		
₦30 000 – ₦70 000	40	26.3	68	29.2		
Above ₦70 000	16	10.5	33	14.2		

*p < 0.05, statistically significant.

TABLE 4: Multilevel regression models of factors associated with HIV-related disability (N = 385).

Variable	COR	95% CI	AOR	95% CI
Age (in years)				
18–30	1.0	-	1.0	-
31–50	1.08	04, 3.2	0.5	0.7, 1.6
51 and above	0.8	0.3, 1.8	1.6	1.4, 3.5
Marital status				
Married	1.0		1.0	
Single	2.0	1.1, 3.8	2.2	1.1, 4.2
Widowed or separated	2.9	1.5, 5.7	3.4	1.5, 7.7
Education				
No formal education	1.0	-	1.0	-
Primary school	0.4	0.2, 1.08	0.2	0.1, 0.7
Secondary school	0.6	0.3, 1.1	0.5	0.2, 1.0
Post-secondary	0.4	0.2, 0.6	0.3	0.2, 0.6
Income per month (₦)				
Less than ₦18 000	1.8	0.9, 3.7	3.9	1.7, 8.9
₦18 000 – ₦30 000	1.1	0.6, 2.3	2.0	0.9, 4.4
₦30 000 – ₦70 000	1.2	0.6, 2.5	1.9	0.9, 4.0
Above ₦70 000	1.0	-	1.0	-

AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio.

an individual's perception of disability is a vital construct that could influence the variation in reported disability levels (Babik & Gardner 2021). On a local scale, the identified prevalence in this study stands lower than that reported in Ibadan, Nigeria, where 71.1% of participants exhibited mild to extreme disabilities (Olaleye et al. 2017). Similar to the findings of Olaleye et al. (2017), the highest level of disability in our study was reported in the participation domain, possibly indicative of a shift in the disability experience of PLWH from concerns related to physical well-being to challenges in daily life activities. Consequently, the limitations confronted by PLWH in this study are predominantly associated with their interaction within their environment.

Participation restriction among PLWH may be influenced by several socio-demographic factors such as age, gender, education level, and income level. For example, the mean age of participants was 42.2 ± 10.43 years, with a range of 22 years to 70 years. These statistics are similar to those related to the mean age of participants in studies conducted in Nigeria, such as Olaleye et al. (2017) and Folasire, Irabor and Folasire (2012), who reported mean ages of 38.1 ± 9.0 years and 35.4 ± 7.0 years, respectively. Although there was no significant association between age and disability in our study, the educational level and marital status showed a significant association (p = 0.001 and p = 0.009, respectively). This could possibly be explained by female vulnerability to HIV in Nigeria which is further increased by the existence of a patriarchal society that promotes gender inequality and the disproportionate distribution of education, which limits female access to socio-economic benefits (Oyekale 2014). Kposowa (2013) suggested a relationship between HIV prevalence and marital status as divorced, separated, or widowed women had a higher risk of HIV infection in their study than single, married, or cohabiting women (Kposowa 2013).

Also, the feminisation of the HIV and AIDS epidemic remains a national and global problem, as evidenced by the gender gap distribution in this study and other similar studies conducted in Nigeria (Awofala & Ogundele 2018; Chiwuba 2022; Iyayi et al. 2011). In North Central Nigeria, 58% of the participants in the study by Ahmed et al. (2022) were females. Additionally, Ezechi et al. (2016) reported that the prevalence of women living with HIV in Southwest Nigeria increased from 60.2% in 2004 to 68.6% in 2015. Findings revealed that most participants were married (56.7%), 26.2% were single, and 19.6% were widowed,

separated, or divorced. The female preponderance observed aligns with the sex distribution observed in other studies from sub-Saharan Africa (Karim & Baxter 2019) and globally, where over half (54%) of all individuals with HIV worldwide are females (UNAIDS 2023). A possible explanation could also be the observation that men are less inclined than women to participate in studies, thus skewing the results (Ryan et al. 2019). In regions where customary and religious laws heavily subjugate women's rights, the preponderance of gender-based violence, particularly toward married women, contributes to the spread of HIV infection (Orisaremi 2017).

Regarding income level, although there was no significant association between disability and income level, considering that the estimated financial cost per individual living with HIV is ₦N36 065 in direct private healthcare expenses and indirect income loss (Ndukwe et al. 2018), the socio-economic impact of HIV cannot be overlooked. Despite the minimum wage in Nigeria being increased from ₦18 000 to ₦30 000 in April 2019 (Urama 2019), more than half (59.3%) of the sample population earned less than ₦30 000 ($65.07) monthly. On the contrary, the relationship between educational level and disability was shown to be statistically significant, demonstrating a greater prevalence of impairment among those with lower educational attainment compared to those with higher educational attainment. These findings are similar to prior literature (Olaleye et al. 2017) and support the hypothesis that people with greater levels of education may benefit from increased healthcare accessibility, which may be affected by higher employment and earning capability. Furthermore, it is possible that people with higher education levels are more likely to make health-conscious decisions, proactively treating symptoms that may develop to impairment.

More than 65% of the respondents had been diagnosed with HIV in the previous 7 years, and the results showed that all respondents were on ART. This indicates that Nigeria is on the path to achieving the Joint United Nations Program on HIV/AIDS 95-95-95 targets. Human immunodeficiency virus continues to affect the immune system and presents various symptoms at different stages of infection. People living with HIV who start ART early have an improved total life expectancy (Katz & Maughan-Brown 2017). Respondents from this study reported medical symptoms experienced in the previous 14 days such as headache, fever, fatigue, and muscular pain, all of which concur with the findings of other authors (Schreiner et al. 2020; Zhu et al. 2021). While most findings in literature (O'Brien et al. 2008; Olaleye et al. 2017) report association between CD4 count and disability, this study did not obtain information on the CD4 count and its relationship with disability level among PLWH as most participants did not have accurate records of these values, and thus was unable to be analysed.

Strengths and limitations

The participants' self-reported experiences of disability and symptoms over a period of 30 days were certain to include recall bias, which may not be accurate. Similarly, the cross-sectional design adopted in this study demands that causality between the explanatory variables and disability cannot be inferred. However, despite these limitations, the study's strengths indicate that it has scientific and practical implications for policy and practice in HIV care. These findings could also have translational relevance in clinical practice and the management of disability in PLWH.

Conclusion

The prevalence of disability among PLWH receiving ART was 39.5% in this study, with more than one-third of participants experiencing some form of disability. This highlights the significant prevalence of disability in this population, providing important insights into its prevalence and socio-demographic correlates in the Nigerian context. The findings shed light on the nuanced factors that shape disability experiences and highlight the need for tailored interventions that take into account the unique challenges that PLWH face. It is imperative to advocate for continuous disability screening, identification of potential risk factors, and development of effective management strategies. Recognising disability as a potential indicator of health status and quality of life, a longitudinal study to establish a cause-effect relationship between HIV-related disability and presumed risk factors is recommended. Furthermore, future research should consider the efficacy of various interventions aimed at improving the quality of life for PLWH, contributing to a better understanding of the disease and improving health outcomes in this population.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

T.S.O. conceptualised the study, and contributed to data curation, investigations, visualisation, data analysis, writing

and editing the original draft. H.M. conceptualised the study, and was involved in visualisation, writing and editing, and supervision. A.T.A.'s contribution included visualisation, writing and editing, and supervision. S.I. was involved in further analysis, writing and editing, and supervision.

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Data availability

Data sharing does not apply to this article as no new data were created or analysed in this study.

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4.6 Summary of Chapter Four

The study's findings align with its objectives by shedding light on the prevalence, predictors, and impact of HIV-related disability among PLWH in Nigeria. Prevalence was lower than expected based on previous literature, with the most disability reported in the participation domain and the least in the self-care domain. Sociodemographic factors such as marital status and education level were significantly associated with disability among PLWH, highlighting the importance of considering these factors in disability management strategies. The findings highlight the importance of addressing disability in HIV care and advocating for interventions aimed at improving the quality of life and health outcomes for PLWH.

Chapter 5 Health-related quality of life and associated factors among people living with HIV/AIDS in Lagos, Nigeria

5.1 Introduction

Chapter five is presented as a published article according to the journal guideline. The paper aims to understand the factors influencing the health-related quality of life among individuals living with HIV/AIDS in Lagos, Nigeria. The paper has been published by the African Journal of Primary Health Care and Family Medicine.

5.2 Publication reference

Oladejo, T., Myezwa, H, Ajidahun, A., & Ibeneme, S., (2024). Health-related quality of life and associated factors among people living with HIV/AIDS in Lagos, Nigeria: a cross-sectional study. African Journal of Primary Health Care and Family Medicine, 16 (1), 1-8. DOI: 10.4102/phcfm. v16i1/4519

5.3 Details of author contribution

The Contributor Roles Taxonomy (CRediT) (Allen et al., 2019b) was used to outline the authors' contribution to the study. The full explanation of the terms is in Appendix 10.

Table 5.1: Details of author contribution

	Oladejo	Myezwa	Ajidahun	Ibeneme
Conceptualization	√	√	√	√
Method	√	√	√	√
Resources	√			
Manuscript writing draft	√			
Manuscript writing review and editing	√	√	√	√
Supervision		√	√	√

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5.5 Published article: Health-related quality of life and associated factors among people living with HIV/AIDS in Lagos, Nigeria: a cross-sectional study

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Health-related quality of life and associated factors among people living with HIV/AIDS in Lagos, Nigeria

Authors:
Temitope S. Oladejo[1]
Hellen Myezwa[2]
Adedayo T. Ajidahun[1]
Sam Ibeneme[3]

Affiliations:
[1]Department of Physiotherapy, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

[2]School of Therapeutic Sciences, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

[3]Department of Medical Rehabilitation, Faculty of Health Sciences, College of Medicine, University of Nigeria, Enugu, Nigeria

Corresponding author:
Temitope Oladejo,
temi.oladejo@yahoo.com

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Background: Although people living with HIV (PLWH) now have a longer life expectancy due to antiretroviral therapy, several factors impact their health-related quality of life (HRQoL). Understanding the dimensions and determinants of HRQoL among PLWH is crucial to developing solutions to improve their overall wellbeing.

Aim: This research aimed to explore the HRQoL and its associated factors among PLWH in Lagos, Nigeria.

Setting: Seven HIV testing and treatment centres in Lagos.

Methods: A cross-sectional survey was conducted with 385 participants. Socio-demographic and HRQoL data were obtained using questionnaires and the Medical Outcomes Study HIV Health Survey (MOS-HIV). Logistic regression models were used to identify variables that were associated with quality of life.

Results: The physical health summary and mental health summary scores measured by the MOS-HIV were 54.2 ± 5.3 and 56.3 ± 6.7, respectively. Being married, having higher levels of education, shorter duration of HIV and higher income levels were significantly associated with better HRQoL. The duration of HIV was found to have an inversely proportional influence on the quality of life of PLWH, both in physical health ($\chi^2 = 9.477$, $p = 0.009$) and mental health ($\chi^2 = 11.88$, $p = 0.004$) dimensions.

Conclusion: The HRQoL of PLWH in Lagos, Nigeria was relatively low. Education, duration of HIV, marital status and income level are predictors of HRQoL.

Contribution: This study is valuable for healthcare professionals and policymakers, providing them with essential information to tailor interventions and allocate resources effectively to improve the overall wellbeing of PLWH in Nigeria.

Keywords: health-related quality of life; HIV; Nigeria; associated factors; anti-retroviral therapy.

Introduction

Of the estimated 37.9 million persons with HIV (PLWH) living in the world, 67.5% are in Africa.[1] Despite the low prevalence of 2.1% (1.9 million PLWH), Nigeria has the second-largest population of PLWH in the world.[2] Although there has been an increase in access to Anti-Retroviral Therapy (ART) in Nigeria, the rate of new infections and opportunistic infections, such as tuberculosis, has risen in the past year.[1] This indicates that although mortality rates among PLWH may fall, they are, however, prone to a diverse range of health-related challenges because of the HIV infection and their use of ART.

The Federal Government of Nigeria led by National Agency for the Control of AIDS (NACA) in the recent National HIV/AIDS strategic framework 2021–2025,[3] emphasised the aim for Nigeria to be AIDS-free by 2030, with no new infections, discrimination, or deaths because of the disease. One of the seven principles guiding this strategic framework is 'to ensure care and support for all people living with and affected by HIV'.[4] Central to this target is the UNAIDS 95-95-95 goal of ensuring that, 95% of persons living with HIV are aware of their HIV status, 95% of patients diagnosed with HIV undergo ongoing antiretroviral medication and 95% of people on antiretroviral medication maintain viral suppression.[5] Currently, these strategies have aided in transforming HIV/AIDS from a deathly acute infection to a chronic disease, as PLWH are living longer lives because of improved access to ART.[6] Thus, these strategies collectively aim at improving the health-related quality of life (HRQoL) of PLWH.

The definition of HRQoL continues to be debatable. According to the World Health Organization, quality of life is defined as 'the individual's perception of their position in the context of culture and value systems in which they live and in relation to their goals, expectations, standards and concerns'.[7] This concept renders quality of life (QoL) subjective and specific to a person, his or her culture, and environment. Although an individual's personal view about their quality of life may alternate throughout their life,[8] the multidimensional concept of HRQoL encompasses various domains such as emotional health, physical health, social functioning (SF), and pain, which play a vital role in how an individual rates their overall perception of general health.[9,10] In furtherance of this, various factors that could impact the HRQoL of a PLWH have been explored,[11] and findings reveal that sociodemographic characteristics, presence of comorbidities, socioeconomic status, environmental factors, coping mechanisms, and clinical factors could influence the HRQoL of PLWH.

Studies exploring the influence of various factors in determining the QoL of PLWH have been assessed nationally[12,13] and globally.[14,15,16] Findings from these studies reveal that the determinant factors vary and range across physical, psychological, social and financial domains.[17,18] These factors also differ across participants based on geographical locations, ethnicity, gender, and other concurrent factors.[11]

Several instruments have been utilised in measuring the HRQoL of PLWH.[19] Considering the diverse instruments employed to assess the HRQoL of PLWH, including widely used measures such as the Medical Outcomes Study HIV Health Survey (MOS-HIV) and the World Health Organization Quality of Life (WHOQOL)-BREF,[20] the literature on HRQoL among PLWH in Nigeria lacks consensus. While Ogbuji and Oke[21] utilised the 'HIV Symptom Scale' (HSS) and the 'Quality of Life Scale' (QOLS) to report poor quality of life in Ibadan, Nigeria, a study in South-East Nigeria using the WHOQOL brief version tool indicated an overall good HRQoL among adolescents and adults.[22] Similarly, Salako et al.[23] 2022 assessed HRQoL in Lagos, focusing on children and adolescents with the Paediatric Quality of Life Inventory [PedQoL™] and reported favourable HRQoL scores. This divergence in findings underscores the need for a comprehensive understanding of the factors influencing HRQoL in the Nigerian context.

A scoping analysis of HIV/AIDS in Nigeria[24] from 1986 to 2021 surmised that although there is an increase in scientific literature pertaining to HIV/AIDS-related research in Nigeria, there are still unexplored grey areas, such as the relationship between sociodemographic status and quality of life among PLWH in 'key population hotspots'[25] which had not been precisely characterised. Understanding the factors impacting the HRQoL among PLWH is crucial for identifying potential confounding variables and understanding how different demographic factors may influence the HRQoL of PLWH. Additionally, sociodemographic data can provide insights into the distribution of health outcomes among PLWH which may assist policymakers to allocate resources effectively and implement policies that address the distinct needs and challenges encountered by PLWH.[26] Hence, the primary objective of this research is to assess the current status of HRQoL and identify the factors associated with it among PLWH in Lagos, Nigeria, using the MOS-HIV questionnaire.

Research methods and design

Study design and participants

This cross-sectional study was conducted between July 2022 and January 2023 in Lagos, Nigeria. With Lagos being one of the key population hotspots for targeted HIV programme planning in Nigeria,[25] seven HIV/AIDS testing and treatment centres in Lagos were randomly selected as study sites for the survey. The required sample size was determined using relevant literature[22,27] and the Cochran's sample size equation for categorical data[28]:

$$n = (t)2(p)(q) \div (d)2 \quad \text{[Eqn 1]}$$

where:

t = value for selected alpha level of 0.025 in each tail = 1.96;

d = acceptable margin of error = 5%; and

$(p)(q)$ is the estimate of variance = 0.25.

Thus, a minimum sample size of 385 participants was calculated. Participants were selected using convenience sampling, and the following inclusion criteria were applied in determining the eligibility of participants:

- people living with HIV;
- people above the age of 18;
- people who voluntarily indicated interest to participate and are able to consent.

Data collection

Data collection was done using paper questionnaires. The principal investigator was assisted by two physiotherapists who worked as research assistants for the study. All researchers underwent training on administering the questionnaires and provided information to participants about the study's purpose, content and potential risks before data collection. Participants completed the anonymous questionnaires independently while the researchers provided detailed clarification and recorded answers for participants who had difficulty understanding or reading the questionnaire.

Measurements

Sociodemographic characteristics

The sociodemographic survey tool used in this study provided information on the age, gender, educational qualifications, income range, duration since HIV diagnosis, and ART information of participants.

Medical symptoms

Based on literature and clinical experience, common symptoms experienced by PLWH were included in the questionnaire. This questionnaire asked participants to respond 'yes' or 'no' to symptoms they had experienced over the previous 14 days.

Health-related quality of life

The MOS-HIV was utilised as the primary measure of HRQoL. Medical Outcomes Study HIV Health Survey is a widely used 35-item questionnaire that comprehensively assesses various dimensions of health relevant to HIV/AIDS,[29] including general health perceptions (GHP), pain, physical functioning (PF), role functioning, SF, mental health (MH), energy, fatigue, cognitive function, and overall quality of life. Previous studies have reported satisfactory reliability, with a Cronbach's α coefficient exceeding 0.7 for group comparisons,[30] indicating adequate internal consistency. Additionally, validity has been established for the physical health summary (PHS) and mental health summary (MHS) scores of the MOS-HIV.[30] Scoring of the questionnaire involved a two-step process: firstly, numerical values were re-coded, and then each item was scored on a scale of 0 to 100, with higher scores reflecting better functioning and overall well-being. Secondly, to estimate the 10 domains of patient functioning, items from the same scale were averaged.

Statistical analyses

The data from the completed questionnaires were captured in Microsoft Excel and imported into IBM SPSS 25 ® for analysis. Descriptive statistics were utilised to summarise all demographic variables. For the quantitative measures, continuous variables were presented as mean ± standard deviation (M ± s.d.) while categorical variables were described using percentages. Using the MOS-HIV scoring protocol,[30] the individual scores from the questionnaire were re-coded where required and computed to achieve domain scores (PF, pain, SF, role functioning, emotional well-being, energy, fatigue, cognitive function, health distress (HD), health transition, general health, and overall quality of life) with a mean of 50, and a standard deviation of 10. Scores above 50 indicated better HRQoL, while scores below 50 indicated poorer HRQoL.

Univariate analysis using the χ^2-test for categorical data and Spearman's correlation for continuous data were utilised to assess the quality of life among PLWH across the various sociodemographic characteristics. Fischer's Exact Test was utilised to ascertain the relationship between HRQoL and sociodemographic variables. Binary logistic regression analysis was conducted to identify factors associated with HRQoL in PLWH. The goodness-of-fit of the regression model was evaluated using the Hosmer–Lemeshow statistic, with a p-value > 0.05 indicating a well-fitting model. All variables with a significance level of $p \leq 0.2$ in the univariate analysis were included in a multivariable logistic regression analysis.

Ethical considerations

Approval was obtained from the Human Research Ethics Committee of the University of the Witwatersrand (M200906) and the Lagos State University Teaching Hospital Health Research Ethics Committee (LREC/06/10/1547). The clinical director of the participating testing and treatment centres granted permission. Written informed consent was obtained from the participants.

Results

Sociodemographic characteristics of participants

A total of 385 PLWH participated in the study, of which 27% (104) were male and 73% (281) were female. Most participants (66.5%) were between the ages of 31 and 50 years, and the overall mean (s.d.) age was 42.22 ± 10.43 years. Over half (n = 219; 56.9%) of the participants were married and had a secondary education (n = 194; 50.4%). Majority of the participants were low and middle-income earners, as only 12.7% (n = 49) of the participants earned above ₦70 000 ($76.81) per month. The sociodemographic characteristics of the participants are presented in Table 1.

HIV profile and medical symptoms

Table 2 outlines the medical symptoms of the participants. All participants were on ART. The range of duration since diagnosis spanned from 6 months to 21 years with a median of 4, and 80% of the participants were diagnosed in the second decade of the 2000s (2011–2020). Headaches were the most commonly reported medical symptom (36.6%).

TABLE 1: Sociodemographic characteristics of the people living with HIV in Lagos, Nigeria (N = 385).

Variables	*N*	%
Age		
18–30 years	48	12.5
31–50 years	256	66.5
> 51	81	21.0
Gender		
Male	104	27.0
Female	281	73.0
Marital status		
Married	219	56.9
Single	101	26.2
Widowed/Divorced/Separated	65	16.9
Education		
No education	24	6.2
Primary education	51	13.2
Secondary education	194	50.4
Post secondary education	115	29.9
Monthly income		
< 18 000	104	27.0
18 001–30 000	116	30.1
31 000–70 000	108	28.3
> 70 000	49	12.7

Note: For some participants, income and education level data were not provided in the questionnaire. Therefore, the total number of participants for these variables is less than the total sample size of 385.

Mean ± s.d. = 42.22 ± 10.43 (Ages: 18–30 years).

s.d., standard deviation.

Health-related quality of life of participants

Table 3 shows that the mean (s.d.) for the PHS score is 54.2 ± 5.3 and MHS score is 56.3 ± 6.7. Of the 10 domains, the highest mean was found in the pain domain 57.2 ± 6.3 and the lowest mean was found in GHP domain 49.1 ± 5.1.

Factors associated with health-related quality of life

Table 4 shows that in the univariate analysis, higher education level was significantly associated with overall PHS, while being married (χ^2 = 1.326, p = 0.022) and having higher income levels (χ^2 = 14.628, p = 0.002) was linked to better MHS. Shorter duration of HIV was associated with better PHS (χ^2 = 9.477, p = 0.009) and MHS (χ^2 = 11.88, p = 0.004).

Factors associated with health-related quality of life in the multivariable logistic regression

The results in Table 5 show that only duration of HIV diagnosis was significant in PHS and MHS in the univariate analysis and multivariate logistic regression analyses. People living with HIV who had a secondary school education showed significantly increased odds ratio (OR = 3.83; CI; 1.45–10105, p = 0.007) suggesting that secondary school education is associated with higher odds of better PHS HRQoL.

Similarly, compared to the reference category of widowed or separated individuals, the results show that marital status plays a significant role, with married (95% CI: 0.13, 0.80, p = 0.014) and single (95% CI: 0.11, 0.74, p = 0.010) individuals exhibiting a substantially lower odds ratio of 0.32 and 0.28 respectively. Thus, this suggests that being married or single is associated with a reduced likelihood of experiencing poor MHS compared to being widowed or separated. Income levels also show a significant association with MHS. Individuals with an income between ₦18 000 and ₦30 000 display a notably lower odds ratio of 0.29 (95% CI: 0.11, 0.75, p = 0.011), indicating a decreased likelihood of poor MHS compared to those with an income less than ₦18 000.

The Hosmer–Lemeshow goodness-of-fit test yielded p-values of 0.989 and 0.082 for the PHS and MHS models, respectively, indicating well-fitting models. These models accounted for approximately 7% of the variability in PHS (Nagelkerke R^2 = 0.077) and 10% of the variability in MHS (Nagelkerke R^2 = 0.105).

TABLE 2: HIV information and medical symptoms in the last 14 days (N = 385).

Medical symptoms	*N*	%
Abdominal pain	34	11.20
Breathlessness	17	4.40
Change in taste, sore mouth	23	6.00
Confusion	26	6.70
Diarrhoea	26	6.80
Fatigue	61	15.80
Fever	66	16.90
Headache	141	36.60
Muscular pain	65	16.90
Nausea and vomiting	16	4.20
Weight loss	107	27.80

TABLE 3: HIV-related quality of life in patients with HIV – Summary scores and dimension scores.

MOS-HIV domains	Median	IQR	Mean	s.d.
Summary scores				
PHS	55.8	51.8–58.1	54.2	5.3
MHS	56.3	51.2–60.0	56.3	6.7
Dimension scores				
GHP	49.3	47.2–51.3	49.1	5.1
PF	58.1	47.2–58.1	53.5	8.4
Pain	58.3	54.5–62.2	57.2	6.3
RP	56.6	56.6–56.6	54.6	6.3
SF	57.2	57.2–57.2	53.0	10.4
MH	60.0	51.47–62.1	56.0	8.9
Energy/Fatigue	51.1	49.0–53.9	50.5	4.9
HD	70.0	53.7–70.0	56.6	8.7
CF	58.1	55.7–58.1	54.4	8.4
QoL	53.0	53.0–59.3	52.1	11.1

Note: Association between PHS and MHS showed statistical significance (Spearman's rho = 0.243, p = 0.000).

IQR, interquartile range; PHS, Physical health summary score; MHS, Mental health summary score; GHP, General health perceptions; PF, Physical functioning; RP, Role-psychical; SF, Social functioning; MH, Mental health; HD, Health distress; CF, Cognitive functioning; QoL, Quality of life; MOS, Medical Outcomes Study; s.d., standard deviation.

Discussion

Findings from this study revealed that the total PHS and MHS of HIV/AIDS in Lagos, Nigeria were 54.2 ± 5.3 and 56.3 ± 6.7 respectively, which were higher than those in previous studies surveyed in other sub-Saharan countries.[14,31] Although the MOS-HIV is a widely used, reliable and validated instrument for HRQoL evaluation in PLWH,[29,32] no parallel comparison could be drawn between our study and those conducted in other parts of Nigeria, as previous studies were conducted using other HRQoL instruments such as the World Health Organization Quality-of-Life-HIV Bref – WHOQOL-HIV BREF,[33] Short Form-36 – SF-36,[34] European Quality-of-Life Instrument-5 Dimension – EQ-5D.[12] However, findings from these studies all reported good HRQoL among the participants, who were living with HIV in Nigeria. Irrespective of the measurement tool, HIV-specific HRQoL outcomes vary by country and region, with some studies showing higher overall scores than our findings.[35] These distinctions may be ascribed to variances in healthcare infrastructure, access to treatment and cultural variables impacting perceptions of health and well-being.

Although the lowest score was reported in the health perception domain (49.3), participants in our study scored highest in MH (60.0) and HD (70.0) domains, which is similar to other studies.[36,37,38] While several factors could be responsible for these varying results, this underscores the complex interplay between physical and MH aspects in the quality of life of individuals with HIV. One notable finding is the positive correlation (Spearman's rho = 0.243, p < 0.01) between mental and PHS scores. This indicates that individuals with higher MH scores also tend to report better physical health and vice versa. This correlation emphasises

TABLE 4: Association between sociodemographic characteristics and physical health summary score mental health summary score.

Sociodemographic characteristics	Total (N = 368)	PHS				MHS			
		Bad (< 50)	Good (> 50)	χ^2	p	Bad (< 50)	Good (> 50)	χ^2	p
Age (years)	-	-	-	-	-	-	-	2.736	0.255
18–30	47	12	35	6.104	0.191	14	31	-	-
31–50	243	43	200	-	-	54	199	-	-
> 51	78	20	58	-	-	15	65	-	-
Gender	-	-	-	-	-	-	-	0.261	0.609
Men	101	19	82	0.211	0.646	21	83	-	-
Women	267	56	211	-	-	62	212	-	-
Marital status	-	-	-	-	-	-	-	1.326	0.022*
Married	209	47	162	1.326	0.515	51	163	-	-
Single	96	17	79	-	-	26	73	-	-
Widowed/Separated	63	11	52	-	-	6	59	-	-
Education	-	-	-	-	-	-	-	3.356	0.340
No formal	21	8	13	12.028	0.007*	6	16	-	-
Primary school	50	13	37	-	-	9	40	-	-
Secondary school	188	26	162	-	-	37	155	-	-
Post-secondary	108	28	80	-	-	31	83	-	-
Income	-	-	-	-	-	-	-	14.628	0.002*
₦18 000	98	20	78	0.244	0.970	33	69	-	-
₦18 001–₦30 000	113	24	89	-	-	28	85	-	-
₦30 001–₦70 000	105	21	84	-	-	14	93	-	-
> ₦70 000	45	8	37	-	-	6	43	-	-
Duration of diagnosis (years)	-	-	-	-	-	-	-	11.188	0.004*
1–10	294	55	239	9.477	0.009*	66	241	-	-
11–20	66	15	51	-	-	16	51	-	-
> 20	8	5	3	-	-	6	3	-	-
PHS	-	-	-	-	-	-	-	-	-
Bad	-	30	48	0.243	0.059	-	-	-	-
Good	-	42	241	-	-	-	-	-	-
MHS	-	-	-	-	-	-	-	0.243	0.059
Bad	-	-	-	-	-	30	48	-	-
Good	-	-	-	-	-	42	241	-	-

Note: *p < 0.05 = statistically significant.
PHS, physical health summary score; MHS, mental health summary score; χ^2, chi-square.

TABLE 5: Factors associated with health-related quality of life in the multivariable logistic regression (N = 385).

Variable	OR (95%CI)	P
PHSS		
Education		
No formal education (reference)	1.0	-
Primary school	1.75 (0.59, 5.18)	0.311
Secondary school	3.83 (1.45, 10.15)	0.007
Post-secondary	1.76 (0.66, 4.69)	0.259
Duration of diagnosis (years)		
1–10	7.22 (1.68, 31.23)	0.008
11–20	5.17 (1.21, 26.5)	0.028
> 20 (reference)	1.0	-
MHSS		
Marital status		
Married	0.32 (0.13, 0.80)	0.014
Single	0.28 (0.11, 0.74)	0.010
Widowed/Separated (reference)	1.0	-
Income (₦/month)		
Less than ₦18 000 (reference)	1.0	-
₦18 000–₦30 000	0.29 (0.11, 0.75)	0.011
₦30 000–₦70 000	0.42 (0.16, 1.10)	0.078
> ₦70 000	0.93 (0.33, 2.58)	0.884
Duration of diagnosis (years)		
1–10	7.90 (1.90 – 32.5)	0.004
11–20	6.38 (1.44 – 28.4)	0.015
> 20 (reference)	1.0	-

PHSS, Physical health summary score; MHSS, Mental health summary score; OR, odds ratio; CI, confidence interval; P, p-value (level of significance).

the interdependence of mental and physical wellness and emphasises the significance of addressing both dimensions in interventions aimed at improving the HRQoL of PLWH.

When examining the individual dimensions of HRQoL, several trends emerge. Mental health-related dimensions, including MH, HD, and cognitive functioning (CF), show moderate to high scores, indicating relatively better mental well-being compared to physical health. Comparatively, PF and pain scores indicate moderate levels of physical well-being among participants while SF scores are notably lower, suggesting potential challenges in interpersonal relationships and social interactions. This suggests that while PLWH in Lagos may experience challenges in PF and social interactions, they exhibit resilience in coping with MH-related stressors.[39] Several factors may contribute to health-related stress among this population.

In the present study, participants reported that they experienced headaches, weight loss and muscular pain in the previous 14 days (36.6%, 27.8%, and 16.9% respectively). These are common findings in studies conducted among the HIV population.[40] Because of the HIV infection and adverse effects of the ART, symptoms cluster commonly reported among PLWH include depression, anxiety, insomnia, fatigue,

nausea, vomiting, joint pain, and headache, all of which negatively impact the QoL among PLWH.[40] Similarly, energy and fatigue scores (50.5 ± 4.9) indicate a substantial burden of fatigue experienced by PLWH in this population, which might impact their daily activities and overall functioning. Thus, studies that focus on fatigue management and self-perception of health promotion are needed.

The findings of this study show that education level was significantly associated with PHS. With majority (70%) of the participants educated only up to the secondary school level, the impact of education level on PLWH cannot be overemphasised. As evident from findings of previous studies,[38,41] education level is a significant predictor of HRQoL among PLWH. Furthermore, having little formal education is a barrier to getting health treatments, leading to an escalation of unsafe sexual practices,[42] and subsequently increasing the vulnerability of PLWH. Therefore, health interventions for PLWH should take into consideration the impact of education level and ensure that PLWH have a clear understanding of their health conditions and management strategies during hospitalisation and follow-up visits.

Duration of HIV infection was an independent risk factor that was significantly associated with the PHS and MHS of PLWH. This implies that irrespective of other confounding factors, the likelihood of experiencing physical and MH challenges or complications increases as one ages with HIV. The long-term implication of this is that policy makers and health professionals' interventions must evolve to address both the intrinsic capacity of PLWH and the external environment.[43]

Another noteworthy sociodemographic factor in this study was that MHS was significantly associated with marital status and income level of the participants. The finding that married individuals exhibited better HRQoL compared to widowed, separated or single individuals may be attributed to several factors. Marriage often provides emotional support, companionship and a sense of belonging, which can positively impact mental well-being and overall HRQoL.[44,45] Married individuals may also benefit from shared responsibilities, financial stability and social engagement, all of which contribute to a higher perceived quality of life. Additionally, marriage may offer a protective effect against loneliness and social isolation.[45] Married individuals have access to greater social support networks and resources, which can buffer against the negative effects of living with HIV and associated challenges.

Furthermore, our study findings suggest that individuals with an income between ₦18 000 and ₦30 000 have a significantly lower likelihood of experiencing poor MHS compared to those with an income less than ₦18 000. The odds ratio of 0.29 indicates that individuals in the higher income bracket have a substantially reduced risk of poor MHS. With over half (59.3%) of the participants in our study earning less than ₦30 000 ($65.07) monthly, which is the minimum wage in Nigeria,[44] the socioeconomic impact of HIV cannot be overlooked.

Understanding the socioeconomic factors associated with HIV allows policymakers to develop more effective and inclusive policies aimed at mitigating disparities and improving outcomes for affected populations. Moreover, by acknowledging the socioeconomic determinants of health, healthcare providers can offer holistic care that addresses not only the medical aspects of HIV but also the social and economic factors that influence health outcomes.[45] This may involve connecting patients with social support services, financial assistance programmes, and vocational training opportunities to enhance their overall well-being and quality of life. By addressing the underlying social and economic factors that contribute to HIV-related disparities, healthcare professionals and policymakers can work towards achieving better health outcomes and promoting equity in healthcare access and delivery. Thus, further research is needed to understand potential interventions to improve quality of life and address confounding socioeconomic disparities among affected populations.

Study limitations

Nearly one-third of the participants reported experiencing weight loss during the 14-day period. However, as the study did not include objective measurements of weight before and after this timeframe, it is challenging to accurately quantify the extent of weight loss. This lack of objective data underscores a broader limitation inherent in self-report cross-sectional studies, where reliance on participants' subjective accounts may introduce inaccuracies or biases. Another limitation was that the study was conducted only in Lagos state. Future studies need to be conducted in other HIV/AIDS 'key population hotspots' in Nigeria to determine the variation in quality-of-life scores across geographic areas. Also, the cross-sectional design of our study prevented us from establishing the precise causality between HRQoL and its associated factors. Consequently, further research aimed at exploring causal relationships between these variables is vital.

Conclusion

Our study revealed that the HRQoL of PLWH in Nigeria is relatively low. The findings highlight the importance of addressing the multifaceted determinants of HRQoL among PLWH in Nigeria. By understanding these determinants, healthcare professionals, policymakers and stakeholders can work together to improve the quality of life for PLWH, thereby enhancing their health outcomes and promoting a more inclusive and supportive environment for individuals living with HIV.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

The author T.S.O. was responsible for conceptualisation, data curation, investigations, visualisation, data analysis, writing and editing the original draft. H.M. was responsible for conceptualisation, visualisation, writing, editing and supervision. A.T.A. was responsible for visualisation, writing, editing and supervision. S.I. was responsible for further analysis, writing, editing and supervision.

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Data availability

Data supporting this study are included within the article and/or supporting materials.

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5.6 Summary of Chapter Five

The study aimed to explore and analyze the factors influencing the well-being of PLWH in Nigeria. Factors such as education level, HIV duration, marital status, and income level were found to significantly impact the health-related quality of life among PLWH. Overall, the research emphasized the importance of understanding the multidimensional factors influencing the quality of life among PLWH in Lagos, Nigeria and highlighted the need for tailored interventions to address the evolving needs of individuals aging with HIV, including managing chronic health conditions and providing mental health support.

Chapter 6 Physical activity levels among people living with HIV in Lagos, Nigeria: Evaluation of adherence to recommended guidelines

6.1 Introduction

Chapter six is presented as a published paper. The paper aims to assess the physical activity level of people living with HIV in Nigeria. The paper has been published by the Journal of the Nigeria Society of Physiotherapy.

6.2 Publication reference

Oladejo, T., Myezwa, H, Ajidahun, A., & Ibeneme, S., (2024). Physical activity levels among people living with HIV in Lagos, Nigeria: Evaluation of adherence to recommended guidelines. Journal of the Nigeria Society of Physiotherapy.

6.3 Details of author contribution

The Contributor Roles Taxonomy (CRediT) (Allen et al., 2019b) was used to outline the authors' contribution to the study. The full explanation of the terms is in Appendix 10.

Table 6.1: Details of author contribution

	Oladejo	Myezwa	Ajidahun	Ibeneme
Conceptualization	√	√	√	√
Method	√	√	√	√
Resources	√			
Manuscript writing draft	√			
Manuscript writing review and editing	√	√	√	√
Supervision		√	√	√

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6.5 Published article: Physical activity levels among people living with HIV in Lagos, Nigeria: Evaluation of adherence to recommended guidelines.

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Physical activity levels among people living with HIV in Lagos, Nigeria: Evaluation of adherence to recommended guidelines

Temitope Oladejo[1]*, Hellen Myezwa[1], Adedayo Ajidahun[1] and Sam Ibeneme[2]

[1]Department of Physiotherapy, Faculty of Health Sciences, University of the Witwatersrand, South Africa.
[2]Department of Medical Rehabilitation, Faculty of Health Sciences, University of Nigeria, Nigeria.

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In the era of highly active antiretroviral therapy (HAART), people living with HIV (PLWH) experience increased longevity but also face a rising burden of HIV-related comorbidities and disabilities, impacting their quality of life. The WHO 2020 Guidelines have recommended lifestyle adjustments, such as physical activity, as a strategy to minimize the risk of HIV-related disabilities. However, there is insufficient data on the physical activity levels of PLWH in Nigeria, which are crucial for monitoring preventive efforts. To assess the physical activity level of PLWH in Nigeria according to the WHO physical activity recommendations, a cross-sectional survey involving 385 PLWH in Lagos was conducted. Demographic and physical activity data were collected using the International Physical Activity Questionnaire (IPAQ) and analyzed according to the research hypotheses and related statistical methods. Results revealed that 45.5% of participants did not meet the WHO-recommended physical activity levels. Notably, individuals with higher educational levels were more likely to be physically active. The findings emphasize a concerning trend where a significant proportion of PLWH fall short of recommended physical activity, highlighting the need for targeted interventions. Implementing strategies to promote physical activity in this population becomes crucial for enhancing overall health and reducing the risk of HIV-related comorbidities.

Key words: HIV, physical activity, health, HAART, comorbidities, disabilities, quality of life.

INTRODUCTION

Although the global mortality rate from HIV has drastically declined since the advent of antiretroviral therapy (ART) in 1995-1996 (Palmisano and Vella, 2011), findings from current research show that despite the role of ART in viral suppression, people living with HIV (PLWH) generally demonstrate reduced physical function, greater loss of independence, and overall higher morbidity when compared with seronegative populations (Slogrove et al., 2019; Quigley and MacKay-Lyons, 2019; Falutz et al., 2021). HIV infection itself and the side effects of antiretroviral treatments (ARTs) are independently associated with increased risks for the immune system (Zicari et al., 2019), cardiovascular system (Pinto and da Silva, 2018), central nervous system (Sheybani et al., 2021), and musculoskeletal system (Walker-Bone et al., 2017). These compromised body systems make

*Corresponding author. E-mail: temi.oladejo@yahoo.com.

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individuals prone to fatigue, joint pain, hypertension, dyslipidemia, neuropathy, depression, opportunistic infections (e.g., pneumonia), and non-communicable diseases (e.g., kidney disease, cardiovascular disease, and diabetes) (Ibeneme et al., 2019). These symptoms contribute to poor health-related quality of life (HRQoL) among people living with HIV (Yaya et al., 2019). Thus, PLWH are now faced with the double burden of HIV and the emergence of comorbidities attributed to the use of ART (Todowede et al., 2019).

To enhance health, prevent the onset of HIV comorbidities, and limit functional decline, public health authorities such as the Centers for Disease Control and Prevention (CDC, 2022) and the World Health Organization (WHO, 2020) recommend that PLWH should engage in the same levels of physical activity (PA) as seronegative individuals to accrue health benefits (WHO, 2020). The health benefits of PA and exercise, both for the general population and for PLWH, have been documented (Ibeneme et al., 2019; Martin et al., 2019; Ceccarelli et al., 2020; O'Brien et al., 2021; Ajidahun 2020; Ibeneme et al., 2022), and findings show that PA is a safe and effective method for improving metabolic function, cardiorespiratory fitness, and the quality of life of people living with HIV. According to the World Health Organization, physical activity is defined as “any bodily movement produced by skeletal muscles that require energy expenditure” (WHO, 2020). This refers to all movement, including during leisure time, transportation, occupation, housework, etc. Although this definition is clear, it is commonly used interchangeably with the terms “exercise” and “physical fitness”. To distinguish between these terms, exercise is described as a form of physical activity that is pre-planned, organized, and involves repeated bodily motions to maintain or enhance one or more aspects of physical fitness, while physical fitness refers to the ability to engage in physical activity through the possession of specific physical characteristics (Caspersen, Powell, and Christenson, 1985; ACSM, 2018).

Engaging in physical activity, which can include small amounts of activity throughout the day (e.g., household chores and recreational activities) or scheduled blocks of time for more strenuous activities (e.g., exercise), is recommended (Bull et al., 2020). The “World Health Organization guidelines on physical activity and sedentary behaviour” suggest that people aged 18 to 64 should engage in 150 min of moderate weekly physical activity, evenly spread throughout the day; and 75 min of intense weekly physical activity, or an equivalent amount of both intense and moderate weekly physical activity. Each training session should also include at least 10 min of aerobic exercise. In the recommendations, it is also stressed that physical activity for this age group should include sports, occupational activity, home chores, and transport-related activities (WHO, 2020). Furthermore, routine jogging or running, walking, and cycling at the recommended intensity and duration have been linked to the prevention of dementia, cardiovascular disease, metabolic disease, type 2 diabetes, adverse side effects of ART, and disability caused by sarcopenia in people living with HIV (Ibeneme et al., 2019). Despite these benefits, there is limited information on the uptake of PA among PLWH in resource-poor countries (Mabweazara et al., 2019). A systematic review by O’Brien et al. (2016) reported positive cardiorespiratory, strength, and body composition outcomes. Other benefits of engaging in physical activity by people living with HIV include lower blood pressure, improved lipid profiles, improved functional capacity, reduced risk of cardiovascular disease, and overall cardiometabolic effects (Ibeneme et al., 2022).

Compared to Western societies, which have a preponderance of data on PA (Vancampfort et al., 2018), PA participation among PLWH in sub-Saharan Africa is limited by a myriad of contextually-sensitive barriers (Ley and Prista, 2015; Vancampfort et al., 2018) such as cultural habits, the unavailability of safe exercise-friendly environments, low socioeconomic status, and unsatisfactory intrapersonal factors (Roos et al., 2014; Adeloye et al., 2022). A possible reason for this poor uptake could be that PLWH in resource-poor countries are not aware of the potential health benefits of PA to their overall health, and PA promotion is not routinely practiced by healthcare professionals (Cunningham and O’Sullivan, 2021). According to Maduagwu et al. (2014), the limited data on PA among Nigeria's HIV/AIDS population is partly due to the lack of knowledge and advocacy of healthcare providers regarding the positive effects of exercise on PLWH. In Nigeria, the barriers to physical activity participation are mainly mediated by cultural, socioeconomic, and environmental variables (Adeloye et al., 2022). Thus, the constraints hindering physical exercise involvement include a lack of access to exercise facilities, discomfort in working out, financial implications, lack of time and self-motivation, poor wellbeing, family demands, lack of social support, and a physically active partner. Furthermore, numerous environmental issues that impact healthy behaviours have been brought on by the country's rapid urbanization and its vast amount of industrial activity. Many cities have elevated levels of traffic, dangerous topography, and poor road designs, making leisure walking and cycling unattractive to many (Foster et al., 2011). For example, some Nigerians believe that walking or cycling is a sign of low socioeconomic standing; hence, the desire to possess a vehicle to gain greater societal acceptance and respect (Adeloye et al., 2022).

Regarding the prevalence of PA, most of the available research in Nigeria has been conducted among the general population, with reports of PA levels ranging from 43 to 78% (Oyeyemi et al., 2018). According to a recent meta-analysis, between 1995 and 2020, the frequency of non-physically active Nigerians grew by 240% (Adeloye

et al., 2022). Thus, within 25 years, the number of people engaging in only low levels of PA increased from 14.4 million to 48.6 million. As PLWH may be less capable of completing PA-related tasks than the general Nigerian population, it is hypothesized that PLWH have lower PA levels than their healthy counterparts. However, there is a dearth of studies measuring PA levels, specifically among PLWH in Nigeria, and how the mentioned factor influences their health-related quality of life (Vancampfort et al., 2018). This apparent gap forms the basis of this study. Thus, the purpose of this study was to examine the level of PA among people living with HIV in Nigeria and the associations between PA levels and sociodemographic variables. Understanding the extent to which this population engages in physical activity is crucial for developing future therapeutic interventions to manage disability among people living with HIV.

MATERIALS AND METHODS

Study design

A cross-sectional descriptive study design was used in this study. The study participants were recruited using a convenience sampling approach.

Participants

This study population included PLWH in Lagos, Nigeria, who attended the HIV clinics/treatment centres from September 2021 to October 2022. This was a multi-centre study with participants recruited from seven HIV/AIDS testing and treatment centres in Lagos, the largest city in Nigeria. With a population of over 15 million (Idris and Fagbenro, 2019), Lagos has 20 local governments with 31 HIV/AIDS testing and treatment centres across the state. Based on the cluster sampling method, the seven centres selected were: Mainland Hospital, Yaba; Lagos State University Teaching Hospital (LASUTH), Ikeja; General Hospital, Ikorodu, Lagos; General Hospital, Marina, Lagos; Randle General Hospital, Surulere, Lagos; General Hospital, Isolo, Lagos; and Hope for HIV/AIDS International, Mushin, Lagos. Lagos State is one of the key population hotspots with evidence of a high HIV burden and needs not met by the HIV/AIDS treatment services (Lo et al., 2021). Thus, Lagos was selected based on the relevant resource data available to the researcher and the national key population size estimate.

Inclusion criteria

To be included in the study, participants were required to meet the following criteria: Participants should be: (i) PLWH aged ≥ 18 years (ii). PLWH who have been on ART for at least six months, and (iii) PLWH attending an HIV/AIDS outpatient clinic.

Exclusion criteria

The following participants were excluded from this study: (i) PLWH who did not consent to the study, (ii) PLWH who was younger than age 18, (iii) in-patients living with HIV/AIDS, and (iv) PLWH attending the HIV/AIDS testing and treatment centre for the first time.

Sample size

The sample size was calculated according to the 51.9% prevalence rate for disability in PLWH in South Africa (Myezwa et al., 2018). Using a power of 95 %, a level of significance of 5 %, and the 51.9% prevalence rate for disability, a minimum sample size of 384 participants was calculated using the formula $n=Z^2P\ (1-P)/d^2$ (Taherdoost, 2017).

Data collection tool

The following tools were used to obtain information regarding the specific objectives:

Sociodemographic questionnaire: The sociodemographic questionnaire used in this study provided information on the age, gender, marital status, educational qualifications, and income range of the participants.

The International PA Questionnaire (IPAQ-SF): It is a self-reported measurement tool for PA suitable for assessing PA and inactivity in a population (Stelmach, 2018). The IPAQ-SF measures the PA levels of people aged 15 to 69 years and was adapted from the long form IPAQ, which assesses activity levels across five domains (job-related, transportation, housework, recreation, and time spent sitting), contains four generic items, and can be self-administered or administered via telephone (Craig et al., 2017). The questionnaire requires information on the time spent on physical activities over the past seven days and has acceptable measurement properties for developed and developing nations. It has been previously used in the Nigerian population, where the overall PA (ICC = 0.79, 95% CI 0.65 to 0.82) showed moderate test-retest reliability (ICC > 75, intraclass correlation coefficient) (Oyeyemi et al., 2014). The IPAQ-SF measures three specific types of activity: walking; moderate physically intense activity; and vigorous physically intense activity (Craig et al., 2017).

The IPAQ scoring protocol was used to report the collected data in terms of categorical and continuous measures (Cleland et al., 2018). For continuous data, one measure of the volume of activity was computed by weighting each type of activity in terms of its energy requirements, as defined in METs. Thus, walking = 3.3 METs; moderate PA = 4.0 METs; and vigorous PA = 8.0 METs.

Using these values, four continuous scores were defined:

1) Walking MET-min/week = 3.3 * walking minutes * walking days.
2) **Moderate MET-min/week** = 4.0 * moderately intense activity minutes * Moderate intensity, days.
3) Vigorous MET-min/week = 8.0 * vigorously intense activity minutes * Vigorous intensity, days.
4) Total PA MET-min/week = sum of walking + moderate + vigorous MET- minutes/week scores.

For the categorical data, individuals who do not meet the criteria for Categories 1 or 2 are considered to have a 'low' PA level (Category 0).

Moderate (category 1): The pattern of activity classified as 'moderate' should comply with either of the following criteria: a) three or more days of vigorously intense PA for at least 20 minutes per day OR b) five or more days of moderately intense PA and/or walking for at least 30 minutes per day OR c) five or more days of any combination of walking involving moderately intense or vigorously intense activities and achieving a minimum total PA level of at least 600 MET-minutes/week.

Vigorous (category 2): The pattern of activity classified as'vigorous' should comply with either of the following criteria:

Table 1. Sociodemographic characteristics of the participants (N=385).

Sociodemographic characteristics	N (%)
Gender	
Men	104 (27.0)
Women	281 (73.0)
Marital status	
Married	219 (56.9)
Single	101 (26.2)
Widowed/Divorced/Separated	65 (16.9)
Education	
No formal education	24 (6.3)
Primary school	51 (13.3)
Secondary school	194 (50.4)
Post-secondary	115 (29.9)
Income (in Niara):	
Less than 8,000	113 (29.4)
Between 18,001 - 30,000	115 (29.9)
Between 30,001 - 70,000	108 (28.1)
Above 70,000	49 (12.7)

a) Vigorously intense activity for at least three days, achieving a minimum total PA level of at least 1500 MET- minutes/week, OR seven or more days of any combination of walking, of moderate intensity, or vigorous intensity, achieving a minimum total PA level of at least 3000 MET-minutes/week.

Procedure

The principal investigator and two researchers collected participant data according to the study protocol requirements. The research assistants collected the sociodemographic data using a researcher-developed questionnaire, while the PA level data were collected through a self-administered questionnaire.

Data analysis

The data were captured from the completed questionnaires in Microsoft Excel and imported into IBM SPSS 23® for analysis. Descriptive statistics were applied for all demographic variables. Quantitative data and categorical variables were described as mean ± standard deviation (M ± SD) and expressed as frequencies or percentages, respectively. The PA score of IPAQ-SF was the main outcome measure. The overall sitting time, described as the level of sedentary time, was also analyzed. Pearson's Chi-square was used to determine the association between PA level and sociodemographic variables. Univariate binary logistic regression was used to determine predictors of PA. The level of significance was set at a p-value of less than 0.05.

Ethical considerations

Approval was obtained from the Human Research Ethics Committee of the University of the Witwatersrand (M200906) and Lagos State University Teaching Hospital Health Research Ethics Committee (LREC/06/10/1547). The clinical director of the participating testing and treatment centre's granted permission. Participants were informed about the voluntary nature of their participation and their right to withdraw from the research at any point without being obliged to explain their reasons. All participants read, understood, and signed a written informed consent form.

RESULTS

Sociodemographic characteristics

The sociodemographic characteristics of the participants are presented in Table 1. The mean age of the participants was 42.2 ± 10.43 years with a range of 22 to 70 years. The data showed that the majority of participants were female (73%), married (56%), and had a secondary school education (50.4%). Additionally, a significant portion (29.9%) earned below the minimum wage or between N18,001 - N30,000 per month.

PA level

Based on the WHO recommendations, the survey results revealed that 176 (45.7 %) of the 385 participants had a low level of PA (Figure 1).

Analysis of PA level according to sociodemographic categories

Based on the IPAQ scoring guidelines, participants who

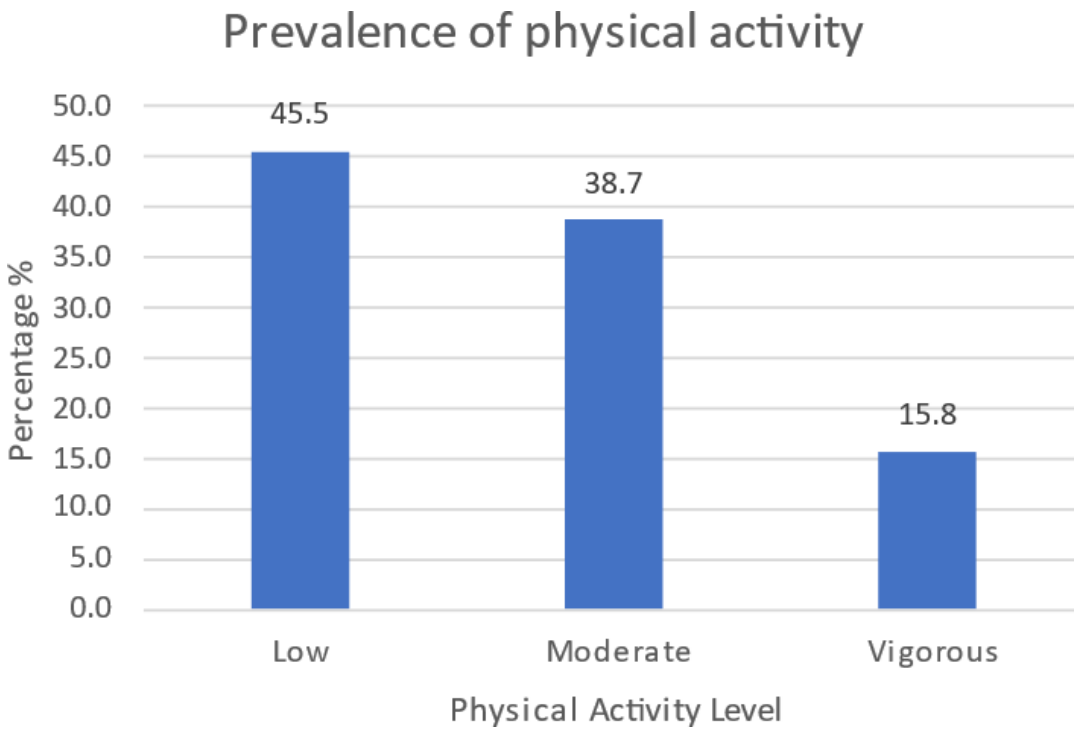

Figure 1. PA categories among PLWH.

did not achieve a minimum of 600 MET-min/week were categorized as physically inactive/limited, while participants who achieved above 3,000 MET-minutes/week were categorized as physically vigorous/superior. Participants were classified as moderately active if they achieved between 600 – 3,000 MET-minutes/week. Table 2 describes the sociodemographic distribution of the participants across the PA levels. Pearson's chi-square test was used to determine the association between sociodemographic variables and PA level (Table 2). Male participants showed higher PA levels than female participants (57.7% vs. 53.4%). Based on marital status, 48.9% of married individuals did not meet the PA recommendations, and statistical analysis revealed a significant association ($p<0.05$) between PA and marital status ($\chi 2 = 9.612$; $p = 0.048$). Participants with no formal education had the lowest PA levels (60%), while 38% of the participants had moderate PA levels, regardless of their income level. Furthermore, according to the findings of an unadjusted analysis, level of education and marital status were associated with increased odds of PA, while gender and income were associated with decreased odds of PA.

Energy expenditure in PA and sedentary time

Based on WHO recommendations, the energy expended in engaging in PA was calculated and categorized into Vigorous = ≥ 3,000 MET/mins/wk; Moderate = 600 – 3,000 MET/mins/wk; and Low = < 600 MET/mins/wk. Results showed that the total PA fell within the moderate PA level (600-3,000 MET-min/week) with a mean value of 1,620 ± 2,396 MET-min/week. The participants reported the average time (in minutes) that they spent sitting per day, and the overall mean was 238 ± 136 min/day (median = 3h/day; IQR = 2 – 5h/day) (Table 3).

Predictors of PA level

Univariate binary logistic regression showed that the results suggested that none of the predictor variables (Marital status, Gender, Education, Income, and Age) had a statistically significant effect on PA levels among the participants. It can be deduced that the marginally significant p-value for Age and the wide confidence intervals (CI) for all variables could indicate the potential need for further investigation with a larger sample size. The coefficient for Education was positive (0.105), indicating a potentially positive effect on the outcome variable. However, the p-value (0.214) was not statistically significant, suggesting that the effect of Education on PA may be weak or negligible. The wide confidence interval (0.902 to 1.368) added further uncertainty to the association. Regarding the model fit, the AIC (Akaike Information Criterion) was used for the null and final models. The lower AIC value (731.79) for

Table 2. Prevalence and unadjusted analysis of factors associated with PA level (N=385).

Sociodemographic characteristics	Low PA N (%)	Moderate PA N (%)	Vigorous PA N (%)	OR (95%CI)	χ^2	p-value
Gender						
Men	44 (42.3)	40 (38.5)	20 (19.2)	0.84 (0.53 to 1.32)	1.344	0.511
Women	131 (46.6)	109 (38.8)	41 (14.6)			
Marital status						0.048*
Married	107 (48.9)	72 (32.9)	40 (18.3)	1.38 (0.92 to 2.07)	9.612	
Single	40 (39.6)	45 (44.6)	16 (15.8)			
Widowed/Divorced/Separated	28 (43.1)	32 (49.2)	5 (7.7)			
Education						
No formal education	15 (60.0)	9 (36.0)	1 (4.0)			
Primary school	20 (39.2)	20 (39.2)	11 (21.6)	1.88 (0.82 to 4.29)	10.751	0.096
Secondary school	97 (50.0)	72 (37.1)	25 (12.9)			
Post-secondary	43 (37.4)	48 (41.7)	24 (20.9)			
Income (in Niara)						
Less than 30,000	100 (43.9)	88 (38.6)	40 (17.5)	0.85 (0.57 to 1.29)	1.382	0.847
Betw. 30,001- 70,000	52 (48.1)	42 (38.9)	14 (13.0)			
Above 70,000	23 (46.9)	19 (38.8)	7 (14.3)			

Table 3. PA levels of the participants in MET/min/wk.

PA	Mean ± SD	Median (IQR)
Total MET/ min/wk	1.620 ± 2.396	693 (297-1.680)
Vigorous MET/ min/wk	6.422 ± 2.549	5.970 (4.158-8.106)
Moderate MET/ min/wk	1.268 ± 594	1.044 (792-1.663)
Low MET/ min/wk	246 ±194	248 (0-396)
Walking MET/ min/wk	637 ± 844	396 (149-693)
Sitting min/day	238 ± 136	180 (120-300)

the final model indicated a better fit than the null model. Because the difference in AIC values (0.018) was relatively small, it indicated a modest improvement in model fit (Table 4).

DISCUSSION

This study aimed to determine the prevalence of physical activity among people living with HIV in Nigeria and the associations between PA levels and sociodemographic variables. The results of this study indicated that approximately 45.5% of people living with HIV in Nigeria do not meet the recommended level for PA. This is higher than the 22% reported among the general population in a national survey (Oyeyemi et al., 2018), the 20.8% in southwest Nigeria (Iwuala et al., 2015), and the 36.2% in Northeastern Nigeria (Akinrolie et al., 2022). Although these studies were conducted on the general population, they used the same research instrument as used in our study. The results of studies conducted between 1995 and 2020, which covered 13, 814 Nigerian adults aged 20 to 79 years, confirmed a clear reduction in PA levels, as the reported prevalence of low PA was only 52.0% (Adeloye et al., 2022). Since a lack of PA has been linked to the emergence of non-communicable diseases, this reduced level of physical inactivity in the general population raises public health concerns (Katzmarzyk et al., 2022). Likewise, regular PA has been shown to lessen the effects of HIV on both physical and mental health, subsequently reducing the potential risk of disability and morbidity among PLWH. Thus, to reduce the risk of HIV-related disabilities, the WHO (2020) guidelines advocate for modifying one's lifestyle to increase PA. The second aim of this study was to investigate the relationship between PA level and sociodemographic variables. Consistent with PA research conducted nationally and globally, the male participants

Table 4. Predictors of PA level.

Variable	B	S.E.	p-value	OR (95% CI)
Marital status (Married/Single/Widowed/Divorced)	0.151	0.121	0.214	1.163 (0.917 - 1.475)
Gender (Male/Female)	-0.315	0.252	0.212	0.730 (0.445 - 1.197
Education: No formal education /primary/secondary/post-secondary	0.105	0.121	0.214	1.111 (0.902 - 1.368)
Income <18k /18-30k /31-70k / >70k	-0.097	0.117	0.408	0.908 (0.722 - 1.141)
Age (22-41/42-70 years)	-0.019	0.010	0.061	0.981 (0.961 - 1.001)
Null model AIC				733.19
Final model AIC				731.79 (0.018)

in the present study were found to be more physically active than females (Iwuala et al., 2015; Guthold et al., 2018; Adeloye et al., 2022; Akinrolie et al., 2022). Gender differences in PA are a recurrent theme in PA studies from adolescence to adulthood, possibly due to pre- existing gender stereotypes, external influences, differences in motivation, and variations in PA context preferences (Edwardson et al., 2013; Schlund et al., 2021). Similarly, the association between educational level and PA level was explored by Shaw and Spokane (2008), who reported that lack of employment and job loss were linked to decrease PA in those with low levels of education. However, the opposite was true for those with high levels of education in this present study. Vancampfort et al. (2017) also observed this in a systematic review of PA correlates among people living with HIV. Although health behaviour theories posit that an individual's knowledge and understanding of health risks and rewards are beneficial for motivating behaviour (Fisher et al., 2014), participation in PA is influenced by a wide range of factors, which should be considered when planning rehabilitation programs.

PA level is also impacted by the socioeconomic factors of PLWH, which cannot be ignored, especially when one considers the estimated financial cost per person living with HIV, which is estimated to be 36,065 Naira in direct private healthcare expenses and indirect income loss (Mahal et al., 2008). Even though the minimum wage in Nigeria increased in April 2019 from 18,000 to 30,000 Naira (Alege et al., 2020), more than half (59.3%) of the sample population reported that their income was less than 30,000 Naira ($65.07) per month. Although not statistically significant, participants in our study who earned less than ₦18,000 per month (40 U.S. Dollars) reported less vigorous PA than those from other income levels. This is contrary to the global trend shown in a study by Chastin et al. (2020), which revealed an association between higher income and a lower likelihood of meeting PA recommendations. It is frequently challenging to explain this link, as several other studies have reported that high PA is related to high income (Kari et al., 2015; Zapata-Lamana et al., 2021). Income level was a vital confounder in this study, as the HIV epidemic has been reported to disproportionately affect people with low socioeconomic status (Ogunmola et al., 2014), who have been reported to be less likely to engage in PA (Mangona et al., 2020). Given the link between physical inactivity and poor health, it is conceivable that disparities in income have a significant impact on the PA level of people living with HIV and on their overall health-related quality of life.

Furthermore, sedentary behaviour and its correlation with comorbidity, neurological impairment, walking dysfunction, symptoms, and poor quality of life in people living with HIV have received little attention (Vancampfort et al., 2017). The current study also examined sedentary behaviour using scores from the sitting-time item on the IPAQ-SF among people living with HIV. Participants in our study spent approximately four hours a day sitting. These results are less than those obtained in other studies using the same questionnaire. For example, Vancampfort et al. (2017) highlighted that PLWH spent 533 min/day (95% CI = 466 to 599) sitting, while Zou et al. (2022) observed that PLWH in China spent 370.62 (SD =176.27) min/day sitting. Another study assessing sedentary time among older adults in Nigeria showed that participants spent on average 284.8 ± 125.4 min/day in a sedentary position (Oyeyemi et al., 2018), which is in line with the findings from the present study. Although these results show that participants spend considerable time sitting, it does not necessarily indicate a lack of exercise (Matusiak-Wieczorek et al., 2020). With advancements in technological innovations and environmental changes, sitting has become the default position in the workplace, transportation, and domestic settings. Thus, sedentary behaviour is increasing globally (Bull et al., 2020). It is crucial to remember that the WHO (2020) recommendations on PA and sedentary behaviour for PLWH call for moderate and intense PA bouts in addition to the movement one already engages in daily.

A report published in The Lancet Public Health (2019) highlights the need for public health professionals and policymakers to adapt interventions and opportunities to tackle the PA gender gap if the worldwide PA goal of a 10% relative decrease in insufficient PA by 2025 is to be achieved (The Lancet Public Health, 2019). This call to action is equally important to the HIV community, as there is evidence that regular PA can lessen the effects of HIV on physical and mental health (Martin et al., 2019). If Nigeria aims to achieve its strategic objective of

improving the quality of life of PLWH, as set out in the 'National HIV and AIDS Strategic Framework 2021-2025' (NACA, 2021), the importance of PA to overall health must be highlighted in policy documents, barriers to PA participation must be overcome, and the health benefits of PA disseminated to all stakeholders. In our study, education was associated with an increased odd of meeting the recommended PA level (OR=1.88; CI 0.82 – 4.29). Encouraging PA among PLWH is essential as an intervention strategy to prevent the added burden of HIV-related disability. Thus, healthcare professionals should be encouraged to promote the health benefits of PA among PLWH and disseminate this information in various contextually sensitive forms to facilitate an increase in the likelihood of meeting the recommended PA levels (Mabweazara et al., 2019). Effective public health status monitoring and intervention depend on understanding the prevalence of PA among PLWH and pinpointing the factors that influence engagement in PA.

Implications for future research

Comparative studies between the general population and people living with HIV (PLWH) can be explored to delve deeper into the disparities in physical activity (PA) levels with the aim of designing tailored interventions for PLWH with low income. Understanding the unique challenges faced by this subgroup and developing targeted strategies to enhance PA participation may contribute to reducing health disparities. Furthermore, future studies may evaluate the effectiveness of policy-driven initiatives aimed at promoting PA among PLWH and could involve collaborations to address sociodemographic factors, economic constraints, and educational needs influencing PA among PLWH.

Conclusion

Most people living with HIV and receiving ART in Lagos are not meeting the recommended levels of physical activity. There was a significant association between educational level and physical activity level. While physical activity promotion among people living with HIV holds great promise for improving the overall health status of PLWH, interventions to improve physical activity levels among PLWH need a multi-stakeholder framework to achieve optimum results. Thus, further studies should investigate the influencing factors of physical activity among PLWH and target interventions to address these factors.

STRENGTHS, LIMITATIONS AND RECOMMENDATIONS

To the best of our knowledge and according to evaluations of the literature, this study appears to be the first attempt to investigate the prevalence of physical activity (PA) among people living with HIV (PLWH) in Nigeria. The current study had several limitations. First, participants were conveniently sampled from HIV testing and treatment centre's in Lagos. Therefore, we were not able to generalize the findings to those not attending the clinics or to those in other states in the country. Another limitation was that the International Physical Activity Questionnaire (IPAQ), which was used for data collection, is vulnerable to recall bias, as participants were requested to fill in the questionnaires reporting their activities over seven days. Furthermore, HIV clinical variables were not captured in this study as participants did not have accurate CD_4 count and viral load information. Thus, the relationship between PA levels and HIV clinical variables was not explored. A third limitation is that enabling and limiting factors of PA participation were not identified, and the impact of HIV on PA was beyond this study's scope. Rehabilitation professionals aiming to increase PA participation among PLWH should highlight the health benefits of PA and examine the contextual barriers to and facilitators of PA participation. The findings of the present study provide information for policymakers to develop effective strategies to promote PA among PLWH, particularly in low-resource settings where the prevalence of HIV is high.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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6.6 Summary of Chapter Six

This chapter aimed to assess adherence to recommended physical activity guidelines among PLWH and identify sociodemographic factors associated with physical activity levels. The study utilized a cross-sectional descriptive design and recruited participants from HIV clinics in Lagos, Nigeria. Almost half of people living with HIV in Nigeria do not meet the recommended level for physical activity. Individuals with higher educational levels were more likely to be physically active. The study underscores the importance of promoting physical activity among individuals living with HIV to enhance overall health and reduce the risk of HIV-related comorbidities. The findings highlight the need for targeted interventions to improve physical activity levels in this population and emphasize the role of lifestyle adjustments in managing HIV-related disabilities and improving quality of life.

Chapter 7 Factors influencing physical activity engagement among people living with HIV in Nigeria

7.1 Introduction

Chapter seven is presented as a manuscript structured according to the journal guideline. The paper aims to explore the barriers to and facilitators of physical activity participation among people living with HIV in Nigeria. The paper was submitted to the Discover Social Science and Health (DSSH) and is under review. In conducting this qualitative study, we aimed to understand better the factors that influence physical activity participation among PLWH in Nigeria. The findings of the study would help develop tailored intervention strategies to improve the quality of life of PLWH in Nigeria.

The manuscript's title is “Factors influencing physical activity engagement among people living with HIV in Nigeria”.

Journal: Discover Social Science and Health

Authors: Oladejo, T., Myezwa, H, Ajidahun, A., & Ibeneme, S.,

7.2 Details of author contribution

The Contributor Roles Taxonomy (CRediT) (Allen et al., 2019b) was used to outline the authors' contribution to the study. The full explanation of the terms is in Appendix 10.

Table 7.1: Details of author contribution

	Oladejo	Myezwa	Ajidahun	Ibeneme
Conceptualization	√	√	√	√
Method	√	√	√	√
Resources	√			
Manuscript writing draft	√			
Manuscript writing review and editing	√	√	√	√
Supervision		√	√	√

7.3 Abstract

Introduction: Physical activity has been reported to be a useful non-pharmacological intervention for improving quality of life and reducing long-term problems associated with HIV infection and ART. Despite their known benefits, the data on the factors driving the uptake of physical activity among the HIV population in Nigeria are insufficient. Thus, since variations exist in healthcare, cultural and societal structures, caution must be used in drawing comparisons from other settings. To develop a contextually sensitive intervention programme, understanding the factors responsible for physical activity engagement among people living with HIV is vital.

Objective: The study aimed to explore the barriers to and facilitators of physical activity participation among people living with HIV.

Method: A qualitative research methodology was adopted to explore the barriers of and facilitators to physical activity participation among people living with HIV. A semi-structured interview guide was used to interview people living with HIV (PLWH) attending HIV testing and treatment centers in [location masked for blind review] from March to July 2022; a saturation point was reached after the 20th interview. All interviews were audio-recorded and were subjected to a deductive content analysis framework for data analysis.

Results: Twenty (20) PLWH aged 19 to 54 years participated in this study. The majority perceived physical activity as beneficial to their health. Commonly reported barriers to physical activity in PLWH were lack of time, fatigue, an unsupportive environment, lack of funding, and other social commitments. The physical activity facilitators included perceived benefits, habits, influence by others, and the health benefits of illness prevention and pain relief.

Conclusion: Our findings reveal that the key barriers to physical activity participation (lack of time, unsupportive environment, fatigue, and lack of funding) are modifiable. Addressing these factors is likely to facilitate physical activity participation. Thus, efforts to develop a physical activity intervention program for PLWH in Nigeria must consider environmental and interpersonal variables.

Keywords: HIV, physical activity participation, barriers, facilitators.

7.4 Background

Despite evidence of the vital role that physical activity plays in improving physical, cognitive, and psychological health, the global prevalence rates for physical activity among people living with HIV are low (Bull et al., 2020; Guthold et al., 2020). Although people living with HIV are now living longer lives as a result of the effectiveness of antiretroviral therapy (ART), there is currently a public health concern about the prevalence of ageing-related health concerns (e.g., osteoarthritis, dementia, cardiovascular diseases, and frailty); ART side effects (e.g., fatigue, metabolic disorders, lipodystrophy and diabetes); and non-ART poly-pharmacology leading to the double burden of managing HIV and comorbid health conditions (Justice et al., 2018). Thus, physical activity has been recommended as a non-pharmacological approach to aid in preventing and managing HIV-related disabilities (Ibeneme et al., 2019; Montoya et al., 2019; Ajidahun et al., 2020).

Engaging in physical activity is beneficial to PLWH as physical activity has been shown to impart positive health benefits such as improved endurance, strength, and vitality, reduced blood pressure and depressive symptoms, and an overall improvement in quality of life and function (Voigt et al., 2018; Ibeneme et al., 2019). The physiological health benefits of physical activity are evident in conditions such as obesity, in which regular PA causes a reduction in fat mass (Ilacqua et al., 2019); in sarcopenia, where regular PA improves muscle mass and function (Ibeneme et al., 2022); and in osteoporosis, where regular PA improves bone health, thus reducing frailty, the risk of falls and predisposition to fracture (Benedetti et al., 2018). Furthermore, studies conducted on mental health, cognition and memory have reported that there is an increase in blood flow to the brain and promotion of neurogenesis when individuals engage in exercise (Di Liegro et al., 2019), thus supporting the theory that physical exercise is beneficial to both body and mind.

However, despite the many long-term health benefits of physical activity, about one-third of PLWH do not meet the recommended physical activity standards (Montoya et al., 2019). Several factors have been highlighted as determinants of physical activity participation among the general population (Yen and Li, 2019). These determinants have been classified into modifiable (behavioural and personality traits, environmental situations, and community settings) and those presumed to be unmodifiable (age, gender, race, and ethnicity). Among people living with HIV (PLWH), social determinants of health, such as the opportunity to

engage in exercise, the socioeconomic status of individuals, and stigma susceptibility, have been identified as influential in understanding physical activity participation (Safa et al., 2022).

In a systematic review by Vancampfort, Stubbs and Mugisha (2018), physical activity participation in sub-Saharan Africa is influenced by several complex factors. Within the Nigerian context, the lack of a physical activity surveillance system poses a challenge to effective planning and intervention (Oyeyemi et al., 2018). While the reported physical activity prevalence among the general population was estimated at 58% (Adeloye et al., 2022), Oladejo et al. (2024) reported that 45.5% of PLWH did not meet the WHO recommended level of physical activity participation. It is unclear how much physical activity PLWH engage in. Studies on physical activity levels among PLWH in Nigeria are limited, and existing studies are mainly focused on prevalence studies among the general population and the beneficial effects of physical activity on quality of life (Oyeyemi et al., 2016; Ugwueze et al., 2021; Aduroja et al., 2022).

Despite these established benefits, individual and societal physical activity patterns can be influenced by various modifiable and non-modifiable factors (Oluyinka and Endozo, 2019). In general, researchers found that perceived determinants of physical activity participation can be categorised mainly as those that are invariable (age, gender, race, ethnicity) and those that are amenable to change (behavioural and personality characteristics, environmental circumstances, and community settings) (Gretebeck et al., 2007; Kókai et al., 2022). Roos et al. (2014) explored the limitations of physical activity among people living with HIV. They found barriers in three categories, namely physical (e.g., respiratory complaints, low- energy levels), psychological (e.g., stress levels, poor motivation) and environmental (family responsibility, adverse weather conditions). Fewer factors were shown to be PA facilitators, and they include external support (such as walking with family or friends) and community involvement (access to parks or sports fields).

It is vital to study interpersonal and environmental factors that influence physical activity behaviours to gain insight into what actions must be taken to improve physical activity participation behaviours in a given population, as physical activity has a strong potential to improve health outcomes. This study is a component of a more extensive study aimed at developing a context-sensitive physical activity program for people living with HIV. Thus, the

goal of this study is to explore the factors which can act as facilitators and barriers to engaging in physical activity in PLWH in Nigeria.

Theoretical framework

Identifying the factors responsible for engaging in physical activity is crucial in physical activity research. Several theoretical and behavioural methods have been adopted to understand and conceptualise the factors influencing the commencement, practice, and maintenance of physical activity (World Health Organisation, 2005). One of these is the Health Belief Model (HBM), which is grounded in the theory of "expectancy-value", taking into consideration that individuals are rational decision-makers and would weigh the advantages and disadvantages of acting against one another (Tarkang and Zotor, 2015). The Health Belief Model, developed by a group of social psychologists (Irwin M. Rosenstock, Godfrey M. Hochbaum, S. Stephen Kegeles and Howard Leventhal) in the 1950s, was used to guide the process of this study. This framework is used to understand human behaviour and comprises the following elements: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. The effectiveness of the Health Belief Model in identifying critical decision-making points that impact health behaviour depends on each of these essential components (Tarkang and Zotor, 2015).

The Health Belief Model has been applied in studies that explore HIV/AIDS prevention and is the most commonly adopted theory in health education, illness prevention, and health promotion (Tarkang and Zotor, 2015). Existing evidence reveals that the HBM is effective in explaining cues for action in various population settings (Chatzisarantis et al., 2007; Gorin et al., 2012). On the other hand, individual decisions are influenced by health belief constructs, which lead to various outcomes of physical activity interaction (Fig. 1).

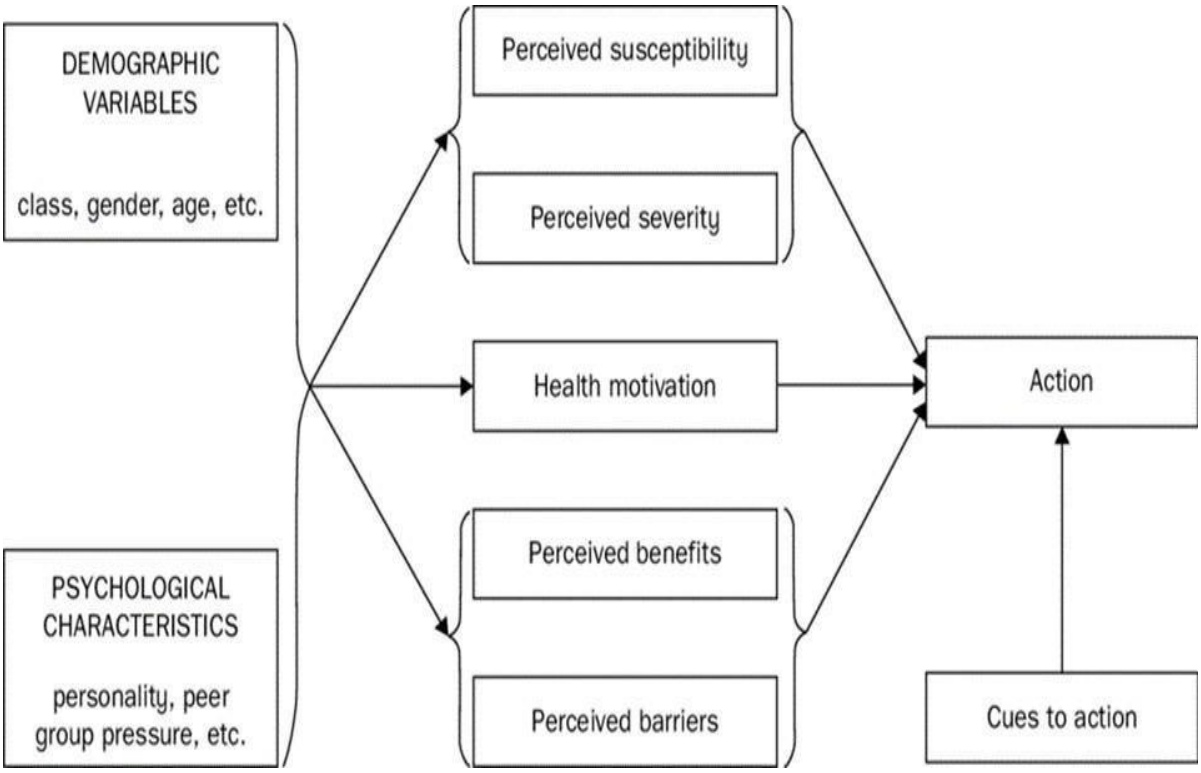

Figure 7.1: The Health Belief Model (Yen and LI, 2019)

7.5 Method

Research design: A qualitative research method was adopted to achieve the objectives of this study, which were to determine the barriers to and facilitators of physical activity participation among PLWH in Nigeria. The qualitative research method is now commonly used in HIV/AIDS research as it is essential to providing insights into the socio-behavioural elements of HIV (Doyal, 2014; Syed et al., 2014). In the methodology, the HBM (Yen and Li, 2019) was considered in understanding the barriers to and facilitators of physical activity among PLWH.

Research setting: The study was conducted at Randle General Hospital, Surulere, Lagos, Nigeria. It is one of the 24 hospitals under the management of the Lagos State Health Service Commission. It provides medical, surgical, maternal and child health services, as nursing, dental, pharmaceutical, diagnostic, and rehabilitative health care. It also has an HIV/AIDS treatment and testing centre with a yearly patient enrolment of over 1,000 and serves as a referral site for people in the community needing HIV testing, counselling, and care. All

interviews in this research setting were conducted face-to-face in a private counselling room set aside for the study.

Study participants: They were selected from the outpatient HIV clinic between March and July 2022 by applying a purposive sampling method. Only adults living with HIV, 18 years of age and above, who had been on antiretroviral therapy for at least six months and who were attending the Randle General Hospital HIV clinic, were approached personally by the principal investigator and invited to participate in the study. The matron in charge and the clerical officer also helped briefly inform the participants about the study's objective while the PLWH were attending their appointments. As the official language in Nigeria is English, study information sheets in English were provided, and participants were given verbal information on the research. Both written and verbal consent were obtained before data collection. A total of 22 individuals consented to participate in the study. However, a saturation point was reached at the 20th interview, and no new information was obtained from any subsequent interviews.

Study procedure: Before the interviews, the principal investigator (Physiotherapist/PhD candidate) and a research assistant (Physiotherapist/MSc candidate) visited the study setting to review the population to be interviewed, the days on which the clinics were open, the preferred times for participants to be approached, and to determine whether the environment was conducive to the interviews. The research assistant was briefed about the study objectives and procedure, and the pilot interview sessions with the principal investigator were observed before conducting any interviews.

The interviews were conducted by the principal investigator in English as most of the participants were comfortable with this language and in the Yoruba Language for participants who preferred to communicate in their mother tongue. The interviewer was bilingual and was able to communicate fluently in both languages. The interviews were conducted using a Philips DVT digital dictaphone, and the recordings were saved in MP3 format. In addition to the audio recordings, the interviewer wrote additional notes, with reflective comments being added at appropriate times during the interviews. The interviews conducted in Yoruba were translated and transcribed into English language. The duration of each interview was between 30 and 45 minutes. The interviewer established rapport with the participants and informed them that

confidentiality was assured. The participants were encouraged to feel relaxed and were informed that the interview could be paused and discontinued at their will.

Data collection: A semi-structured interview guide was used (Appendix 11). Following an extensive literature review, a list of potential questions to assess the perspectives of PLWH on barriers to and facilitators of physical activity participation was presented to each of the participants. Per the pertinent guidelines for reporting qualitative research (Consolidated Criteria for Reporting Qualitative Studies checklist, COREQ), data management, coding, and collection were conducted according to an iterative process.

Part A of the interview guide collected sociodemographic information such as age, sex, marital status, occupation, income range, and educational level. Part B focused on the duration of the participants' HIV condition, adherence to antiretroviral therapy (ART), and current health status. Part C explored participants' knowledge, participation, benefits, barriers to, and facilitators of physical activity. Sample questions included: "How long have you been living with HIV?" and "In what ways does HIV affect your health?" for Part B, and "Can you describe your day-to-day activities?" and "What discourages you from engaging in exercise? (Probe: “What stops you?”)." for Part C. Open-ended questions were designed to give interviewees the best opportunity to express themselves. The supervisors reviewed the drafted interview guide and modified it after several rounds of discussion.

In addition to determining whether a specific set of questions was helpful in retrieving objective information, the interview guide was pre-tested by conducting pilot interviews with PLWH. Finally, the interview guide was updated to include specific probes identified during the pilot interviews. However, the results of the pilot interviews were not included in the data presented.

The 17th interview yielded no additional codes or themes; however, data collection persisted to enrich the dataset. Subsequently, interviews were halted after the 20th session due to resource constraints, and a lack of conducive interview room, compounded by ongoing renovation construction in the hospital's HIV department during the research period.

Data analysis: All the data were anonymised using pseudonyms, which linked the participants’ interview transcripts to their biodata and field notes during the data collection and analysis

phases of the research. Following the completion of the interview, the audio recordings were uploaded to a password-protected file on the computer and deleted from the digital audio recording device.

Three of the interviews were conducted in the Yoruba language. These were first translated into English by an independent translator; the first and second authors then screened the translation. All audio recordings were transcribed into text by an independent transcriber who ensured consistent formatting of the transcriptions, secure storage, and the transfer of the transcribed files. All transcribed data were exported to a computer-assisted qualitative data analysis software program (MAXQDA version 22.3.0), and themes were identified from the data. A thematic content analysis approach was used to analyse the data and explore the participants' experiences. In addition to the predetermined categories deduced from the literature and theoretical framework, further categories were coded and systematically assigned to themes based on their similarities. Furthermore, after the data were organized into categories and subcategories, the analysis focused on interpreting the significance of these findings within the context of the research.

Ethical considerations: Permission to conduct the study at the HIV/AIDS testing and treatment clinic in Randle General Hospital, Surulere was received from the Lagos State Hospital Service Commission (LSHSC/2222/VOLIV/14; 23 June 2021). The Human Research Ethics Committee of the University of the Witwatersrand approved the study (Clearance Certificate M200906; 15 April 2021)

The four trustworthiness criteria - transferability for applicability, credibility for integrity, dependability for consistency, and confirmability for transparency to outside examination and verification - were applied as described below.

Transferability: Purposive sampling of the participants ensured transferability. A description of the population sample and participant characteristics was provided using a mixed sample that listed the age, sex, and background of the participants to examine the transfer criterion. The suitability of the interviews was examined, and the accuracy of the interpretations drawn from the interviews was confirmed.

Credibility: Before the interviews and data collection process, the study site was visited to address the credibility criterion. To avoid the risk of data deviation from the research objectives, peer debriefing and a prolonged engagement was ensured until the scope of the data was covered.

Dependability: The study methodology was thoroughly recorded and explained to the research assistant to address the dependability criterion. The interview guidelines were reviewed by experienced researchers (supervisors). An independent translator transcribed the interviews; in this way, the insights of external observers were used.

Confirmability: Additional issues were brought up during meetings with the research team and considered for confirmability. A third independent reviewer who had not previously been involved in the project was invited to analyse the raw data and compare the various categories and themes, thereby facilitating the peer review process and improving the confirmability of the research. To assess inter-coder agreement and strengthen the reliability of the results, the independent reviewer cross-checked the codes.

Rigour: Member checking and inter-coder agreements were respected to develop rigour. This was done by recapping the questions and responses with the participants and allowing the responses to be validated. The participants were asked to highlight any contradictions observed to strengthen the validation process further.

Reflexivity: As a physiotherapist in the field of public health and community physiotherapy, the researcher kept and updated a reflexive diary to discern knowledge from the data and allow reflection on her contribution, as well as her thoughts on integrating rehabilitation services in HIV management. During the data collection process, the researcher observed that both the service users and the service providers at the HIV testing and treatment centres rely majorly on pharmacological approaches to health management, with little attention paid to health promotion and disease prevention in people with chronic conditions such as HIV.

7.6 Results

Part A: Sociodemographic profile of the participants

A total of 20 participants were involved in the study. The mean age of the participants was 36.2 ± 9.27 years, with a range of 19 to 54 years. The mean time since their HIV diagnoses was 6.5 ± 6.20 years, ranging from 2001 to 2022. Table 7.2 summarises the sociodemographic information obtained from the participants during the interviews.

Table 7.2: Sociodemographic profile of participants

Description	N	%
Gender		
Male	9	45
Female	11	55
Employment		
Yes	17	85
No	3	15
Educational level		
No formal education	2	10
Primary	2	10
Secondary	8	40
Tertiary	8	40
Marital status		
Married	9	47.4
Single	9	47.4
Widowed	1	5.3
Income (in Naira)		
₦≤30,000	7	53.8
₦30,000 – ₦100,000	4	30.8
₦≥100,000	2	15.4

Results Overview

Participants in this study had similar understandings of physical activity and exercise and used the terms interchangeably during the interview. Despite the presence of a physiotherapy department in the next building, PLWH reported that they were not aware of a referral pathway to physiotherapy, and they had not been receiving any public health information promoting

physical activity. All the participants concurred on the benefits of physical activity to all individuals, irrespective of HIV status. The barriers to physical activity that were most mentioned were lack of time, financial constraints, and an unsupportive environment. Twenty-five coding (25) categories were identified. The categories were further abstracted into three themes and fifteen sub-themes.

Theme 1: Attitudes, knowledge, and preferences in respect of physical activity

Attitudes towards physical activity

PLWH demonstrated positive attitudes towards their participation in physical activities, expressing their willingness and interest in engaging in deriving health benefits as described by some of the participants.

"Two things: - the health benefits; then the second thing is that it makes me ready for the day's activities" (Male, 42 years old)

"It makes one physically fit. Some things that people who do not exercise cannot do, you will be able to do them. That road walk is especially good for everyone; you will be able to walk some distance and not get tired. Some people cannot even stand for a long period; I can stand the whole day and not get tired. This is part of the benefit of exercise" (Male, 34 years old)

Knowledge of physical activity

The term 'exercise' was more relatable to participants than 'physical activity' and was used more frequently by all participants. While some participants could highlight the various forms of physical activity that they were aware of, others simply described exercise as leisure-time activities done at a set time to increase strength, endurance, or lose weight.

"When I was growing up, I played hockey, so it is a sport. So, when I go for training in Unilag Sports Centre…. We run around the track. Running is an exercise; jogging is an exercise. I am aware of sit-ups; there was a time when I was growing up, I was working on my stomach, and I was doing seat-ups, press-ups, and push-ups…. [they] are exercising". (Female, 30 years old)

"Walking too is part of the exercise. Sometimes, it is not every trekkable distance one should take bikes or tricycles to…. trekking those distances will make one very fit" (Male, 34 years old)

"Is that work I am doing? not exercise? Even the washing of clothes, sweeping, you know how housework can be?... mopping: they are all exercise." (Female, 54 years old)

Preferences for Physical activity

Walking was described as the most preferred form of physical activity. Participants reported that transportation and occupational physical activity were sufficient for them, as these forms were perceived to be very demanding and time-consuming, thus leaving no time or energy for other forms of physical activity.

"Indoor exercises like cycling, walking on a machine, carrying weights…. My most preferred is walking". (Male, 42 years old)

"When you go to the market and buy, walk down to deliver to customers, it is more than exercise now. I do not know any exercise more than that one". (Female, 35 years old)

"I normally do. Mainly press-ups. It was before I used to do road walking, like jogging, but now I do not have time for that one. I only do press-ups. I just do small exercises inside my house". (Male, 34 years old)

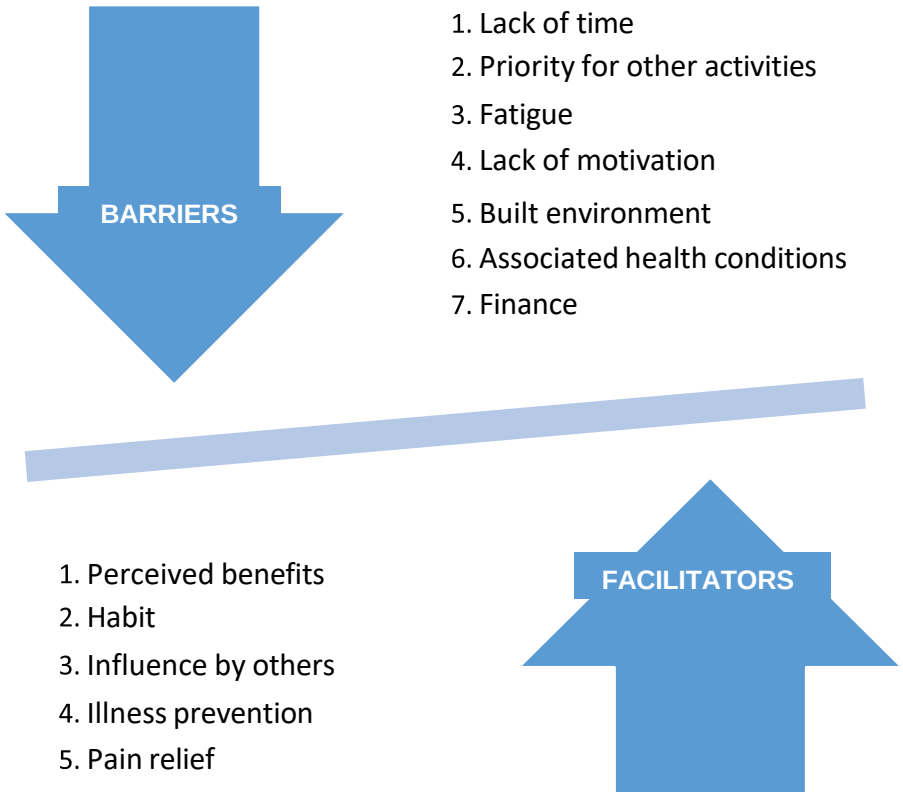

Figure 7.2: Barriers and facilitators to physical activity participation

Theme 2: Barriers to physical activity participation

Using a framework approach and thematic analysis, the issues which were identified as barriers to physical activity participation were categorised as sub-themes. The most recurring barrier to participation in physical activity cited by the participants was 'lack of time.'

Lack of time and other commitments

Participants reported that they could not set time aside for physical activity as work-related activities were a priority and consumed most of their daylight time.

"Not everybody can do that every day. Maybe there are some other commitments when you get back, you will not even have time, you would have forgotten. There are some things that you just forget sometimes because of what you have gone through throughout that day. So maybe it is only in the evening you have time to do what they told you to do in the morning, because of time, everything we deal with is time; time is money" (Male, 48 years old)

"I agree that it is good, but there is no time. I pray, God, give us peace of mind. Before one wakes up and attend to the children, coupled with the fact that I leave home by 5 am and get back home around 10 pm, there is nothing like Saturday or Sunday in my schedule; how will I have time for exercise? I know it is good. I used to exercise when things were okay. I was fat then and was not doing any stressful work; my husband and I used to go to the stadium every Saturday back then when we were in Lagos, but now, I do not do any exercise". (Female, 43 years old)

Priority for other activities

Although participants agreed that physical activity is beneficial, most participants classified it as 'Important, but Not Urgent.'

"If I am looking for money, I cannot be jogging. When you are OK, you can do exercises till 10 am; nobody will hold you [back], but whew, that is struggling, and you are doing exercises… Is it exercises that will feed you? For example, now, if you want to do a test, it is money. If money is not important, the hospital is supposed to be free" (Female, 34 years old)

"There is no one that would not like to, but there is no time regarding my trade, except I decide to say I am not going out to trade in a day, and that would be like once in three months.… It is

not easy. I cater to four children all by myself, and only one of them is out of school. It will be really hard" (Female, 43 years old)

"I would have to leave whatever I am doing to go and be doing something [like] that (exercise)" (Female, 40 years old)

Fatigue

Fatigue among people living with HIV is a common symptom that could limit individuals from carrying out their daily tasks. Participants in this study commented that they cannot engage in physical activity when tired.

"The only discouragement is when I am tired from work" (Male, 34 years old)

"Also, when you have over-walked. Even the car itself...., there are sometimes car must rest. Everything has to rest. This is a locomotor system. When you walk, you are exercising your joint, and you cannot keep on walking the whole day; there are times that you feel tired, and you just rest" (Male, 47 years old)

"Because I am weak, I cannot do it." (Female, 37 years old)

Lack of motivation

Participants expressed that their motivation to engage in physical activity is hindered by the absence of social groups and lack of support from health professionals.

"If I had somebody to guide me, it would motivate me to exercise" (Female, 26 years old)

"If I am exercising without an instructor or a coach, I cannot go far. If I do it alone, I can go for like two minutes or five minutes for a particular programme, but with the aid of an instructor or coach, I can go for like seven minutes way beyond my normal timing" (Male, 19 years old)

"Maybe in the evening when you have done all your business and have nowhere else to go, then you can do your exercise and go to sleep" (Male, 47 years old)

Built environment and related factors

The lack of safe open spaces in the community for physical activity was reported as one of the barriers to physical activity. Participants highlighted that they do not have access to parks, fields, and gyms for physical activities.

"The thing is that, especially in Lagos, everywhere is very rough, but if you are doing it, you have to be careful because the road is narrow, and there is always a rush here and there for people going to work and all. So, one must be careful while on the road, except you do it early in the morning before people start rushing out. So, if you are going for something like that, it is not advisable to hold cash or any other things that are valuable to you. The only way it can be safe is for you not to have valuables on you, even your phones. But some people usually hold their phones while jogging. In such a scenario, one would have to use a less expensive phone so that they will not even think of hijacking it from you or [you] feel pained if it is being hijacked. However, for me, there is nothing they can collect from me because I do that without any valuables. They usually steal early in the morning" (Male, 34 years old)

"It is not ok, like in my area, cars are always on the move" (Female, 34 years old)

"Another one again is weather conditions. I remember a time I was exercising; it was during the Harmattan period, and I was getting all dried up. The things you do in normal weather conditions get limited, and the duration gets shortened in harsh weather conditions." (Male, 19 years old)

Associated health conditions

Participants in our study commented that they are limited in their ability to participate in physical activity on account of the double burden of HIV and their associated conditions.

"Why I do not engage in exercise is because of the reason I told you: my mind believes that since I have Hepatitis B, and it is affecting my liver, I believe that if I lose any calories, I cannot get it back". (Female, 30 years old)

"The only other condition affecting me is that I have mild asthma; that is the other thing that stops me" (Male, 19 years old)

"Well, they do gym around my area, they lift weights. But with this my back, I do not think I can lift the weight. If I go and lift something heavier than me, I do not know what it can cause" (Male, 47 years old)

Finance

Participants described the importance of financial comfort using Maslow's Hierarchy of Needs. They implied that financial stability is a higher priority than engaging in physical activity. Thus, their low economic status hinders them from participating in physical activity.

"If I am looking for money, I cannot be jogging". (Female, 34 years old)

"All of this tends to money because you have to get registered, getting the equipment needed; everything still boils down to money" (Male, 19 years old)

"The only issue I am having is my income is not enough; I am just managing it". (Female, 26 years old)

Theme 3: Facilitators of physical activity

When participants were asked about their perceived facilitators of physical activity participation, the following sub-themes emerged:

Perceived benefits

Participants felt motivated to engage in physical activities because they believed it was beneficial towards achieving their fitness goals. The desire to appear healthy and avoid being recognised as having HIV was also a motivating factor.

"It is the body for me. I just want to build that body; that is the motivation. I am into the bodybuilding type, so I just want to get this muscular shape; that is my aim" (Male, 19 years old)

"Because I want to be strong and have good health" (Female, 27 years old)

"Two things: the health benefits; then the second thing is that it makes me ready for the day's activities" (Male, 42 years old)

"Good life and good health. My doctor advised me to. I just do it to keep fit" (Male, 45 years old)

"No one would know I have any terminal diseases with the way I look except for me and my daughter that knows" (Female, 54 years old)

Habit

Participants in our study revealed that habit and engagement in childhood physical activities were instrumental in motivating them to engage in physical activity.

"*Habits, from my secondary school days. I used to like doing exercises"* (Female, 34 years old)

"Well, for me, while I was very young, I used to play ball. I used to participate in sports activities. I do backflips, and I believe I can still do them even though I am older now. Although I have not done them in a long while, I believe it has become a part of me" (Male, 34 years old)

Influence by others (supportive social environment and relationships)

Another factor influencing the participation of PLWH in physical activity was the support and encouragement of family and friends. Thus, the findings indicate that positive influencing factors play a significant role in motivating participation in physical activity."

"Another motivation, too, is my friend. There is this friend of mine who was looking so out of shape, and within three months of exercising, he is looking back in shape and better. That one too is another kind of motivation; so, if he could do it, then I can do it too" (Male, 19 years old)

"When I see people who do it, they look smart, and I like to look like them" (Male, 35 years old)

"When I see people doing it, I also like to do it" (Male, 39 years old)

Illness Prevention

According to the participants, engaging in physical activity benefited PLWH and the general population in improving their health and preventing illness.

"I do not want to sit down in one place, because if I sit in a spot, I feel weak; but whenever I am working, I have more strength." (Female, 37 years old)

"…. when you are not doing anything (exercising), you start feeling minor issues of your system not working well" (Male, 47 years old)

"As a student, I learned a little bit about human anatomy, the neurons, and muscles. I know that as we age, exercise is mostly good for our bodies. Because if we are dormant, it damages the cells in our body. To my understanding, that will rapidly make the cells in the body die" (Male, 42 years old)

Pain relief

For PLWH, pain is a limiting factor when performing daily activities. However, participants in our study commented that they engage in physical activity to help manage musculoskeletal pain.

"Yes, sometimes I have joint pain, but when I do [physical activity], I get relief. I do exercise because it helps my leg pain, but not every day. It helps [my] skin to be healthy and [my]blood to circulate well." (Female, 19 years old)

"I do not like taking medicine. I like to exercise myself. Let me say my leg is paining me now or any part of my body; I like to start exercising my body". (Female, 34 years old)

"I learnt that if I do not do exercise and start again, I will feel body pain in my muscle; but if I continue, it will be better." (Male, 52 years old)

7.7 Discussion

This study aimed to explore the barriers to and facilitators of physical activity among people living with HIV in Nigeria. The results of the qualitative analysis of data revealed that most of the PLWH in Lagos understood the benefits of physical activity and have positive attitudes to physical activity participation. According to the Health Belief Model, the likelihood of an individual engaging in a particular health behaviour can be predicted by their belief in a personal threat of an illness and their belief in the effectiveness of the recommended health behaviour (Yen and Li, 2019). Such perceptions of health behaviour, in combination with modifying factors, which include sociodemographic factors, are instrumental in determining their likelihood to engage in physical activity programmes designed to optimise their health. An analysis of the modifying factors can assist in understanding physical activity behaviour among people living with HIV.

The mean age of participants in our study was 36.2 ± 9.27 years, and the range was 19 to 54 years. Moreover, this age group constitutes the nation's major workforce. Furthermore, with a national unemployment rate as high as 33.3% (Nigerian Stat, 2023), it is not surprising that many individuals, as evidenced in this study, are self-employed so that they can sustain themselves financially. Findings from our study are consistent with reports indicating that only 17% of workers in Nigeria earn adequate salaries to enable them to escape poverty (Lian and Vishwanath, 2022). Most participants (53.8%) who had an income source earned less than the national minimum wage of #30,000 (66.73 USD) per month, while only two participants (10%) earned more than #100,000 per month (222.43 USD). Thus, socioeconomic factors are vital in influencing physical activity participation as people earning an adequate income, as indicated above, can afford some costs associated with engaging in physical activity.

In Nigeria, as with most developing countries, individuals with no formal education or only an elementary education are the group most affected by poverty (Sulaimon, 2022). In our study, only 42% of the participants had a post-secondary education. The association between educational level and physical activity has been examined in a systematic review by Buja et al. (2020), with reports of existing correlations between educational level, health literacy and physical activity behaviour. Thus, the level of education, the sociodemographic profile of the participant, cultural influences, and financial capacity are significant factors influencing physical activity participation.

Although several studies have highlighted that men are generally more active than women (Hallal et al., 2012; Sallis et al., 2016; Guthold et al., 2018), most of the women in our study classified themselves as being sufficiently active as they consider occupational physical activity and the household chores which they engage in daily as the highest level of physical activity. Amagasa et al. (2017) reported that when monitored, with the actual measurements of their exercises based on the total volume of PA, women are more active than they are when measured based on the current PA recommendations. This is because they are more inclined to engage in light -duties and occasional PA, both of which are connected to their lifestyle (e.g. doing housework). Similarly, other studies (Amagasa et al., 2017; Hoodbhoy et al., 2018) indicate that individuals view such tasks as physically productive and are usually exhausted or feel 'too lazy' to engage in any additional structured physical activity. These are just a few selections of some background variables that were chosen as this study's focus. The potential effects of other background factors not captured in this study need further consideration.

The thematic findings that emanated from the interviews aligned with several constructs of the Health Belief Model, such as perceived benefits, perceived barriers, cues to action, self-efficacy, and perceived severity, shedding light on the individuals' perceptions and attitudes towards physical activity. The "likelihood for action" refers to the perceived benefits minus the perceived barriers to engaging in the recommended activities (Mckellar and Sillence, 2020). These are assumed to affect behavioural intentions and the consequent behaviour around the performance of the physical activity in question. The participants reported a range of barriers limiting physical activity participation, the most predominant being lack of time. From studies conducted nationally and globally in Nigeria (Abaraogu et al., 2016; Oyeyemi et al., 2016), the UK (Withall et al., 2011), Sri-Lanka (Perera et al., 2022), the USA (Lee et al., 2012), Australia (Ashton et al., 2015), lack of time is frequently cited as a limiting factor in engaging in physical activity. A probable reason for this claim is that individuals calculate the cost of engaging in exercise before deciding to participate in any physical activity, particularly in environments where income is dependent on the time put into the job. For example, a participant in our study commented that the time she would be jogging could have been spent "looking for money".

Another identified barrier was the state of the built environment in Lagos State. Lagos State has a population of 21 million and is regarded as a mega city, but it lacks accessible facilities for individuals to engage in recreational physical activity (Lawanson et al., 2020). Thus,

individuals who engage in physical activity use other types of public space, such as roads, bridges, and vacant land. However, in this context, the dangers highlighted by participants in this study are the lack of safety in these spaces, as well as human and vehicle traffic congestion. Giles et al. (2021) highlighted four key environmental factors influencing physical activity: walking ability, green space, traffic-related air pollution and heat. Lawanson et al. (2020) observed that the municipal structures of Lagos are unsupportive and potentially harmful to individuals who choose to engage in leisure-time physical activity as they need to navigate dangers such as air pollution, robberies, and traffic injury. Thus, it is not surprising that individuals would strongly evaluate the benefit of physical activity against the potential risk of harm before deciding to participate in physical activity.

In our study, one participant commented that the only factor limiting him from engaging in physical activity is fatigue, as there are days when he just wakes up tired. It is unclear whether this type of fatigue is due to HIV or the existence of other HIV-related health conditions. The impact of fatigue in influencing physical activity participation should not be underestimated as there is an association between HIV-related fatigue and psychological factors such as life stress, anxiety, and depression (Barroso et al., 2010; Barroso et al., 2015; Loades and Kagee, 2017). Furthermore, some studies have suggested a potential link between certain HIV medications and fatigue (Coetzee et al., 2019), thus requiring non-pharmacological interventions such as physical activity and cognitive behavioural therapy to treat or prevent fatigue (Bernard et al., 2018). Recent studies reveal that physical activity is linked less to fatigue among PLWH (Webel et al., 2019).

Findings from our study revealed multiple motivators for physical activity participation. On an individual level, participants felt that the perceived benefits of engaging in physical activity serve as the most important facilitator since they believe that physical activity contributes to healthier, longer lives, improves fitness, aids relaxation, promotes sleep, and prevents illness. Historically, maintaining good health has been a significant motivation for participation in physical activity. (Vallerand, 2007; Brunet and Sabiston, 2011; Perera et al., 2022). Participants referred to a supportive environment, access to resources, and external social support as vital facilitators. These results are consistent with the literature and explore the influence of modifiable factors on physical activity (Vallerand, 2007; Roos et al., 2014; Geller et al., 2018). Although some studies view modifiable factors as secondary or complementary to non-

modifiable factors (Vallerand, 2007), the impact of external factors in influencing physical activity participation cannot be overlooked (Aaltonen, 2012). Geller et al. (2018) highlighted that the justification behind exercise considerably impacts individuals' ability to maintain consistent physical activity throughout time. Furthermore, since it is known that adolescent sports participation is linked to a high level of physical activity in adulthood (Hallal et al., 2012; Oyeyemi et al., 2018; Guthold et al., 2020), participants in our study highlighted that they engaged in physical activity as it is a habit which they had picked up from their adolescence when they were actively involved in sports. Thus, sociodemographic variables and psychological characteristics significantly influence the likelihood of participating in physical activity.

These results suggest that a supportive socio-cultural environment and the priorities of individuals are crucial to physical activity participation, further strengthening the narrative that voluntary participation in physical activity is motivated by the complex interaction of several factors such as motivation, time, choice of physical activity, environment, and availability of resources. There is, however, an existing debate as to which limiting factors to physical activity participation could be classified as genuine barriers or 'excuses'. This issue can be determined by assessing the barriers while motivation is present (Sjörs et al., 2014; Koh et al., 2022; Perera et al., 2022). The barriers revealed in this study may help develop interventions that will help PLWH increase their physical activity levels in this situation and reduce the long-term effects of non-communicable diseases.

7.8 Conclusion

Reflecting on the determinants of physical activity behaviour identified in this study, it is reasonable to conclude that although background variables were identified as perceived and actual barriers to physical activity participation, PLWH are motivated to engage in physical activity and can be supported to improve their physical activity levels through health promotion interventions. Environmental factors, fatigue, and financial priorities are barriers to physical activity participation. Still, they could be alleviated by individual motivation, the certainty of each individual's value, and the creation of a personalised physical activity programme to be conducted in a more supportive environment. Likewise, social support, positive interprofessional relationships, and perceived health benefits are vital to increasing physical activity participation among PLWH.

Implications for research

Contextual factors must be considered in exercise designs and prescriptions for PLWH. Interventions such as organising exercise classes that would include group sessions for peer support would be beneficial. Concerning PLWH, the findings from this study highlight the fact that cultural attributes, including gender definitions and socioeconomic expectations, may influence physical activity participation and could be more complex than the traditional views regarding gender roles in physical activities, as suggested by previous research in Africa. Furthermore, this study provides contextually based findings for academics, researchers, and policymakers, aiming to develop interventions to improve physical activity levels among PLWH in Nigeria.

7.9 Summary of Chapter Seven

In this chapter, a qualitative approach was adopted to explore the factors that influence physical activity participation among PLWH. Findings reveal that key barriers to physical activity participation (lack of time, unsupportive environment, fatigue, and lack of funding) are modifiable. By synthesizing the diverse array of factors influencing physical activity among PLWH, the chapter lays the foundation for the subsequent development of a targeted and contextually relevant intervention program. Understanding the nuanced barriers and facilitators identified in the chapter provides crucial insights into the design and implementation of effective strategies to promote physical activity uptake among PLWH. Addressing these factors is likely to facilitate participation in physical activity and strengthen the aim of adopting a holistic approach to HIV care, thereby enhancing overall health outcomes and quality of life for PLWH. By elucidating the complex interplay between individual, social, and environmental factors, the chapter sets the stage for the development of a comprehensive physical activity program tailored to the unique needs of PLWH in low-resource settings. Thus, efforts to develop a physical activity intervention program for PLWH in Nigeria must consider environmental and interpersonal variables.

Chapter 8 Rehabilitation programs for people living with HIV-related disability: A scoping review of intervention characteristics using the RE-AIM implementation framework

8.1 Introduction

Chapter eight is presented as a manuscript structured according to the journal guideline. The paper aims to map existing evidence and provide an overview of rehabilitation strategies adopted in the management of HIV-related disability among PLWH. The paper was submitted to the International Journal of Therapy and Rehabilitation (IJTR). In conducting this scoping review, we aimed to identify existing evidence and provide an overview of rehabilitation interventions adopted in the management of HIV-related disability among people living with HIV. The findings of this study would contribute to a comprehensive understanding of the current status of HIV care by offering practical insights for researchers, practitioners, and policymakers in developing and implementing successful rehabilitation programs.

The manuscript's title is “Rehabilitation programs for people living with HIV-related disability: A scoping review of intervention characteristics using the RE-AIM implementation framework”.

Journal: International Journal of Therapy and Rehabilitation Authors: Oladejo, T., Myezwa, H, Ajidahun, A., & Ibeneme, S.,

8.2 Details of author contribution

The Contributor Roles Taxonomy (CRediT) (Allen et al., 2019b) was used to outline the authors' contribution to the study. The full explanation of the terms is in Appendix 10.

Table 8.1: Details of author contribution

	Oladejo	Myezwa	Ajidahun	Ibeneme
Conceptualization	√	√	√	√
Method	√	√	√	√
Resources	√			
Manuscript writing draft	√			
Manuscript writing review and editing	√	√	√	√
Supervision		√	√	√

8.3 Abstract

Introduction: HIV-related disability is prevalent across the lifespan of a person living with HIV. However, research on rehabilitation programs and the range of intervention strategies implemented among people living with HIV is scarce.

Objective: To identify existing evidence and provide an overview of rehabilitation interventions that have been adopted in the management of HIV-related disability among people living with HIV.

Inclusion criteria: Studies on people living with HIV who are over 18 years of age and that reported on rehabilitation intervention strategies were included. Studies of any design conducted in a clinical setting, home or community-based settings were considered.

Methods: A three-step search strategy was used in this review. All relevant literature on the kinds of physical activity intervention strategies for HIV-related disability (published and unpublished) from 2003 to the present date were considered. After duplicates were removed, titles and abstracts were screened against the inclusion criteria by two independent reviewers. A data extraction sheet that included the study outcome was used.

Results: 456 records were identified. Full text for 67 articles were assessed, and 22 were included in the final review. The range of rehabilitation intervention strategies included physiotherapy, therapeutic exercise, occupational therapy, supportive psychotherapy, education program, and other strategies. Most of the studies reviewed used strategies related to health promotion in exercise and health education.

Conclusion: This study findings show a range of strategies that can be used to manage disability among people living with HIV. Future research can assess the effectiveness of the strategies in managing other conditions.

Keywords: Intervention strategies; Rehabilitation Physical activity; HIV, Disability.

8.4 Background

The effects of ageing on people with HIV can be severe, as HIV and antiretroviral therapy (ART) accelerate the natural ageing process of the immune system (Rodés et al., 2022). As a result, individuals with HIV have higher rates of inflammation, even with reduced viral loads and preserved CD4 counts, leading to the development of various diseases like cardiovascular, renal, neurocognitive, oncological, and osteoporotic conditions (Wing, 2016). Evidence from randomised controlled trials conducted in research settings has shown that rehabilitation interventions that address or prevent body impairments, activity limitations, and social participation restrictions experienced by an individual are effective in enhancing short- and long-term outcomes for a variety of chronic health issues across all age groups (Anderson and Durstine, 2019; Lee et al., 2022).

To improve functioning and lessen disability in people living with HIV (PLWH), rehabilitation professionals such as physiotherapists, occupational therapists, speech-language therapists, and physiatrists need to expand rehabilitation interventions beyond research settings to enhance the health and well-being of PLWH truly. However, several barriers exist to implementing rehabilitation programs in low-resource settings (Chu and Weiser, 2021). When developing rehabilitation strategies for managing HIV-related disability, clinicians and HIV support services should consider the environmental and context-specific factors that may influence implementation (Jackson-Best and Edwards, 2018). For instance, the Disability and HIV policy brief recommended involving people with disabilities in the planning, implementation, and evaluation of HIV programs. O'Brien et al. (2020) incorporated this recommendation into the development of "The Framework of Research Priorities in HIV, Disability, and Rehabilitation." Their framework identified facilitators and barriers to accessing formal and informal rehabilitation services for PLWH, as well as different models of rehabilitation service provision. However, since the forum was held in Canada with participants from Canada, the United Kingdom (UK), Ireland, and the United States, the applicability of the framework to other nations, especially resource-poor countries, remains unknown.

In the 2021 fiscal year, low-and-middle-income countries are defined as those with a Gross National Income (GNI) per capita of $1,035 or less in 2019, while lower-middle-income economies have a GNI per capita between $1,036 and $4,045 (The World Bank Data, 2021). Given the concerning poverty statistics in low-middle-income countries, it is critical to develop

country-specific strategies to recognise and overcome local obstacles to the implementation of rehabilitation programs in sub-Saharan African countries, which account for 21 out of 25 countries in the low-income group (Kodali, 2023). Although AIDS-related deaths have declined by 69% since their peak in 2004, mainly due to increased access to antiretroviral therapy (ART), HIV/AIDS remains a significant burden in sub-Saharan Africa, where the continent bears 70% of the global HIV burden (Dwyer-Lindgren et al., 2019).

Currently, there is a need for research on rehabilitation intervention strategies that can be adapted for people living with HIV-related disability in low-resource countries (Chetty and Hanass-Hancock, 2016). Hanass-Hancock et al. (2013) utilised the International Classification of Functioning, Disability, and Health (ICF) to conceptualise the extent, nature, and type of disability among PLWH in hyper-endemic countries. However, they found limited information on context-related elements like the availability of aids, rehabilitation, and social support in the context of HIV. To obtain a better understanding of how, why, and under what circumstances rehabilitation interventions are effective for PLWH in sub-Saharan Africa, more reviews and analyses are needed. Various theories, models, and frameworks exist in the field of implementation science (or knowledge translation science) to inform implementation determinants, the implementation process itself, and the evaluation of its effectiveness (Strifler et al., 2020). RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) is an example of a widely used determinants framework for systematic programme evaluation, intending to improve the quality, speed, and public health impact of programmes in real-world settings (Glasgow et al., 2022).

The RE-AIM framework was developed to evaluate the impact and sustainability of health promotion interventions (Glasgow et al., 2019). Its goal is to "implement a robust and evolving framework to advance science, enhance practice, and influence policy through collaboration and training." The framework assesses reach and effectiveness at the individual level, adoption and implementation at staff, setting, system, or policy/other levels, and maintenance at both individual and staff/setting/system/policy levels (Glasgow et al., 2022). It aims to facilitate the translation of research into practice and inform decision-making regarding the broader implementation of evidence-based interventions.

The RE-AIM framework has been used in various settings and with diverse populations (e.g., evaluating the implementation and effectiveness of a WHO HEARTS-based intervention integrating hypertension management into HIV care (Muddu et al., 2023), assessing the impact of the Exercise is Medicine initiative (Stoutenberg et al., 2018), and evaluating a community-based exercise program for cancer survivors (Covington et al., 2019)). However, a summary of the characteristics of rehabilitation intervention programs for PLWH, as related to the RE- AIM framework, is necessary. This scoping review aims to describe the features of rehabilitation interventions reported in the literature that have been conducted in various settings using the RE-AIM framework. These findings can offer valuable insights for both researchers and practitioners in identifying potential strategies for the future implementation of rehabilitation programs for PLWH.

8.5 Methods

Research objective

This review aims to provide a comprehensive summary of peer-reviewed literature on the feasibility of implementing a rehabilitation intervention program within an HIV treatment setting. To achieve this, we performed a scoping review of the literature using the updated framework of Peters et al. (2021). This review exists as one part of a series of research studies aimed at developing a contextualised physical activity program for people living with HIV in a low-resource setting. Findings were reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guideline (Tricco et al., 2018). Ethics approval was obtained from the Human Research Ethics Committee of the University of the Witwatersrand (M200906) and Lagos State University Teaching Hospital Health Research Ethics Committee (LREC/06/10/1547).

Study eligibility

In this review, we included studies that utilised a rehabilitation intervention among people living with HIV-related disability. Studies of any design conducted in any setting (such as home-based, clinic-based, or community-based) with a clearly defined structure were selected. Studies must essentially provide data for one of the implementation outcomes of acceptability, adoption, appropriateness, practicality (including cost), feasibility, fidelity, penetration, sustainability, and quality assessment. Studies that examined just the effects or benefits of rehabilitation intervention among PLWH were not included. Additional exclusions included

reviews, commentaries, and point-of-view articles, as well as studies conducted in languages other than English. The inclusion criteria for this scoping review were guided by the population, concepts, and context (PCC) approach:

Population

The population considered in this study were adults above the age of 18 living with HIV, with no limitation on the duration of living with HIV, who have received a prescribed rehabilitation program as part of their interventions by a health professional. Studies from the year 2003 (when ART became available to PLWH in Africa) to 2022 (World Health Organisation, 2023)

Concept

Papers that reported on different rehabilitation intervention programs in the management of HIV-related disability in line with the eligibility criteria were included. Specifically, rehabilitation intervention programs that include any reference to prevention or treatment activity or service that addresses impairments, activity limitations, or participation restrictions for adults living with HIV, such as physical therapy, cognitive-behavioural therapy, home rehabilitation, exercise, massage, and other complementary therapies that have been explicitly described as part of the non-pharmacological rehabilitation of PLWH.

Context

Studies on rehabilitation intervention programs for PLWH conducted in a clinical (hospital and primary health care facility), home, or community-based setting were considered. The context was not limited to specific geographic locations or racial or gender-based interests.

Information sources and search

A comprehensive literature search was conducted between July 2022 and December 2022 to identify studies that reported the methodology of physical activity intervention programs for PLWH. The search strategy was established by the authors (TO and AA) and reviewed by a librarian trained in systematic searches. PubMed, Web of Science, and EBSCO databases were searched for publications between January 2003 (when ART became increasingly available and accessible to PLWH in sub-Saharan Africa) and December 2022 using the keywords HIV, exercise, rehabilitation/therapy, physiotherapy, occupational therapy, massage and home-

based, community-based, clinic-based. The following terms were included in the given combination to create relevant search strings for the review:

Condition-related terms: HIV, human immunodeficiency virus, HIV/AIDS
Intervention-related terms: physical activity, massage, behavioural therapy, self-management, exercise, aerobic, resistance, strengthening, physiotherapy, physical therapy, flexibility, balance, rehabilitation, and therapy.
Guideline-related terms: intervention, reach, effectiveness, adoption, implementation, maintenance, compliance, adherence, and uptake

For example, in the Web of Science database, the following search strategy was used: "implementation" outcomes such as acceptability, adoption, appropriateness, practicality (topic) AND HIV (title) AND exercise OR physical activity (title) AND rehabilitation OR therapy (topic). A similar search strategy was used in the remaining databases. Additional studies were identified by examining the reference lists of included studies. Specific keywords and medical subject headings (MeSH) terms applied in the search are detailed in Table 6.1.

Table 8.2: Terms applied in the literature search

Search	Query	Records retrieved
#1 Condition-related	HIV [MeSH Terms]) OR (human immunodeficiency virus [MeSH Terms])) OR (HIV/AIDS [MeSH Terms])) OR (AIDS [MeSH Terms])) OR (acquired immune deficiency syndrome [MeSH Terms]))))	175197
#2 Intervention-related	physiotherapy [MeSH Terms]) OR (physical therapy [MeSH Terms])) AND (exercise [MeSH Terms])) OR (physical activity [MeSH Terms])) OR (aerobic [MeSH Terms])) OR (resistance [MeSH Terms])) OR (massage [MeSH Terms])) OR (flexibility [MeSH Terms])) OR (rehab [MeSH Terms])) OR (balance [MeSH Terms]))))	568760
#3 Guideline-related	(((((((intervention [MeSH Terms]) OR (reach [MeSH Terms])) OR (effectiveness [MeSH Terms])) OR (adoption [MeSH Terms])) OR (implementation [MeSH Terms])) OR (maintenance [MeSH Terms])) OR (adherence [MeSH Terms])) OR (uptake [MeSH Terms])) OR (compliance [MeSH Terms])	692735
	PubMed:	209

	#1 AND #2 AND #3 **Filters applied: English, Year 2003-2022, 18 and above**	
	EBSCOhost: **#1 AND #2 AND #3** **Filters applied: English, Year 2003-2022, 18 and above**	**1802**
	Web of Science: **#1 AND #2 AND #3** **Filters applied: English, Year 2003-2022**	**291**

Article screening and selection

Identified records were exported to EndNote software for de-duplication and then Microsoft Excel Spreadsheet for screening. After duplicates were removed, titles and abstracts were screened against the inclusion criteria by two independent reviewers. Studies that met the inclusion criteria were retrieved and assessed against the review's eligibility criteria. The preferred reporting Items for Systematic Reviews and Meta-analysis (PRISMA) flow chart outlined the search process (Figure 6.1), the number of articles included and excluded with reasons (Page et al., 2021). Potentially relevant papers were retrieved in full, and their citation details were imported into Microsoft Excel.

Data extraction and charting

Data were extracted using Microsoft Excel. The objectives of data extraction were to describe the reach, efficacy/effectiveness of the program, adoption, implementation, and maintenance. A detailed overview of the study intervention is presented using the Consensus on Exercise Reporting Template (CERT). Full-text articles included in the review were abstracted for data to describe the RE-AIM dimensions using the operational definition and questions in Table 6.2 Specifically, data related to (1) study identification (i.e., country, setting, author names, institution); (2) study design; (3) intervention characteristics (i.e., exercise type, frequency, program duration, delivery format, equipment/ space requirements, fee structure, cost for participants); (4) characteristics of the participant population (i.e., sociodemographic information, HIV), program staff characteristics (i.e., training), and program delivery; and (5) contextual factors (i.e., geographic location, organisational characteristics, contact with health care professionals). Quantitative and qualitative results were extracted, analysed, and integrated to produce the final synthesis.

Table 8.3: Definitions of the five RE-AIM dimensions and metrics utilised.

Outcome	Definition	Metric
Reach	WHO was intended to benefit, and who participated in or was exposed to the intervention?	Patient participation: participant demographics *(age, gender, country)*
Effectiveness	WHAT were the most important benefits achieved, and what was the likelihood of adverse outcomes?	Key outcomes *(outcome measures selected, study results and conclusion)*
Adoption	WHERE was the program or policy applied, and WHO applied it?	Representativeness of settings and intervention agents *(description of facilitators)*
Implementation	HOW consistently was the program or policy delivered, HOW was it adapted, HOW much did it cost, and WHY did the results come about?	Intervention characteristics *(Cost, component, dosage, and intensity)*
Maintenance	WHEN did the initiative become operational; how long was it sustained (setting level); and how long were the results sustained (individual level)?	Effects of outcomes *(Adherence, Compliance, Uptake, Longevity of effects (individual level) and program sustainability (setting level).*

8.6 Results

Study inclusion: Four hundred and fifty-six records were identified; 342 records were excluded as they did not meet the inclusion criteria. The full text of 67 articles was assessed, and 22 were included in the final review. Figure 6.1 illustrates the PRISMA flow diagram of the study selection and inclusion process.

Characteristics of the included studies: Table 6.3 describes the characteristics of the studies included in the scoping review. All the studies included people living with HIV above the age of 18, male and female, spanning different geographical locations. Fifteen interventions (68.2%) incorporated a randomised control trial (RCT) study design using simple random, stratified random, fish-bowl procedures, and computerised techniques as the method of randomisation. Three studies (13.6%) adopted a mixed methods research design. The authors characterised the remaining studies as case reports (n=3; 13.6%) and observational, prospective

single-group studies (n=1; 0.05%). The sample size of participants ranged from 2 - 179 (total of 1193 participants), and the mean age of participants across studies was 44.4 years. In total, 50.5% of all the participants were males, with three studies having an all-male participant and three studies having all-female participants. The majority (n=14; 63.6%) of the studies were conducted in high-income countries as classified by the World Bank Group (WBG) country classification, while 6 of the studies were conducted in upper-middle-income countries and 2 in lower-middle-income countries.

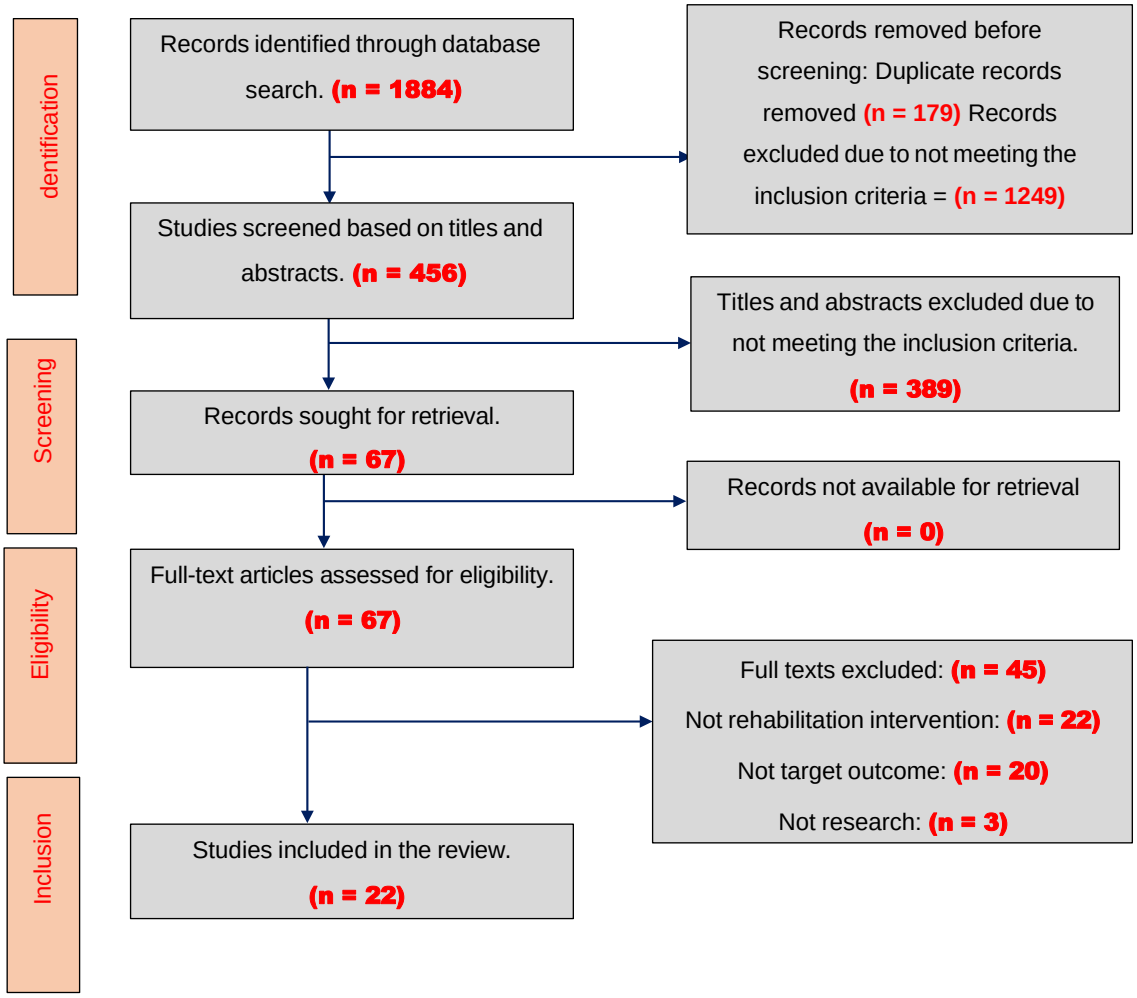

Figure 8.1: PRISMA flowchart for article selection (Tricco et al., 2018).

Table 8.4: Characteristics of the included studies

S/N	Author, Year	Title	Study design	Population	Setting	Country	WBG country classification
1	Schnall et al., 2021	Efficacy, Use, and Usability of the VIP-HANA App for Symptom Self-Management in PLWH with HANA Conditions	RCT	n=100; Mean age = 53; Male = 56, Female = 44	Home/Digital	USA	High
2	Abboah-Offei et al., 2020	Phase II mixed methods' feasibility cluster randomised controlled trial of a novel community-based enhanced care intervention to improve person-centred outcomes for people living with HIV in Ghana	Mixed methods; quantitative + interviews	n = 60; Mean age = 37.75; Male = 29, Female = 31	Community clinic	Ghana	Lower middle income
3	Quigley et al., 2020	Feasibility and Impact of a Yoga Intervention on Cognition, Physical Function, Physical activity, and Affective Outcomes among People Living with HIV: A Randomised Controlled Pilot Trial	RCT	n = 22; Mean age = 55.5; Male = 15, Female = 7	Yoga Studio	Canada	High
4	Webel et al., 2020	Randomised Clinical Trial of a Community Navigation Intervention to Improve Well-being in Persons Living with HIV and Other Co-morbidities	RCT	n = 179; Mean age = 50; Male = 106, Female = 73	Home, clinic, and community	USA	High
5	Piraux et al., 2019	Feasibility and Preliminary Effects of a Telerehabilitation Program for People Living With HIV: A Pilot Randomised Study	RCT	n = 17; Mean age = 46.7; Male = 11, Female = 6	Public fitness centre	Belgium	High
6	Lee et al., 2019	Fatigue management for adults living with HIV: Randomised controlled pilot study	RCT	n= 51; Mean age = 57; Male = 36; Female = 15	Home and clinic	USA	High
7	Merlin et al., 2018	Randomised Pilot Trial of a Novel Behavioural Intervention for Chronic Pain Tailored to Individuals with HIV	RCT	n = 44; Median age = 51; Male = 26, Female = 18	Clinic	USA	High

8	Maharaj and Yakasai, 2018	Does a Rehabilitation Program of Aerobic and Progressive Resisted Exercises Influence HIV-Induced Distal Neuropathic Pain?	randomised pretest, post-test	n= 136; Mean age = 36.79; Male = 57, Female = 79	multicentred	South Africa	Upper Middle Income
9	Daniels and Niekerk, 2018	The impact of a therapeutic exercise intervention on depression and body self-image in HIV-positive women in sub-Saharan Africa	Mixed methods	n = 60, Mean age=39; All women	Clinic and home	South Africa	Upper Middle Income
10	George et al., 2017	A Mixed-Methods Pilot Study of Mindfulness-Based Stress Reduction for HIV-Associated Chronic Pain	mixed methods, randomised, controlled pilot study	n = 32; Mean age = 52; Male= 15, Female = 17	Medical centre	USA	High
11	Parker et al., 2016	Managing Pain in Women Living With HIV/AIDS	RCT	n = 27; Mean age 30.8; All women	Public Community Health Centre	South Africa	Upper Middle Income
12	Cobbing et al., 2016	A Home-Based Rehabilitation Intervention for Adults Living With HIV: A Randomised Controlled Trial	RCT	n = 76; Mean age = 44.1; Male= 18, Female = 58	Home	South Africa	Upper Middle Income
13	Brown et al., 2016	Evaluation of a physiotherapy-led group rehabilitation intervention for adults living with HIV: referrals, adherence, and outcomes	Observational, prospective single-group study	n=92; Mean age = 51.5; Male = 75, Female = 17	Outpatient hospital setting	UK	High
14	Roos et al., 2014	Effects of an Education and Home-Based Pedometer Walking Program on Ischemic Heart Disease Risk Factors in People Infected with HIV: A Randomised Trial	RCT	n=84; Mean age = 39.1; Male = 18, Female = 66	Home	South Africa	Upper Middle Income
15	Pullen et al., 2014	Physiotherapy intervention as a complementary treatment for people living with HIV/AIDS	Case report	n=1; 43-year-old female	Clinic and home	Nigeria	Lower middle income
16	Jaggers et al., 2013	A home-based exercise intervention to increase physical activity among people living with HIV: study design of a randomised clinical trial	RCT	n= 68; Mean age = 40; Male = 31, Female = 37	Home	USA	High

17	Maharaj and Chetty, 2011	Rehabilitation program for the quality of life for individuals on highly active antiretroviral therapy in KwaZulu-Natal, South Africa: a short report	Randomised controlled prospective longitudinal descriptive study	n= 52; Mean age = 33.3; Male = 34, Female = 18	Clinic and home	South Africa	Upper Middle Income
18	Parruti et al., 2007	Occupational therapy for advanced HIV patients at a home care facility: a pilot study	Longitudinal pilot study	n= 14; Mean age = 41.9; Male = 8, Female = 4, Transgender = 2	Home care facility	Italy	High
19	Chan et al., 2005	Cognitive-behavioural group program for Chinese heterosexual HIV-infected men in Hong Kong	RCT	n= 13; Mean age = 38.2; All males	Hospital	Hong Kong	High
20	Harris-Love and Shrader, 2004	Physiotherapy management of patients with HIV-associated Kaposi's sarcoma	Retrospective Case report	n= 2; Mean age = 37.5; All males	rehabilitation medicine department of an acute care hospital.	USA	High
21	Gale, 2003	Physiotherapy intervention in two people with HIV or AIDS-related peripheral neuropathy	Case report	n= 2; Mean age = 44.5; All males	Clinic	USA	High
22	Evans et al., 2003	Randomised Trial of Cognitive Behaviour Therapy Versus Supportive Psychotherapy for HIV-Related Peripheral Neuropathic Pain	RCT	n= 61; Mean age = 46.5; Male = 48, Female= 13	Clinic	USA	High

Findings by RE-AIM Dimensions

The findings of the study were evaluated using the RE-AIM framework, which assessed the impact of health interventions through five dimensions: Reach, Effectiveness, Adoption, Implementation, and Maintenance. ‘Reach’ focused on the recruitment of PLWH, ‘effectiveness’ measured the program's success in improving the health-related quality of life (HRQoL) of participants, ‘adoption’ examined the level of buy-in from healthcare professionals and participants, ‘Implementation’ reviewed how well the program was executed and ‘Maintenance’ focused on the long-term sustainability of the program.

Findings by RE-AIM dimensions

Table 8.5 below describes the RE-AIM dimensions of the included studies.

Table 8.5: RE-AIM dimensions of the included studies

S/N	Author, Year	REACH	EFFECTIVENESS	ADOPTION	IMPLEMENTATION	MAINTENANCE
1	Schnall et al., 2021	**Target population:** PLWH who have non-AIDS conditions associated with HIV. **Recruitment**: from the study registry of individuals who had participated in prior studies and consented to be contacted for future studies, as well as through study flyers posted at HIV-related community organisations	**Outcome measure:** reduction of symptom burden, engagement with healthcare provider, app use and perceived usability. **Key outcomes:** Findings suggest that PLWH are willing and interested in tracking their symptoms, which may have implications for the broader use of digital health for patient surveillance	**Setting:** Digital; **Facilitators:** *Not described	**Intervention strategy:** Video Information Provider (VIP)-HANA app to help PLWH self-manage their symptoms; **Dosage:** weekly for the total duration of the study (6 months). **Cost:** Participants were compensated with $5 for each session completed	**Adherence/Compliance:** 100 participants were enrolled, with 89 subjects retained at three months and 86 subjects retained at six months. **Longevity of effects:** *not described

2	Abboah-Offei et al., 2020	**Target population:** PLWH. **Recruitment**: Participants were approached by their healthcare professional	**Outcome measure:** The selected outcome measures focused on physical and psychological symptoms, spiritual, practical, and emotional concerns, as well as psychosocial needs. **Key outcomes:** The feasibility testing demonstrates that the community-based enhanced care intervention is feasible and acceptable for PLWH and HCP. PLWH were excited about being involved in making decisions about their care and their symptoms and concerns being assessed and addressed holistically using person-centred care	**Setting:** Multi centre; 2 community clinics; **Facilitators**: Health Care Personnel who received a three-session training programme on Person-Centred Care and communication; use of holistic assessment tool to assess symptoms and twice-weekly ongoing clinical supervision and mentorship.	**Intervention strategy:** person-centred intervention for community providers; **Dosage:** three intervention appointments scheduled monthly for over three months; **Cost:** *Not described	**Adherence/Compliance:** recruitment and retention rates of 87% and 97% were achieved within six weeks and at the end of the final time point, respectively. **Longevity of effects:** *not described
3	Quigley et al., 2020	**Target population**: PLWH, above age 35, with identified cognitive concerns on the Communicating Cognitive Concerns Questionnaire	**Outcome measure**: cognition, physical function, medication adherence, health-related quality of life (HRQoL), and mental health. **Key outcomes:** There were no significant differences in cognitive or physical performance between groups. However, there was	**Setting:** A yoga studio.; **Facilitators**: Yoga instructor	**Intervention strategy**: Yoga; **Dosage:** 60 minutes, three times weekly for 12 weeks; **Cost:** Participants were given CAD$50 honoraria at baseline and assessment. Also, parking reimbursements, bus tickets, childcare reimbursement	**Adherence/Compliance**: Two participants withdrew from the yoga group. Reasons for drop-out included illness and relocating out of province. Mean yoga class attendance was 82%, with 100% satisfaction. **Longevity of effects:** 70% of participants were

		(C3Q) with a cutoff of 35 points or less at baseline and medically stable as determined by the Physical activity Readiness Questionnaire. **Recruitment:** participants were recruited from community and health organisations using posters, newsletters, and clinic staff assistance.	a significant improvement in MOS-HIV Cognitive subscale scores and trends toward improvements in HRQoL subscales and depression scores in the yoga group following the intervention.			satisfied with the intervention using a post-participation questionnaire.
4	Webel et al., 2020	**Target population:** PLWH and other chronic conditions. **Recruitment:** Participants were recruited from 3 urban clinical sites specialising in the care of HIV patients: a	**Outcome measure:** quality of life, symptom management, coping ability, social support, self-management, social isolation, HIV self-management, and advance care planning. **Key outcomes:** The community navigator intervention program showed variable improvement over time of	**Setting:** participant's home or clinic or other community sites according to participant preferences and availability.; **Facilitators:** Advanced Practice Nurse, a Social Worker, and trained volunteers.	**Intervention strategy**: HIV Patient Navigation Program intervention; **Dosage**: 36 months. Level 1 patients (most acute) received nurse or social work visits monthly for six months, then every other month and as needed; Level 2 (moderately acute)- patients received visits every other month	**Adherence/Compliance:** Of the 179 participants, 150 (71=Intervention [I]; 79=Control [C]) completed follow-up to 9 months; 122 (51=I; 71=C) were followed to 18 months; 99 (43=I; 56=C) to 27 months, and 25 (10=I;15=C) to 36 months. Thus, only 25 participants completed the 36-month follow-up. **Longevity of**

		large university medical centre, a large county-funded medical centre, and a federally qualified health centre. They were recruited by letter using a clinical database and a research database maintained by co-investigators of PLWH who had given prior consent to be contacted. Participants were recruited by posted notices at clinical sites, clinician referrals, and word-of-mouth.	three outcome variables: self-blame, symptom distress, and HIV self-management. However, the program did not improve overall quality of life, social support, or completion of advance directives.		for six months and as needed; Level 3 (least acute) received visits every three months.; **Cost:** Not described	**effects**: Overall, 3% (n=3) had an increase in acuity from baseline to 9 months, and 17% (n=15) had a decline in acuity
5	Piraux et al., 2019	**Target population:** PLW; **Recruitment:** Potentially eligible patients	**Outcome measure:** feasibility (recruitment and retention rates and safety). **Key outcomes:** Recruitment and retention rates were 93% and 69%.	**Setting**: public fitness centre.; **Facilitators:** A physiotherapist contacted participants weekly by telephone to encourage them to	**Intervention strategy:** Endurance and resistance training exercise sessions, with online guidance and weekly telephone advice;	**Adherence/Compliance:** Recruitment and retention rates were 93% and 69%, respectively. **Longevity of effects:** *not described

		were identified by an infectious disease specialist during an office visit at the HIV reference centre	Telerehabilitation based on endurance and resistance training exercises was feasible in most PLWH.	check for adverse events and to adapt the exercise program if necessary.	**Dosage:** 6 weeks; **Cost:** *Not described	
6	Lee et al., 2019	**Target population:** PLWH and experiencing fatigue; **Recruitment:** Participants were recruited from a prior cohort of participants in the Symptoms and Genetics Study	**Outcome measure:** Fatigue Severity Scale (FSS) and fatigue symptom burden using the four-dimension structure of the Memorial Symptom Assessment Scale that includes occurrence, frequency, severity, and distress of a symptom, the International Physical activity Questionnaire, step counts with a Fitbit Flex, Hospital Anxiety and Depression Scale, Pittsburgh Sleep Quality Index, and Sleep Behaviour Rating Scale. **Key outcomes:** Findings suggest that an intervention to improve sleep quality, rather than sleep quantity, would be more effective than exercise alone in reducing the frequency of fatigue	**Setting:** Home and clinic.; **Facilitators:** The intervention was administered in a single 1-hour session by an interventionist who was an experienced sleep technologist. The interventionist's training was minimal and included practising motivational interview techniques and demonstrating an understanding of the content in the participant's workbook.	**Intervention strategy**: A behavioural-educational intervention to reduce fatigue. The intervention included education about daytime behaviours as well as nighttime sleep behaviours.; **Dosage:** 3 months, with monthly assessments; **Cost:** Participants received a $25 gift card for completing assessments at baseline and monthly follow-ups	**Adherence/Compliance**: 50 recruited, 15 lost to follow-up; **Longevity of effects:** *not described

7	Merlin et al., 2018	**Target population:** PLWH and chronic pain; **Recruitment**: participants were recruited using fliers, provider referrals, and by querying the clinic's pain patient-reported outcome (PROs)	**Outcome measure:** Feasibility outcomes included recruitment, randomisation, retention, timely completion of the intervention, and completion of an outcome assessment battery. Acceptability was assessed by semi-structured qualitative interviews at the midpoint and end of the study, as well as treatment satisfaction questionnaires. **Key outcomes:** Skills TO Manage Pain (STOMP) is feasible, acceptable, and shows preliminary evidence of efficacy for pain management in PLWH	**Setting:** Clinic.; **Facilitators:** four paid interventionists: two peers with HIV and chronic pain ("pain pals") and two research staff ("pain coaches") to work in pain coach–pain pal pairs. Pain pals were patients identified by clinic leadership as having excellent PSM skills and were hired as paid study staff. The pain coaches had master's degrees in health education or social work and had served as interventionists in prior HIV behavioural trials.	**Intervention strategy:** Skills TO Manage Pain (STOMP), an innovative social cognitive theory-based pain self-management intervention tailored to PLWH; **Dosage:** 12 weeks; **Cost:** *Not described	**Adherence/Compliance:** Among 22 participants randomised to STOMP, median session attendance was 9/12 (75%). **Longevity of effects:** *not described
8	Maharaj and Yakasai, 2018	**Target population:** participants being on antiretroviral therapy for at least six months, referred for rehabilitation after HIV-related DSPN and able	**Outcome measure:** subjective periphery neuropathy, brief peripheral neuropathy screening, and numeric pain rating scale. **Key outcomes:** Pain scores within and between aerobic exercise and progressive resisted exercise groups showed significant improvement from baseline	**Setting:** Clinic. **Facilitators:** Medical officers supervising the clinics screened participants through medical records and a physical examination to determine their ability to engage in exercises.	**Intervention strategy:** Group 1: The participants of this group underwent AE while receiving Voluntary Counselling and Treatment's routine services; Group 2: The participants of this group underwent PRE while receiving Voluntary Counselling and	**Adherence/Compliance:** Retention and adherence in the AE and PRE groups were 99 (96%). The reasons for the 18 participants (12%) not completing their group allocation were the following: getting "tired" 5 (28%), "bored" 3 (17%), and "unknown" 10 (55%).29 (80%) of exercise

		to participate in weekly exercise sessions for 12 weeks. **Recruitment:** recruited from four HIV-outpatient clinics	to 6 and 12 weeks compared with the control		Treatment's routine services.; **Dosage:** 30 mins, on alternate days three times per week for 12 weeks; **Cost:** *Not described	sessions were considered adherent. **Longevity of effects:** *not described
9	Daniels and Niekerk, 2018	**Target population**: PLWH; **Recruitment:** participants were randomly selected from three selected HIV outpatient clinics	**Outcome measure:** the Beck's depression inventory (BDI) and the body self-image questionnaire (BSIQ). **Key outcomes:** depression was impacted positively by the therapeutic exercise program, as were certain aspects of body self-image. Evidence was therefore provided that this type of intervention offers the person living with HIV effective tools for resolving some of the issues surrounding their disease.	**Setting**: Home.; **Facilitators:** *Not described	**Intervention strategy:** Therapeutic exercise; **Dosage:** Twice a week for six weeks; **Cost:** *Not described	**Adherence/Compliance:** *Not described; **Longevity of effects:** *not described
10	George et al., 2017	**Target population:** PLWH and experiencing neuropathic or musculoskeletal pain for at least three months.	**Outcome measures:** the Brief Pain Inventory, Perceived Stress Scale, HIV Symptoms Index, autonomic function testing, and audiotaped focus groups. **Key outcomes:** preliminary evidence that	**Setting**: the medical centre where the participants were receiving their primary HIV care.; **Facilitators:** All focus groups were facilitated by the same investigator, a PhD	**Intervention strategy:** Mindfulness-Based Stress Reduction; **Dosage:** once a week, eight weeks; **Cost**: *Not described	**Adherence/Compliance:** 32 recruited, nine lost to follow-up. The main barriers cited by participants were scheduling conflicts with other responsibilities or appointments, transportation, and the

		Recruitment: Participants were recruited from prior research studies or referred by primary care physicians at the institution	Mindfulness-Based Stress Reduction may be a helpful tool in reducing chronic pain associated with HIV and that some of this effect is likely related to the supportive social environment of the course	candidate in health psychology. The Mindfulness-Based Stress Reduction (MBSR) teacher was a social worker specialising in HIV and geriatrics who had previous experience leading MBSR groups in an HIV clinic.		weather. **Longevity of effects**: The three-month follow-up revealed that 11/14 (79%) were still practising one or more of the techniques they had learned. Six were practising every day or almost every day, four were practising 2–3 days per week, and one was practising about once a week.
11	Parker et al., 2016	**Target population:** PLWH; **Recruitment:** PLWH who had participated in a cross-sectional survey to determine the prevalence of pain in this population conducted 15 months previously. Potential participants were contacted telephonically for two weeks	**Outcome measure:** The primary outcome was pain severity as measured on the Brief Pain Inventory-Xhosa, pain interference on the BPI-Xhosa, self-efficacy (Self-efficacy for Managing Chronic Disease 6-item Scale Xhosa—SE), depression (Beck Depression Inventory in Xhosa - BDI), and health-related quality of life (EQ-5D Xhosa). **Key outcomes:** Both the 6-week peer-led exercise and education intervention using the workbook and the workbook alone seem to be feasible and effective	**Setting:** public community health centre.; **Facilitators:** As none of the authors speaks isiXhosa, a research assistant (RA) fluent in the language, trained in data collection, and blinded to participant allocation was employed to recruit, screen, and interview participants. A peer leader (PL) was identified from the target community who was bilingual in English and isiXhosa. The PL underwent 40 hours of training for two weeks	**Intervention strategy:** peer-led exercise and education program using chronic pain management approaches aimed at changing behaviour; **Dosage:** 2 hours weekly for six weeks; **Cost:** *Not described	**Adherence/Compliance:** Of the 50 women eligible to participate in the intervention study and invited to attend the physiotherapy department after telephonic recruitment, 22 failed to attend the initial appointment, one was excluded due to intellectual disability, and 27 were recruited. **Longevity of effects:** Pain was reassessed monthly for four months. Although the early improvements are statistically significant, it was only at Weeks 12 and 16 that the improvements in PSS neared three points out

		and invited to attend the CHC for screening and recruitment by a research assistant not associated with the clinic.	methods to treat pain in amaXhosa women living with HIV/AIDS.	with a physiotherapist who was experienced in delivering this model of intervention. Training included the theory and practice of group exercises and relaxation techniques and targeted training in group facilitation skills, facilitation of goal setting, and activity scheduling.		of a possible 10, the minimum change required for patients to report feeling better.
12	Cobbing et al., 2016	**Target population:** PLWH; **Recruitment:** Study participants were recruited from an observational cohort study that included 1,041 adult PLWH who obtained ART from clinics in the study district	**Outcome measure**: quality of life, functional mobility, and functional capacity. The WHO Quality of Life–short version (WHOQOL-HIV BREF; the WHODAS 2.0 – short version; the Rivermead Mobility Index (RMI); and the Six Minute Walk Test (6MWT); **Key outcomes:** The results showed that an HBR intervention was both safe and showed promise in improving the functional ability and QOL of PLWH. Also, a task-shifting approach was a feasible and potentially cost-saving	**Setting:** state hospital and in participants' homes in a peri-urban area. **Facilitators:** Participants were assessed before and after the HBR intervention by five trained research assistants at the study hospital. The HBR intervention was conducted by four community health care workers who lived in the study area and volunteered their services for a local nongovernmental	**Intervention strategy:** Home-based rehabilitation program; **Dosage:** once a week, 16 weeks; **Cost:** For the duration of the 4-month intervention, the community health workers were paid from a research grant awarded to the lead author	**Adherence/Compliance:** Of 141 individuals who met the study inclusion criteria, 76 were able to attend, consented to, and were deemed fit to participate in the preintervention assessments. Eight lost to follow-up. **Longevity of effects:** *not described

			method of providing rehabilitation for PLWH.	organisation, performing basic home-based care for people living in the community. None of these individuals had a background in formal health or rehabilitation provision. They were trained as rehabilitation assistants for our study by the lead author, a registered physical therapist, who also fulfilled a supervisory role throughout the study.		
13	Brown et al., 2016	**Target population:** PLWH; **Recruitment:** patients referred by a member of the multi-disciplinary hospital team for health challenges associated with HIV, treatments, and comorbidities	**Outcome measure:** locomotor performance (6-minute walk test; 6MWT), flexibility, upper and lower limb strength, and health-related quality of life (HRQOL). **Key outcomes:** The Kobler Rehabilitation Class is a novel approach to rehabilitation for adults living with HIV, provided in an outpatient hospital setting supervised by physiotherapists. Physical function and quality of life	**Setting:** outpatient hospital setting.; **Facilitators:** Two physiotherapists	**Intervention strategy:** The Kobler Rehabilitation Class is a physiotherapy-led, supervised group exercise intervention and educational "self-management programme" **Dosage:** twice weekly for ten weeks; **Cost:** *Not described	**Adherence/Compliance:** A total of 95 patients were invited to attend the Kobler Rehabilitation Class. Of these, 92 (97%) started the intervention and completed baseline measurements. Adherence was achieved by 42 (46%) patients, with open access utilised by 34 patients, returning (n = 19) or restarting when non-adherent (n = 15). Reasons for non-adherence from 21 telephone interviews

			improved in the cohort, and patients achieved personal goals. Sub-optimal levels of adherence were observed that may be related to episodic disability experienced by PLWH.			identified physical health challenges, individual factors and time or location issues. **Longevity of effects:** *not described
14	Roos et al., 2014	**Target population:** PLWH with risk factors of IHD; **Recruitment:** Participants were recruited from an HIV outpatient clinic, were included if they were HIV+ on HAART for > six months, 20–65 years of age, ambulatory without an assistive device, and willing to accept randomisation	**Outcome measure:** physiological and anthropometric body measures, perceived stress, activity, and functional capacity; **Key outcomes**: education in combination with a walking program that is mostly dependent on participant self-monitoring has beneficial outcomes.	**Setting:** Home; **Facilitators:** Physiotherapists	**Intervention strategy:** Education and Home-Based Pedometer Walking Program; **Dosage:** 12 months; **Cost:** *Not described	**Adherence/Compliance:** 84 participants were recruited to study, 67 participants at six months, and 51 participants remaining at 12 months; frequency on how often participants wore their pedometers during this period was as follows: 1–3 times per week (n = 5; 17.2%), four times per week (n = 4; 13.8%), five times per week n = 4; 17.2%), daily (n = 6; 20.75%), infrequent use (n = 2; 6.9%), and non-use (n = 8; 27.65).; **Longevity of effects:** *not described
15	Pullen et al., 2014	**Target population:** PLWH complaining of pain, weakness,	**Outcome measure:** morphology, pain, cardiopulmonary fitness, strength, neurological balance, immune markers	**Setting:** Clinic and home; **Facilitators:** Physiotherapist	**Intervention strategy:** exercise and manual therapy; **Dosage:** 30 minutes, three sessions per	**Adherence/Compliance**: Patient fully adhered to the intervention program; **Longevity of effects**: *not described

		and decreased endurance. **Recruitment:** The patient volunteered for the study after attending a health promotion talk at the University Teaching Hospital	(CD4 cell count), and quality of life. **Key outcomes:** The results showed complete elimination of pain and shortness of breath on exertion. The patient showed improvements in the quality-of-life domains of general health, pain, energy/fatigue, social and physical functioning, and emotional well-being. Physiotherapy interventions consisting of exercise and manual therapy appear beneficial in several areas as an adjunct therapy in HIV management.		week, for 12 weeks; **Cost:** *Not described	
16	Jaggers et al., 2013	**Target population:** PLWH with a sedentary lifestyle: not actively exercising ≥three days ·to one week for 20 min per session, with HIV viral load below 75 copies/mL,	**Outcome measure:** Stress level, quality of life, depression. **Key outcomes:** Results show that the home-based PA intervention was not successful in increasing the total amount of MPA for PLWHA. Results indicate that a home-based exercise approach with telephone-based coaching may not be a feasible method for increasing the amount of	**Setting:** Home. **Facilitators:** Two interventionists were trained by a clinical psychologist with expertise in behavioural interventions to implement the Active Choices program (developed at Stanford University).	**Intervention strategy:** Telephone delivered home-based PA program: Active Choices program (developed at Stanford University). Active Choices is a home-based physical activity program that uses theoretically based strategies to help participants make lifestyle changes.; **Dosage:** 6	**Adherence/Compliance:** 94% of those who consented and measured at baseline were randomised to an intervention condition. **Longevity of effects:** *not described

		Capable of performing the required exercise regimen and have daily access to a telephone for approximately ten months; **Recruitment**: All participants were recruited from one of two sites via physician reference or word of mouth	MPA among PLWHA. However, it did appear to decrease sedentary time, indicating some positive changes in activity habits.		months; **Cost**: *Not described	
17	Maharaj and Chetty, 2011	**Target population:** PLWH with complete medical records and adherence to the HAART regime, willingness to attend weekly exercise sessions for three months, and the ability to read, write, and comprehend the	**Outcome measure**: Quality of life: short-form health survey (SF-36); **Key outcomes**: The results support the positive benefits of a rehabilitation program of moderate intensity and a home program of exercises for patients on HAART. The results show a significant increase in all domains of QoL, with a possible achievement of an increase in the function and	**Setting**: outpatient gymnasium of the provincial hospital. **Facilitators:** The researchers were assisted by the medical staff and senior therapists experienced with exercise interventions employed in the hospital and medical school.	**Intervention strategy:** rehabilitation program of moderate intensity cycling and treadmill walking exercises with a home program; **Dosage:** 40 mins exercises and 20 min of rest, once a week over three months; **Cost:** *Not described	**Adherence/Compliance:** 20 (77%) of the experimental and 16 (62%) of the controls completed the program. Thirty-eight (69%) participants completed the 3-month program, with four (15%) women and two (8%) men dropping out from the experimental group and six (23%) women and four (15%) men dropping out from the control group, resulting in a significant

		SF-36 questionnaire. **Recruitment:** patients on HAART were referred for outpatient rehabilitation	participation of activities of daily living.			female dropout from the study of 10 participants (38%). **Longevity of effects**: *not described
18	Parruti et al., 2007	**Target population:** PLWH with advanced HIV infection and multiple disabilities; **Recruitment:** patients who resided in the facility for >6 months and had a Karnofsky score >30 after six months of stay.	**Outcome measure:** Social and occupational abilities were evaluated using the Axis of DMS-IV, as assessed by the Global Assessment of Functioning Scale. Patients' abilities in coping with stressful situations were examined using the Social Dysfunction Rating Scale. **Key outcomes:** As compared to the baseline, the social function mean score significantly increased by 42% after one year of follow-up, and the social stress mean score was significantly reduced by 11%. These findings suggest that occupational therapy may provide a relevant benefit and could be integrated with the	**Setting:** Home care facility.; **Facilitators:** social health workers	**Intervention strategy:** an integrated approach including occupational therapy.; **Dosage:** 6 years; **Cost:** *Not described	**Adherence/Compliance:** Three participants died after 2 to 4 years: two because of end-stage liver disease and one because of wasting syndrome. **Longevity of effects:** Acceptance of the intervention was high, and three patients got outdoor job positions.

			treatment of severely disabled HIV patients.			
19	Chan et al., 2005	**Target population:** (1) a diagnosis of HIV illness; (2) being in a symptomatic stage of infection (CDC stage B or C); (3) being heterosexual male and older than 18 years old; (4) able to comprehend and communicate in Chinese and (5) willing to participate in the study; **Recruitment:** Participants were recruited from a pool of 62 HIV-seropositive heterosexual men, who attended the Clinical AIDS Service of a	**Outcome measure:** Depression, quality of life; **Key outcomes:** there was a significant reduction in psychological distress and improvement in quality of life. These preliminary findings suggested that short-term cognitive-behavioural therapy can be effective in improving the quality of life and mood of Chinese heterosexual HIV-infected men.	**Setting:** hospital.; **Facilitators:** a clinical psychologist specialising in treating HIV-infected patients and a clinical psychologist in training.	**Intervention strategy:** Cognitive-behavioural group program; **Dosage:** 2 hours once a week for seven weeks; **Cost:** *Not described	**Adherence/Compliance:** Eight participants entered the CBP group, and eight participants entered the waitlist control (WLC) group. However, two participants in the CBP group and one from the WLC group dropped out due to practical reasons.; **Longevity of effects:** *not described

		major general hospital.				
20	Harris-Love and Shrader, 2004	**Target population:** PLWH with invasive Kaposi's sarcoma; **Recruitment:** patients referred to outpatient physiotherapy by the attending physician	**Outcome measure:** ambulation, goniometric measures. **Key outcomes:** Patient A progressed to walking 400 feet after a treatment regimen of gait training with the use of custom plastazote sandals. Patient B experienced an 18% reduction in limb volume, a 38% reduction in pain and a 20° increase in terminal knee flexion after therapeutic exercise and the use of compressive bandaging and garments.	**Setting:** rehabilitation medicine department of an acute care hospital.; **Facilitators:** Physiotherapists	**Intervention strategy:** Tailored needs-based physiotherapy intervention; **Dosage:** 4 weeks; **Cost:** *Not described	**Adherence/Compliance:** Both participants adhered/complied with the intervention.; **Longevity of effects**: *not described
21	Gale, 2003	**Target population**: PLWH with symptoms of HIV-related peripheral neuropathy; **Recruitment:** patients referred to physiotherapy clinic	**Outcome measures**: Functional ambulation; **Key outcomes**: Both patients showed decreased symptoms of neuropathy and increased functional abilities and independence after physiotherapy intervention. One patient returned to community ambulation, and the other returned to full-time employment.	**Setting:** Clinic.; **Facilitators:** Physiotherapists	**Intervention strategy:** physiotherapy intervention using joint mobilisation, soft tissue mobilisation, microcurrent, stretching and instruction in self-management; **Dosage**: two to four times monthly for 12 and 18 months; **Cost:** *Not described	**Adherence/Compliance: Longevity of effects:** One patient returned to community ambulation, and the other returned to full-time employment

22	Evans et al., 2003	**Target population:** PLWH with HIV-related peripheral neuropathy who reported pain intensity and functional interference; **Recruitment:** recruited through notices posted in newspapers and at hospitals	**Outcome measures**: pain, symptoms, depression: The Brief Pain Inventory, The Brief Symptom Inventory, the self-report Beck Depression Inventory; **Key outcomes**: Both groups showed significant reductions in pain. The cognitive behaviour group improved in most domains of pain-related functional interference and distress, while the supportive psychotherapy group showed fewer gains.	**Setting:** Clinic.; **Facilitators:** All interviewers were doctoral students in clinical and health psychology programs who underwent extensive reliability training with a consulting psychiatrist. The therapists were graduate psychology students who participated in a training program and attended weekly supervision meetings to protect against drift in techniques and to ensure treatment precision. An expert clinical psychologist monitored and rated the videotaped sessions to ensure adherence to the study protocol.	**Intervention strategy:** cognitive behaviour therapy or supportive psychotherapy.; **Dosage:** 1-hour therapy sessions over the next six weeks; **Cost:** *Not described	**Adherence/Compliance**: 61 patients were recruited; thirty-three subjects completed the protocol. Twenty-eight participants dropped out before week six of the 6-week treatment. More participants dropped out of the cognitive behaviour intervention (N16) than dropped out of supportive psychotherapy (N12). Sixty-four per cent of the dropouts (N18) attended only one session. **Longevity of effects**: *not described

Reach

What is the nature of HIV-related disabilities according to the ICF?

In all the studies, the authors described the target population, inclusion criteria and selected sample size. The target population was made up of PLWH with a range of conditions or symptoms, including risk factors for heart diseases, multiple disabilities, chronic pain, fatigue, neuropathy, and non- AIDS conditions associated with HIV. While some studies focused on multiple aspects of the ICF, seven studies focused on disability in PLWH as a result of an impairment (problems in body structure or function) such as non-AIDS condition associated with HIV (Schnall et al., 2021), cognitive concerns (Quigley et al., 2020), chronic conditions (Webel et al., 2020), chronic pain (Merlin et al., 2018), neuropathic or musculoskeletal pain (George et al., 2017) and symptoms of HIV-related peripheral neuropathy (Gale, 2003; Evans et al., 2003). Three studies focused on disability in PLWH as a result of activity limitations (difficulty carrying out a task or function), such as experiencing fatigue (Lee et al., 2019), pain, weakness, and decreased endurance (Pullen et al., 2014) and a sedentary lifestyle (Jaggers et al., 2013). Two studies (Parruti et al., 2007; Harris-Love and Shrader, 2004) focused on participation restrictions (difficulty in life situations).

How were participants recruited in the study?

The recruitment criteria often focused on medical stability, specific questionnaires, health-related quality of life scales (such as C3Q or SF-36), being on antiretroviral therapy for a specific duration, adherence to HAART regime, sedentary lifestyle, and diagnosis of HIV. The studies used a variety of recruitment techniques, with contacting participants from earlier studies and study registries being the most common approach (Schnall et al., 2021; Webel et al., 2020, Lee et al., 2019, George et al., 2017, Parker et al., 2016), distributing study flyers at community organisations (Quigley et al., 2020, Merlin et al., 2018, Evans et al., 2003), approaching participants through their health worker (Abboah-Offei et al., 2020), utilising community and health organisations (Maharaj and Yakasai, 2018, Daniels and Niekerk, 2018), infectious disease specialists to identify qualified patients (Roos et al., 2014), primary care physicians referring patients (Jaggers et al., 2013, Gale et al., 2003), and referrals from a multidisciplinary hospital team (Brown et al., 2016).

Effectiveness

What outcome measures were adopted in the studies?

Outcome measures varied across the studies and included reduction in symptom burden (Schnall et al., 2020), engagement with healthcare providers, app use and perceived usability, physical and psychological symptoms (Abboah-Offei et al., 2020), quality of life (Quigley et al., 2020, Webel et al., 2020), cognitive function, medication adherence, pain management, coping ability, advance care planning, fatigue severity, physical activity levels, depression, sleep quality, self-efficacy, functional mobility, stress levels, and social and occupational abilities.

Measured outcomes include those related to physiological measures (n=4; 18.2%) evaluated by cardiovascular parameters such as heart rate (HR), blood pressure (BP), maximal oxygen consumption (VO_2max), a saturation of peripheral oxygen (SpO_2); quality of life measurements (n=6; 27.3%) evaluated using self-report questionnaires such as WHO disability assessment schedule (WHODAS), WHOQOL-BREF, short form 36 health survey (SF-36); immunologic measures (n=5; 22.7%) evaluated by CD4 count and viral load; biochemical measures (n=2; 9.1%) evaluated by glucose, lipids, and hs-CRP levels; psychological measures evaluated by (n=5; 22.7%) evaluated by depression, anxiety and self-efficacy levels; anthropometric measures (n=3; 13.6%) evaluated by height measurements, weight measurements and body mass index (BMI); physical function capacity (n=3; 13.6%) evaluated by the 6 minute walk test (6MWT); and pain (n=3; 13.6%) evaluated by the pain rating scale.

What were the key outcomes of the studies?

Overall, the effectiveness of rehabilitation interventions for PLWH showed positive outcomes in various domains, including symptom management, quality of life, physical and functional abilities, pain management, mental health, and social support. The interventions showed promise in improving the well-being of PLWH and addressing their specific needs. Similar themes highlighted from the outcomes of the study include community-based enhanced and telerehabilitation care interventions are feasible and acceptable for PLWH (Abboah-Offei et al., 2020; Piraux et al., 2019), cognitive function improvement (Quigley et al., 2020), improvement in pain scores (Maharaj and Yakasai, 2018; Daniels and Niekerk, 2018), a combination of education, a walking program, self-monitoring and physiotherapy interventions, including exercise and manual therapy, showed benefits in pain elimination,

functional improvement, and quality of life in different domains (Roos et al., 2014; Pullen et al., 2014; Jaggers et al., 2013)

Adoption

Where were the rehabilitation interventions conducted?

HIV rehabilitation interventions can be conducted in various settings based on factors such as the individual needs of PLWH, available resources, and the specific goals of the rehabilitation intervention. In this review, the execution of rehabilitation interventions varied across settings, with majority (n=8; %) of the studies conducted in the clinic (Abboah-Offei et al., 2020; Maharaj and Yakasai, 2018; Webel et al., 2020; Merlin et al., 2018; George et al., 2017; Parker et al., 2016; Gale, 2003; Evans et al., 2003) and seven in the home (Lee et al., 2019; Daniels and Niekerk, 2018; Roos et al., 2014; Pullen et al., 2014; Jaggers et al., 2013; Maharaj and Chetty, 2011; Parruti et al., 2007). Although some studies were multi-centred, incorporating a combination of both clinic and home-based settings, three studies were conducted in outpatient settings of the hospitals (Cobbing et al., 2016; Chan et al., 2005; Harris-Love and Shrader, 2004), two in the community centre (Webel et al., 2020; Parker et al., 2016) and one in a yoga studio (Quigley et al., 2020)

Who provided these rehabilitation interventions?

The adoption of rehabilitation interventions varied across facilitators and was supported by training, supervision, and ongoing support from professionals in the specific intervention domains., with healthcare personnel, researchers, physiotherapists, social workers, peer leaders, and trained volunteers being involved in delivering the interventions. Majority of the studies (n=5) were implemented or supervised by qualified physiotherapists (Brown et al., 2016; Roos et al., 2014; Pullen et al., 2014; Harris-Love and Shrader, 2004; Gale, 2003), clinical psychologists (Chan et al., 2005; Gale, 2003). Social/community health workers (Cobbing et al., 2016; Parruti et al., 2007), trained volunteers (Webel et al., 2020) and research assistants (Parker et al., 2016) played vital roles in delivering the designed rehabilitation intervention program to PLWH. Two studies did not describe the facilitators of their intervention program (Schnall et al., 2021; Daniels and Niekerk, 2018)

Implementation

What intervention strategies were implemented in the studies?

Eight different intervention strategies were implemented to address specific HIV-related disabilities in the studies reviewed. The most common rehabilitation intervention was physiotherapeutic, incorporating a walking program, aerobic exercise, manual therapy, progressive resisted exercise, peer-led exercise, home exercise program, and rehabilitation class. Some of these interventions included a combination of the physiotherapy intervention and an education component (Roos et al., 2014) or relaxation technique (Parker et al., 2016). Other rehabilitation interventions include person-centred care and enhanced care intervention (Abboah- Offei et al., 2020), yoga (Quigley et al., 2020), Mindfulness-Based Stress Reduction (MBSR) (George et al., 2017), Skills to Manage Pain (STOMP) (Merlin et al., 2018), and an intervention to improve sleep quality (Lee et al., 2019)

How were these rehabilitation interventions implemented?

The implementation of rehabilitation interventions varied in terms of dosage, duration, and delivery methods. The studies with the longest duration lasted 36 months (Webel et al., 2020), 18 months (Gale, 2003) and 12 months (Roos et al., 2014), while the minimum timeframe for implementation of the intervention was four weeks (Harris-Love and Shrader, 2004; Chan et al., 2005). The frequency of the interventions varied between weekly, twice weekly, and alternate days, with each session lasting between 30 minutes to 60 minutes. The majority of the studies did not describe the specific dosage and costs incurred in implementing the interventions. Of those who included a financial implication, monetary compensation ranged from CAD$50 (Quigley et al., 2020) to a $25 gift card (Lee et al., 2019). Other forms of payments described include parking reimbursements, bus tickets, childcare reimbursement, and stipends paid from a research grant awarded to the lead author (Cobbing et al., 2016).

Maintenance

What were the adherence, compliance, and uptake rates of these interventions?

Overall, the maintenance of interventions varied across studies, with retention rates ranging from 69% to 97% and varied longevity of effects. Studies with one (Pullen et al., 2014) or two participants (Harris-Love and Shrader, 2004; Gale, 2003) had the highest level of compliance and adherence as the facilitators more closely monitored them. Seven studies did not describe the adherence/compliance rates of participants in their intervention program (Schnall et al.,

2021; Lee et al., 2019; Daniels and Niekerk, 2018; Merlin et al., 2018; Roos et al., 2014; Chan et al., 2005; Evans et al., 2003). Reasons for dropouts include those related to *Logistical Challenges* (Quigley et al., 2020; George et al., 2017; Parker et al., 2016; Chan et al., 2005) such as relocating, scheduling conflicts, transportation issues, weather, and practical reasons; *Health-related issues* (Brown et al., 2016; Cobbing et al., 2016); *Boredom or lack of interest* (Maharaj and Chetty, 2011) and *Unspecified or unknown reasons* (George et al., 2017; Cobbing et al., 2016; Maharaj and Chetty, 2011). *Dropout discrepancy was also observed between interventions* (Evans et al., 2003), with more dropouts in the cognitive behaviour intervention compared to supportive psychotherapy.

8.7 Discussion

In exploring the rehabilitation interventions for people living with HIV (PLWH), the scoping review unveiled valuable insights into the nature of HIV-related disabilities. There is a growing public health imperative to incorporate non-pharmacological care interventions into the comprehensive health framework for people living with HIV (PLWH) as they live longer (O'Brien et al., 2020). The findings from our review of 22 studies indicate a range of rehabilitation intervention strategies that can be utilized to promote health among individuals with disabilities related to HIV. The recruitment strategies, outcomes, settings of adoption, facilitators, implemented strategies, and intervention implementation details explored by the different articles included in the review offer valuable insights into the diverse approaches employed in addressing disabilities associated with HIV. This comprehensive examination forms the basis for a nuanced discussion on the methodologies and challenges of existing rehabilitation approaches.

In addressing the wide range of disabilities that this population faces, this study recognised the multifaceted impact of HIV on individuals, encompassing impairments, activity limitations, and participation restrictions as per the International Classification of Functioning, Disability, and Health (ICF). Although a majority of the studies in this review addressed impairments (problems in body structure or function) identified by immunologic, physiologic, health-related quality of life and anthropometric measures, the inclusive approach of the rehabilitation interventions implemented aligns with person-centred care, acknowledging the individualised needs of PLWH. While Stevens and Nixon (2016) highlighted similar results and called for further research focus on other dimensions of disability, other studies have reported activity

limitations as the most predominant issue affecting PLWH (Banda et al., 2019; Kitilya et al., 2023), particularly in sub- Saharan Africa, which is the epicentre of HIV.

Reach

Based on the burden of HIV disease and disability, it would be expected that low-and-middle-income countries would have a preponderance of rehabilitation interventions to address these challenges. On the contrary, findings from this review reveal that a significant majority of studies (63.6%) were conducted in high-income countries. This concentration may be attributed to well- established healthcare infrastructures, research capabilities, resources, and funding availability. However, the presence of studies in lower-middle-income countries highlights a growing awareness of the importance of rehabilitation interventions in diverse settings. It creates an avenue to explore the feasibility of adopting these interventions in regions with varying resource availability. Thus, understanding the contextual factors influencing the implementation of rehabilitation programs in low and middle-income countries is essential for promoting inclusivity and addressing the unique needs of PLWH in these settings.

The varied recruitment strategies employed underscore the challenges in reaching and engaging PLWH for rehabilitation interventions. Relying on study registries, health worker referrals, and collaborations with community organisations emerged as common approaches. These findings emphasise the importance of establishing diverse recruitment channels to ensure representative study populations. Our findings imply that rehabilitation interventions can be implemented on both small and large scales, given the variation in sample sizes across interventions. Per recommendations and guiding principles for future clinical practice guidelines in HIV rehabilitation (O'Brien et al., 2020), it is beneficial for researchers to adopt recruitment strategies that would increase sample size and maximise participants' exposure to the advantages of rehabilitation interventions.

Effectiveness

The reviewed studies demonstrated positive outcomes in various domains, emphasising the potential of rehabilitation interventions in addressing the diverse needs of PLWH. For example, six studies emphasised the effectiveness of multifaceted interventions, combining education, walking programs, self-monitoring, and physiotherapy. This integrated approach, as demonstrated by Roos et al. (2014), Pullen et al. (2014), Jaggers et al. (2013), Maharaj and

Chetty (2011), Parruti et al. (2007), and Gale (2003), showcased benefits in pain elimination, functional improvement, and quality of life across diverse domains, all reporting statistically significant improvements. The findings collectively highlight the nuanced nature of rehabilitation interventions, with tailored approaches yielding positive outcomes across the range of disability levels in the ICF.

As the field of rehabilitation for PLWH continues to evolve, the positive outcomes observed in these studies provide a foundation for future research and interventions as well as translation to service and policy. In a recent multi-stakeholder consultation (O'Brien et al., 2020), determining the effectiveness of rehabilitation interventions to support healthy ageing with HIV was identified as one of the major research priorities. Subsequently, studies included in our review exploring the integration of innovative approaches, telerehabilitation care, consideration of cognitive concerns, the positive impact of education, physical activity, physiotherapy interventions and the development of multifaceted programs tailored to individual needs are essential lessons that can inform the design and implementation of effective rehabilitation strategies for PLWH.

Adoption

The diverse settings and facilitators of rehabilitation interventions highlight the adaptability of these programs to different contexts. The varied settings in which rehabilitation interventions were executed in the reviewed studies underscore the adaptability and diverse approaches within the field. Most studies (n=8) opted for a clinical setting (Abboah-Offei et al. 2020; Maharaj and Yakasai 2018; Webel et al. 2020; Merlin et al. 2018; George et al. 2017; Parker et al. 2016; Gale 2003; and Evans et al. 2003), emphasising the importance of structured environments for rehabilitation. This choice aligns with the controlled healthcare conditions provided by clinics, ensuring consistent delivery and monitoring of interventions. Conversely, Cobbing et al., (2016) explored home-based rehabilitation interventions for PLWH and described this setting as efficient for low-resource environments where access to institution-based rehabilitation is restricted. In our review, seven studies opted for a home-based approach, acknowledging the importance of tailoring interventions to the daily lives and environments of individuals living with HIV, further bridging the gap between clinical care and the realities of patients' lives and fostering a more patient-centric approach. Multicentre studies combining both clinic and home-based settings, as well as even unconventional settings like a yoga studio,

add another layer of diversity to the execution of rehabilitation interventions that cater to the diverse needs of PLWH.

The diversity of facilitators involved in the delivery of rehabilitation interventions across the reviewed studies underscores the multidisciplinary nature of addressing the complex needs of people living with HIV (PLWH). A significant proportion of studies (n=5) leaned heavily on the expertise of qualified physiotherapists and highlighted the importance of specialised care in addressing physical impairments and promoting functional well-being among PLWH. The expertise of physiotherapists is particularly valuable in designing and implementing exercise-based interventions, which emerged as a common theme across the studies. Clinical psychologists, as observed in studies by Chan et al. (2005) and Gale (2003), brought a psychological perspective to rehabilitation interventions. Their involvement speaks to the recognition of the interconnectedness of physical and mental well-being in PLWH. Addressing psychological aspects, including depression and anxiety, is integral to comprehensive rehabilitation programs, ensuring a more holistic approach to improving the quality of life. Social/community health workers, trained volunteers, and research assistants played crucial roles in extending the reach of rehabilitation interventions. Their involvement not only contributes to the accessibility of interventions but also fosters a sense of community and peer support. However, the absence of detailed facilitator descriptions in two studies (Schnall et al., 2021; Daniels and Niekerk, 2018) raises questions about the replicability of the interventions and may hinder the translation of findings into practice.

Implementation

The array of intervention strategies deployed across the studies reflects the acknowledgement of the multifaceted nature of disabilities among PLWH. Physiotherapy interventions emerged as the cornerstone of rehabilitation strategies, and their prevalence across studies (Roos et al., 2014; Parker et al., 2016; Abboah-Offei et al., 2020; Quigley et al., 2020; George et al., 2017; Merlin et al., 2018; Lee et al., 2019) highlights their efficacy in enhancing physical function and well-being among PLWH. This is not surprising as physiotherapists and occupational therapists have been identified as vital players in the multidisciplinary approach to HIV management. Furthermore, the integration of educational components and relaxation techniques into physiotherapeutic interventions, as observed in studies by Roos et al. (2014) and Parker et al. (2016), signifies a holistic approach to rehabilitation. Education contributes

to empowering individuals with knowledge about their conditions and self-management strategies, while relaxation techniques address the psychological dimensions of disabilities, promoting mental well-being.

Person-centred and enhanced care interventions (Abboah-Offei et al., 2020) represent a shift towards more individualised approaches, recognising the unique needs and preferences of PLWH. Alternative interventions, such as yoga (Quigley et al., 2020), Mindfulness-Based Stress Reduction (MBSR) (George et al., 2017), Skills to Manage Pain (STOMP) (Merlin et al., 2018), and sleep quality improvement interventions (Lee et al., 2019), signify a broader recognition of the interconnectedness of physical and mental health. These interventions address not only the physical symptoms but also the psychological and emotional aspects of living with HIV-related disabilities.

Maintenance

Of the five domains of the RE-AIM framework, 'Maintenance' was the least reported in this scoping review. This lack of information limits a comprehensive understanding of intervention engagement and hinders the potential identification of facilitators, barriers, or predictors of adherence. Although this study suggests that rehabilitation interventions can be successful in addressing HIV-related disabilities, attrition was found to be a significant limitation across the studies. Retention rates ranging from 69% to 97% underscore the need for a nuanced understanding of factors influencing adherence and the lasting impact of rehabilitation interventions. Studies with low sample sizes, such as Pullen et al. (2014), Harris-Love and Shrader (2004), and Gale (2003), demonstrated exceptionally high compliance and adherence rates. This trend suggests that closer monitoring and individualised attention may positively influence participants' commitment to the intervention. However, caution is warranted in generalising findings based on studies with limited sample sizes.

Reasons for participant dropouts encompass a spectrum of challenges, revealing the episodic nature of HIV-related disability and the impact of socioeconomic factors. Thus, moving forward, interventions should prioritise addressing logistical challenges, incorporating participant preferences, and ensuring ongoing support to bolster long-term engagement (Quigley et al., 2020; George et al., 2017; Parker et al., 2016; Chan et al., 2005). In addition,

tailoring interventions to the unique needs and preferences of PLWH may mitigate issues of boredom or lack of interest, promoting sustained engagement over time.

Lessons learnt from the scoping review.

The aim of this study was to extract reproducible intervention strategies from existing studies that can be adopted for PLWH in Nigeria. The result from this review provides empirical support for the integration of rehabilitation interventions in the holistic care of PLWH while acknowledging the multifaceted impact of HIV in the world today. Our findings suggest that rehabilitation interventions demonstrated effectiveness across domains, emphasising the success of various approaches such as education, walking programs, and physiotherapy for pain alleviation, HIV- related disability, and improved quality of life. As shown in table 8.4 above, the most common rehabilitation intervention that can be executed by a physiotherapist are those that involve exercises. Examples include aerobic exercise, manual therapy, progressive resisted exercise, peer- led exercise, home exercise program, and rehabilitation class (Daniels and Niekerk, 2018; Maharaj and Yakasai, 2018). Specifically, the exercises were combinations of aerobic, strength, stretching, and functional exercises such as bicep curls, shoulder raises, triceps pushdowns, and hip, knee, and ankle flexion and extension. These exercises would be considered for inclusion in the developed exercise program.

Warm up and aerobic exercises should be important to the overall programme because of their protective and beneficial effects in cardiovascular health, weight management, immune function, mental health, energy levels, metabolic health, and overall quality of life. Specific exercises targeted at improving muscle strength and flexibility should be evaluated. With HIV-related fatigue and sleep disturbance being common symptoms among PLWH (Voss et al., 2021), physical conditioning which include endurance training and relaxation techniques would aid in mitigating these symptoms and improving overall well-being. Thus, exercise therapy would be effective in the management of HIV-related musculoskeletal problems.

Some of the interventions examined in this review included a combination of the physiotherapy intervention and an education component (Roos et al., 2014). Considering that the end-users would be individuals with varying education levels, the incorporation of an educational component alongside physiotherapy interventions is paramount. It is pertinent that the exercises should be easy to understand and adaptable based on the individual's needs and

choice in order to achieve maximal effect. This ensures that information is disseminated effectively, catering to the diverse needs and abilities of the target audience. Educational workshops on the benefits of exercise for PLWH, along with practical tips for integration into daily life, can address misconceptions and enhance motivation.

The scoping review showed that rehabilitation interventions do not necessarily have to be conducted within the hospital, as some services can be disseminated in community settings or through outreach programs, enhancing accessibility and engagement among PLWH (Abboah-Offei et al., 2020). The adaptability to various settings, including clinics, homes, and unconventional spaces like yoga studios, ensures a patient-centric approach. The state of the built environment in Lagos, Nigeria will be put in consideration when planning the setting in which the exercise will be conducted. Due to the unavailability of free, safe and easily accessible parks and community centers for exercises in Lagos (Lawanson et al., 2020; Obilaonu et al., 2023), the intervention program will be designed to accommodate home-based exercises, utilizing minimal equipment and incorporating exercises that can be performed indoors.

A home-based program also eliminates barriers related to transportation and safety concerns (Cobbing et al., 2016; Morandi et al., 2022). However, the review highlights other limitations posed by maintenance challenges and attrition rates, emphasising the need for closer monitoring and individualised attention to sustain engagement (Collado-Mateo et al., 2021). To promote compliance and adherence, the exercise program will be tailored to individual preferences and abilities, offering flexibility and convenience while promoting engagement and sustained participation. Additionally, establishing virtual support groups or online communities allows participants to connect with others facing similar challenges, fostering social support, motivation, and a sense of community, which are vital for long-term adherence. Furthermore, collaborating with local gyms and sport centers to provide discounted access to exercise facilities or classes expands options for participants and reduces financial barriers. Integrating behavioral change techniques, such as goal-setting and problem-solving skills training, empowers participants to overcome barriers and develop sustainable exercise habits, ultimately improving the long-term effectiveness of exercise programs for PLWH (Bernard et al., 2018).

In conclusion, the scoping review showed that exercise plays a role in the prevention and management of HIV-related disability. The involvement of multidisciplinary facilitators, from physiotherapists to psychologists and community health workers, underscores the complexity of addressing PLWH's diverse needs. Thus, the recommendations for exercise development for PLWH should:

- Explore adapting aerobic, strength, endurance, and stretching exercises to the needs and context of PLWH
- Incorporate health promotion and education on the benefits of exercise for PLWH
- Assess the environment and aim for the program to be accessible, safe, and easily adaptable to various settings, including home-based, community-based, or virtual platforms in order to ensure adherence and compliance.

8.8 Conclusion

Synthesising findings from existing literature, the review underscores the necessity for targeted interventions in rehabilitation care for disability among people living with HIV (deBoer et al., 2019; Brown, 2020; O'Brien et al., 2020). This review gives a spectrum of approaches used to manage disability among PLWH. The intervention strategies for PLWH ranged across physiotherapy interventions, education, self-management, mindfulness programs, and health promotion. The overlap between the interventions suggests that rehabilitation strategies are not mutually exclusive but can synergistically combine to yield more favourable health outcomes. Considering the impact of the implications of HIV on both the quality of life of individuals and the associated healthcare costs, this study provided intervention strategies that could be used to manage HIV-related disabilities. As a result, it contributes to the evolving landscape of HIV care by offering practical insights that help researchers, practitioners, and policymakers create and implement successful rehabilitation programmes.

8.9 Summary of Chapter Eight

This scoping review was conducted to explore current rehabilitation interventions implemented in the management of HIV-related disability globally. The range of rehabilitation intervention strategies included physiotherapy, therapeutic exercise, occupational therapy, supportive psychotherapy, education programs, and other strategies. Most of the studies reviewed used strategies related to health promotion in exercise and health education. In reflecting on the

results of these studies, an intervention program has been developed to address the identified challenges. However, a Delphi study needs to be conducted to ask leading experts what should be included or excluded from the proposed context-sensitive program.

Chapter 9 Development of a contextualised physical activity program for people living with HIV in Nigeria

9.1 Introduction

This chapter aimed to describe the development of a context-sensitive physical activity program for PLWH in a low-resource setting - presented as a manuscript. Building upon insights gathered from the three previous studies – the cross-sectional study that aimed to determine the prevalence of HIV-related disability, health-related quality of life and physical activity level of PLWH, the qualitative study that sought to understand the barriers and facilitators of physical activity participation among PLWH, and the scoping review on rehabilitation intervention strategies adopted in the management of HIV-related disability - encapsulates the collective findings obtained from these investigations. By synthesizing findings from each study, we aim to construct a program that not only addresses the unique challenges faced by PLWH but also fosters sustainable physical activity promotion strategies among PLWH in low-resource communities. Through meticulous analysis and synthesis, this chapter endeavours to address the objectives of phase two of this research, which is to 1). To triangulate data from the previous studies and 2). To explore expert opinion on developing a holistic and context-sensitive physical activity program that caters to the contexts of PLWH in low-resource settings.

9.2 Background

Although physical activity cannot cure or prevent HIV, there is an established body of research that shows the advantages of regular physical activity to enhance short- and long-term results across a range of chronic health issues in people of all ages (Anderson and Durstine, 2019; Lee et al., 2022). These studies demonstrate that engaging in adequate physical activity positively impacts the health-related quality of life of people living with HIV (PLWH)) (Ibeneme et al., 2022). For example, ageing can have significant ramifications for people living with HIV as HIV and ART use affect the ageing process by causing the immune process to age faster than usual (The Lancet, 2022). Thus, even when viral loads are suppressed, and CD4 counts are preserved, PLWH are faced with the double burden of HIV and Anti-Retroviral Therapy (ART) which contributes to higher rates of inflammation triggering the development of cardiovascular, renal, neurocognitive, oncological, and osteoporotic disease (Wing, 2016). The prevalence of these HIV-related conditions is a significant public health concern, with a call for non-pharmacologic interventions (Merlin et al., 2016; Miller et al., 2019).

To achieve positive health benefits, physical activity has been recommended as an effective, non- pharmacological management strategy for several chronic conditions, including HIV (Shim and Noh, 2022). Physical activity is any human movement generated by skeletal muscle contraction at an increased metabolic cost over a basal value at rest (Westerterp, 2013). When this physical activity is carried out in a structured, organised, repetitive manner to improve or maintain physical fitness, it is called exercise. It can be performed in several ways, such as through aerobic exercises, balance training, strength and resistance training, tai chi, and yoga, and can be engaged at moderate to vigorous intensity (Montoya et al., 2019). In the clinical setting and commonly among physiotherapists, regular physical activity is recommended in the management regimen for many conditions except when contraindicated, in which the physical activity prescribed may be modified (Luan et al., 2019).

Global physical activity recommendations aim to reduce sedentary time. The consensus of evidence-based physical activity guidelines is that "adults between the ages of 18 and 64 should engage in 150 to 300 minutes of moderate-intensity aerobic exercise, 75 to 150 minutes of vigorous-intensity aerobic activity, or an equivalent combination of both throughout the week." (Bull et al., 2020). The duration and intensity may be increased for additional benefits and modified across age groups and various conditions. Concerning participation in physical activity, the prevalence of physical activity is low globally (Varela et al., 2021) and among the HIV population (Kitilya et al., 2022). Specifically, people living with HIV face several barriers to meeting the recommended physical activity level. For instance, in Nigeria, PLWH accounts for 3.2% (about 3,229,757) of the adult population (Awofala and Ogundele, 2018), with 66% of those being physically inactive (Edward et al., 2013; Vancampfort et al., 2018).

Considering this, it has been determined that creating efficient methods for improving PLWH's physical activity levels is a vital national health concern. To develop and implement a physical activity intervention program for people living with HIV, a variety of context and setting-specific factors must be considered (Mabweazara et al., 2019). Acknowledging that the prospects for rehabilitation are based on individual functional deficits and must be geared towards providing person-centred interventions (Bristowe et al., 2019), O'Brien et al. (2020) explored the development, implementation, and evaluation of evidence-based physical activity programs among PLWH, which is gaining popularity. For instance, the Disability and HIV

policy brief (UNAIDS, 2017) recommended involving people with disabilities in the planning, implementation, and evaluation of HIV programs. O'Brien et al. (2020) incorporated this recommendation into the development of "The Framework of Research Priorities in HIV, Disability, and Rehabilitation." Their framework identified facilitators and barriers to accessing formal and informal rehabilitation services for PLWH, as well as different models of rehabilitation service provision. Rehabilitation professionals (such as physiotherapists and occupational therapists) present at the forum emphasised the significance of creating interventions aimed at fostering healthy ageing throughout the lifespan of PLWH. However, since the forum was held in Canada with participants from Canada, the United Kingdom (UK), Ireland, and the United States, the framework's applicability to other nations, especially resource-poor countries, remains unknown.

Although a lot of time and effort has been put into describing the health benefits of physical activity among PLWH, and there is a large body of literature on interventions globally (Ceccarelli et al., 2019; Ibeneme et al., 2022; Mabweazara et al., 2023), it is vital to explore the components of physical activity intervention programmes, particularly in public health settings where significant resource constraints exist. Implementing physical activity intervention programmes in low- resource settings has unique challenges that are different from those of developed nations (Pantoja et al., 2017). Furthermore, implementation research at this scale demands in-depth information on what specific implementation strategies would be used, why and how they would be selected and delivered, and how successful they would be in improving physical activity levels among people living with HIV with limited access to social and health care services.

Triangulation of previous studies

This study represents the second phase of this project. Before this present study, the first phase of this project was comprised of three studies aimed at: (1). Determining the physical activity level; (2). Exploring the barriers and facilitators to participation in physical activity among PLWH (3). Reviewing the existing literature on how rehabilitation interventions for PLWH are implemented globally. The analysis of findings from these previous studies employed a methodological triangulation approach. The outcome of this is a more nuanced understanding of appropriate exercise intervention programs tailored for PLWH. The survey revealed that a significant proportion of PLWH in Nigeria do not meet the recommended levels of physical

activity. This finding was corroborated by insights from interviews, which highlighted various barriers to physical activity participation, including socioeconomic factors, cultural beliefs, and stigma associated with HIV. Additionally, the scoping review identified a variety of rehabilitation interventions used in managing HIV-related disability, emphasizing the importance of incorporating physical activity promotion strategies into comprehensive care programs for PLWH.

Through triangulation, it became evident that while PLWH recognize the benefits of physical activity for their health, they face numerous challenges in engaging in regular exercise. These challenges range from individual-level barriers such as fatigue and lack of motivation to broader societal factors like inadequate infrastructure and social stigma. Moreover, the review of rehabilitation interventions strengthened the need for context-sensitive approaches that address the unique needs and constraints of PLWH in low-resource settings like Nigeria. Key outcomes and recommendations from the studies conducted in phase one were extracted in addition to information from the literature review to develop the research questions of this study, as shown in Figure 9.1.

Study	Findings	Contributions to the study
Literature review	• Physical activity is an integral part of HIV rehabilitation and is effective in preventing HIV-related disability by reducing the impact of HIV on physical and mental health. • Public health recommendations state that PLWH need at least 150 to 300 minutes per week of moderate- intensity physical activity to accrue health benefits. • Health care professionals such as Nurses/Physiotherapists educate PLWH on types and benefits of exercises.	• The designed physical activity program should meet recommended frequency and intensity level • Advocacy and recommendation of physical activity participation by healthcare professionals is instrumental towards increasing physical activity level
Cross-sectional study	• Majority of participants had a poor general health perception about their health status; Participants experienced the most limitation in the participation domain (problems encountered because of the society in which they live rather than because of their own difficulties). • 45.7% of PLWH in Nigeria have a low level of physical activity. Male participants showed higher physical activity than female participants (26% vs. 18.9%). • There was a significant difference in physical activity levels by level of education. • Majority of the participants earned less than the national minimum wage of ₦30,000.	Health behaviour theories posit that an individual's knowledge and understanding of health risks and rewards are beneficial for motivating behavior. Thus, education on physical activity types and benefits should be emphasised. Information on physical activity should be easily understandable to people with low education level.
Qualitative study	• Knowledge of physical activity and its benefits exist, but participation in structured physical activity is poor. • Occupational and transport physical activity are the most common forms of physical activity. • Participation in physical activity is dependent on several individual and environmental factors. Barriers such as lack of time, fatigue, unsupportive environment, lack of funding and other social commitments are challenges to physical activity participation among PLWH. Perceived health benefits, habit, influence by others and pain relief are seen as major facilitators. • PLWH acknowledge that having medical support is essential in maintaining a good health-related quality of life but access to rehabilitation support is poor or non-existent. There is no existing referral pathway to physiotherapy inn the HIV centres. • Nurses, Doctors, Physiotherapists are perceived as authority figures by PLWH, and they take their recommendations seriously.	• The physical activity program should be time-sensitive and easily incorporated into participants 'daily activities'. • A safe environment for physical activity participation is essential for the participants. • Healthcare professionals in contact with PLWH should encourage physical activity
Scoping review	• Physical activity intervention programme for people living with HIV were conducted in home-based, clinic- based, and community-based settings. • Physiotherapists and trained assistants supervised the implementation of the physical activity programmes in the clinic and community setting. A self-management approach is adopted in the home-based programmes. • Walking is the most common exercise program for PLWH. Components of rehabilitation programs from other studies include moderate intensity cycling, aerobic activity, stretching, resistance programs and treadmill walking exercises with a home program.	• The program should include exercises aimed at improving strength, endurance and flexibility • The contextual factors that may impact the implementation and effectiveness of the exercise program must be considered

Figure 9.1: Key outcomes of the studies from phase 1 and their contribution to the present study

In summary, the triangulation of findings from the survey, interviews, and scoping review highlights the complex interplay of individual, interpersonal, and environmental factors influencing physical activity among PLWH in Nigeria. These insights can inform the development of tailored interventions and policies aimed at promoting physical activity and improving the overall well-being of PLWH in similar contexts. However, certain gaps exist in the planning and implementation of contextually relevant exercise initiatives for PLWH in resource-limited settings. To address this gap, a Delphi study attaining consensus by a group of qualified experts was considered beneficial.

Delphi study

The main research questions were:

1. what information do PLWH need to know before engaging in physical activity?
2. what are the vital components of a physical activity programme among PLWH in low-resource communities?
3. what are the most appropriate methods to deliver this physical activity programme?
4. what are the vital factors that could influence the success of the physical activity programme?

9.3 Methods

9.3.1 Study design

A consensus-based strategy based on a modified Delphi procedure was used. Designs that rely on consensus, also called "collective agreement," have been used in various contexts, including developing core curriculums, recommendations, and regulations when supporting data is insufficient (Brujins et al., 2020). The Delphi technique is established based on multiple administrations of anonymised surveys, usually in two or three rounds and ensuring feedback to the group in between rounds (Chalmers and Armour, 2019). The Delphi study was conducted online to address the barrier of logistics challenges posed by physical meetings.

9.3.2 Population and sampling

Appropriate selection of the "expert panel members" is vital to ensure robustness and data validity. The inclusion criteria required participants to have a minimum of two years of experience in their specialised field, which was restricted to professionals in physical activity, exercise, or rehabilitation. Furthermore, participants needed to meet at least one of the

following requirements: stakeholder in a clinical decision-making role, experts who work closely for and with people living with HIV, affiliation to HIV/AIDS clinic, membership in physical activity organisations, government entities or universities.

Existing literature in health science recommends a sample size of 8 to 23 participants for a Delphi study (Shang, 2023). Thus, a purposive sampling method was adopted to ensure that the final sample accurately represents specific categories of cases in a sampling universe (Robinson 2014). The researcher obtained contacts through a variety of techniques, including contacting the authors of scientific articles on the application of physical activity intervention, examining conference proceedings pertaining to physical activity intervention in HIV, systematic searches on social media sites (Twitter and LinkedIn), professional networks, and colleagues in the physical activity and HIV field. The second, third and fourth authors recommended experts from connections established over the years in the academic and clinical space.

Potential participants were contacted via email and phone. Individuals who were unable to participate were asked to recommend suitable individuals who met the inclusion criteria. Recruitment continued until the necessary number and variety of panel members was attained. Each panellist was sent complete study details, including the purpose of the Delphi, the scope and timeframe of their anticipated involvement, and instructions on how to give informed consent to participate. All participants gave informed consent before completing each round of the Delphi questionnaire in accordance with the Declaration of Helsinki (2018). Participant information was de-identified, and there was minimal to no risk to the participants. No compensation was provided to participants, and they were informed of their choice to withdraw their participation at any time during the process.

9.3.3 Data collection procedure

Data collection took place between November 2023 and January 2024. The data were collected in two rounds.

Round one: The experts were emailed a link to the questionnaire via RedCap™ (Appendix 12), a privacy note, and information about the research. The online questionnaire asked panel members to provide their biographical information, country, practice environment, and

qualifications. The first round of the Delphi included four sections of five-point Likert scale questions and a free-text comment section that allowed for the suggestion of new opinions on the following – exercise information booklet, FITT, implementation strategies, barriers and facilitators:

1. Exercise information booklet: For people living with HIV to successfully improve their physical activity level, the physical activity programme should include a set of contents that they can understand. Experts were asked to review an exercise information booklet and pre-exercise screening questions. They were then asked to rank their levels of agreement or disagreement with each item and to include other items they considered necessary when designing an exercise information booklet and pre-exercise screening questions for PLWH.
2. FITT: The physical activity program was developed using the 'Frequency, Intensity, Type, Time' (FITT) principle. Experts were asked to review the suggested frequency, intensity, time, and type principle of physical activity. They were then asked to rank their levels of agreement or disagreement with each FITT parameter and to include other suggestions to improve the physical activity program.
3. Implementation strategies: The physical activity programme should be implemented in a context-sensitive setting. Experts were asked to rank their levels of agreement or disagreement in the settings in which the programme can be carried out. Examples of such settings include home-based, community-based, and virtual-based. Furthermore, participants were asked to suggest other settings they considered important to implementing a physical activity program for PLWH in low-resource communities.
4. Barriers and facilitators: Prior to the programme's development, it is crucial to envisage the factors that could limit the effectiveness of the physical activity programme. Experts were asked to review a list of factors that could influence the implementation of physical activity programmes among people living with HIV in Nigeria. Examples of limiting factors include lack of time, lack of resources, and fatigue. They were then asked to rank their levels of agreement or disagreement with these factors and to suggest other factors that could be considered important.

The survey closed three weeks after opening. At weekly intervals, all panel members received a reminder email. Data from the online questionnaire was exported to Microsoft Excel for descriptive analysis (frequencies and percentages) to determine whether each statement had

reached a consensus. The consensus for the first round was set at 70 per cent. Written responses were subjected to a content analysis.

Round two: Based on the feedback and analysed results, the final output for round one was compiled, and a draft of the physical activity program was developed. The round two questionnaires required participants to evaluate each section of the physical activity program to obtain an overall agreement on the developed physical activity program. The content of the physical activity program was divided into four sections, and it included:

- Section one: Exercise information booklet
- Section two: Pre-exercise screening questions
- Section three: Program structure
- Section four: Goals worksheet

A three-week deadline was given for participants to complete and return the questionnaire. Reminders were sent every week. Estimated time of completion for each questionnaire was approximately 15 minutes.

9.3.4 Consensus determination

Participants rated their level of agreement or disagreement with each statement on a five- point Likert scale, which was described as 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree (Shang, 2023). The Delphi approach yielded qualitative and quantitative data from questionnaire responses of both rounds. Although there are various methods of identifying consensus (such as per cent agreement, a measure of central tendency, proportion within a range, and response dispersion) (Grant et al., 2018), this paper adopts a specific approach based on a predetermined level of agreement. In this context, 'level' refers to the degree of consensus (Shang, 2023). Thus, the consensus for the first round was set at 70 per cent, and the second round was set at 80 per cent (summative of agree and strongly agree) for each statement.

9.3.5 Data analysis

Data were summarised using measures of central tendency (mean, median, and mode), frequencies, and percentages to give information about descriptive statistics and the collective

judgements of the expert panel. Qualitative results were analysed using thematic content analysis (Braun and Clarke, 2006) to summarise and present the experts' opinions in tabular form.

9.4 Results

9.4.1 Response rate

Sixty-seven experts were identified for recruitment into the modified Delphi study. Thirty- one experts consented to participate and were recruited (46.3% of target), with twenty- eight respondents at the end of the first round of the Delphi and twenty-four respondents at the end of the second round. The recruitment process is seen in Figure 7.2 below:

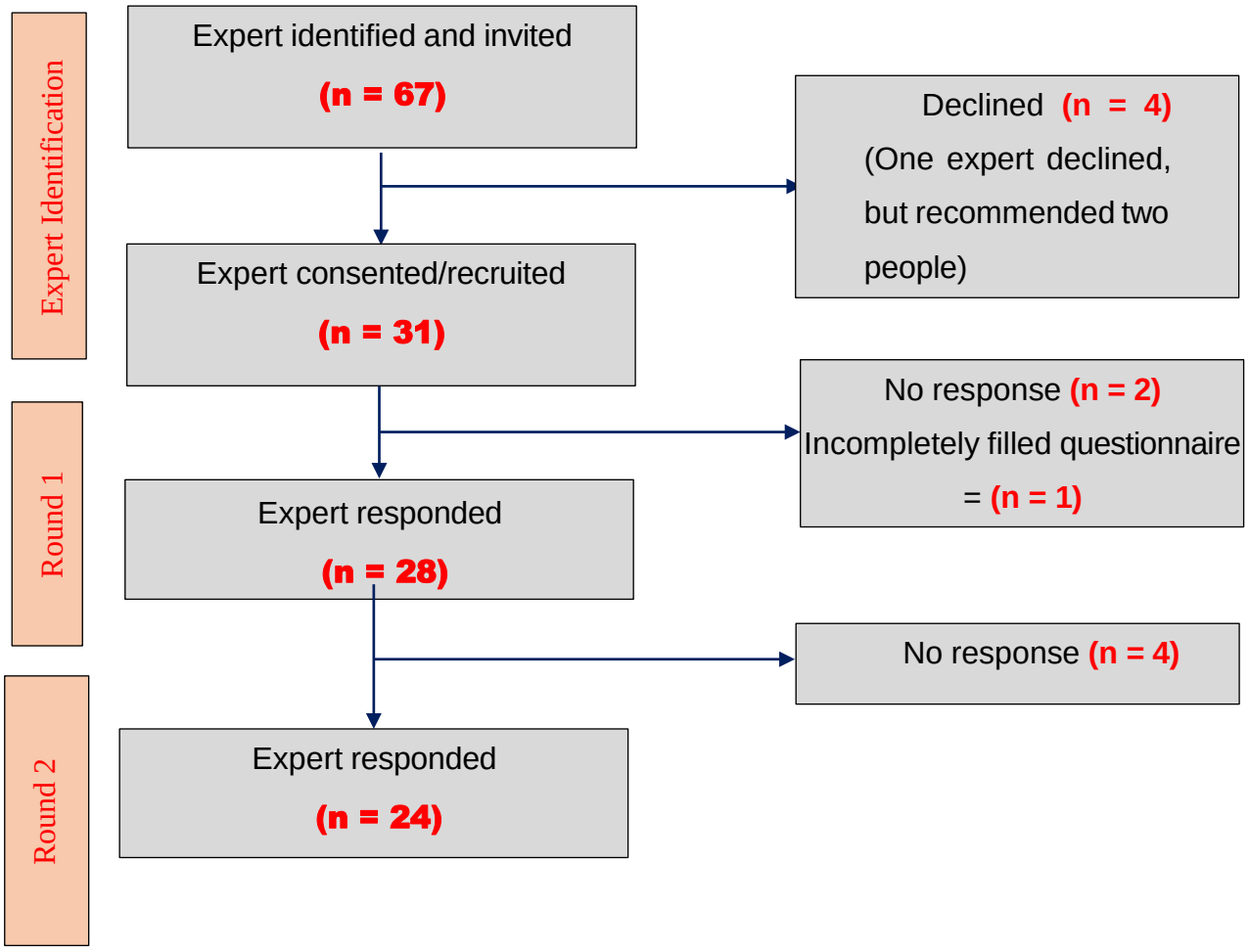

Figure 9.2: Modified Delphi recruitment and process

DELPHI ROUND ONE

9.4.2 Demographic characteristics

A total of 28 participants responded to the questions for the Delphi round one. Physiotherapists represented the highest number of respondents (64.3%). The educational backgrounds of the experts were diverse, with the majority having doctoral degrees (53.6%) followed by 32.1% with master's degrees. They also represent an array of practice settings, with 57.1% and 25% working in university/research and tertiary care settings, respectively. Respondents in this survey had a mean of 14.74 (+6.5) years of experience in their field, with most of the professionals practising in Nigeria (37%). Table 9.1 shows the demographic characteristics of participants in round one of the modified Delphi study.

Table 9.1: Demographic characteristics of the expert panel (n=28)

Demographic information		
Age		
	Mean/SD	41.26±7.96
	Range	30-64
Gender		
	Male	22 (78.6)
	Female	6 (21.4)
Designation		
	Physiotherapist	18 (64.3)
	Medical Doctor	3 (10.7)
	Biokineticist and exercise specialist	3 (10.7)
	Researcher	2 (7.1)
	Exercise physiologist	1 (3.6)
	Public health professor	1 (3.6)
Highest level of university qualification		
	Bachelor's degree	2 (7.1)
	Postgraduate Diploma	2 (7.1)
	Master's degree	9 (32.1)
	PhD	15 (53.6)

Years of experience		
	Mean/SD	14.74 (6.5)
	Range	5-29
Country of practice		
	Australia	1 (3.7)
	Canada	3 (11.1)
	Ethiopia	1 (3.7)
	Nigeria	10 (37.0)
	South Africa	2 (7.4)
	Thailand	1 (3.7)
	United Kingdom	5 (18.5)
	United States	4 (14.8)
Practice setting		
	Primary care	3 (10.7)
	Tertiary care	7 (25.0)
	Private practice	2 (7.1)
	University/research	16 57.1)

9.4.3 Physical activity program

SECTION 1: EDUCATION PROGRAM

Exercise information booklet: All the experts had over 90% agreement on the sub-sections of the exercise information booklet. Additional suggestions on enriching the content of the exercise information booklet were also provided.

Table 9.2: Exercise information booklet

Exercise information booklet sub-sections	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Why exercise?	0	0	0	5 (17.9)	23 (82.1)
What are the benefits of exercise for people living with HIV/AIDS?	0	0	0	4 (14.3)	24 (85.7)
What types of exercise are suitable for people living with HIV/AIDS?	0	0	1 (3.7)	4 (14.8)	22 (81.5)

How much activity should you do?	0	0	0	9 (32.1)	19 (67.9)
Special considerations before commencing your exercise program	0	0	0	7 (25.0)	21 (75.0)
Getting started: planning your exercise program	0	0	0	7 (25.0)	21 (75.0)
Sustaining your exercise program	0	0	0	7 (25.0)	25 (92.6)

SECTION 2: PRE-EXERCISE SCREENING QUESTIONS

Pre-exercise screening questions: All the experts had over 90% agreement on the sub-sections of the pre-exercise screening questions. One (3.6%) respondent disagreed with including questions about diabetes history, and 2 (7.1%) disagreed with including questions about any diagnosed muscle, bone, or joint problems in the pre-exercise screening questions.

Table 9.3: Pre-screening questions

Pre-exercise screening questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Has your doctor ever told you that you have a heart condition, or have you ever suffered a stroke	0	0	0	11 (40.7)	16 (59.3)
Do you experience unexplained pains in your chest at rest or during physical activity/exercise	0	0	0	6 (21.4)	22 (78.6)
Do you ever feel faint or experience dizziness during physical activity/exercise that causes you to lose balance?	0	0	0	4 (14.3)	22 (85.7)
Have you had an asthma attack requiring immediate medical attention at any time over the last 12 months?	0	0	1 (3.6)	10 (35.7)	17 (60.7)
If you have diabetes (type 1 or type 2), have you had trouble controlling your blood glucose in the last three months?	0	1 (3.6)	1 (3.6)	10 (35.7)	16 (57.1)
Do you have any diagnosed muscle, bone, or joint problems that you have been told could be made worse by participating in physical activity/exercise?	0	2(7.1)	0	9 (32.1)	17 (60.7)
Do you have any other medical condition(s) that may make it dangerous for you to participate in physical activity/exercise?	0	0	0	8 (28.6)	20 (71.4)

SECTION 3: PROGRAM STRUCTURE

FITT: Three times a week was considered the most appropriate exercise frequency (85.7%), followed by four times a week (60.8%). 'Self-paced with a gradual progression' of intensity was considered the most appropriate level of intensity (85.7%) for PLWH to engage in physical activity. Vigorous intensity had the highest level of disagreement (46.4%) among the participants. With regards to the duration of exercise, 30 minutes was considered the most appropriate duration for implementing a physical activity programme for PLWH (85.2%), followed by 45 minutes (75%).

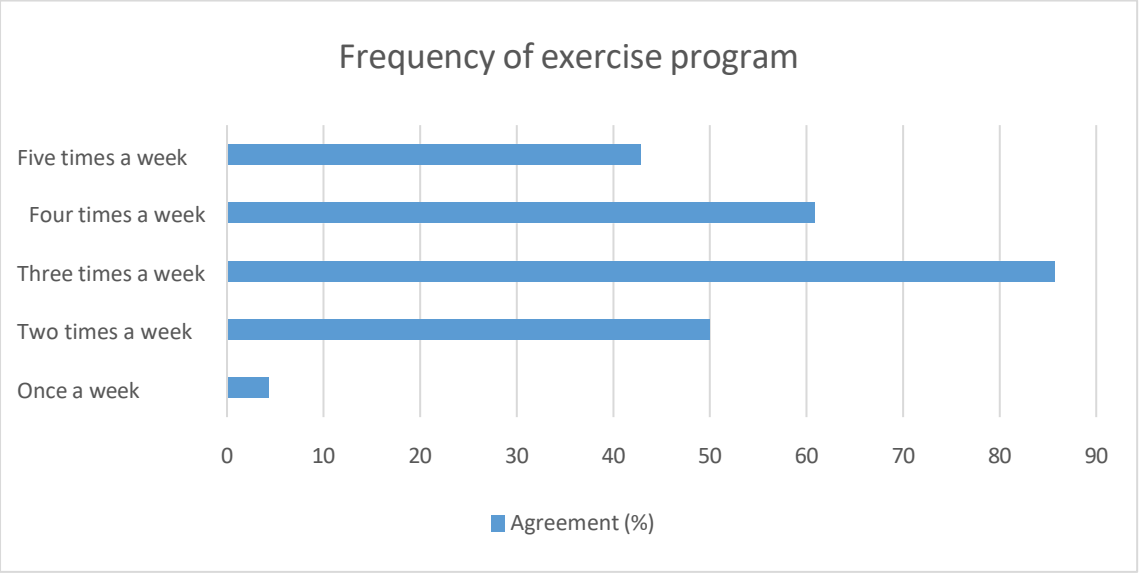

Figure 9.3: Frequency of exercise program

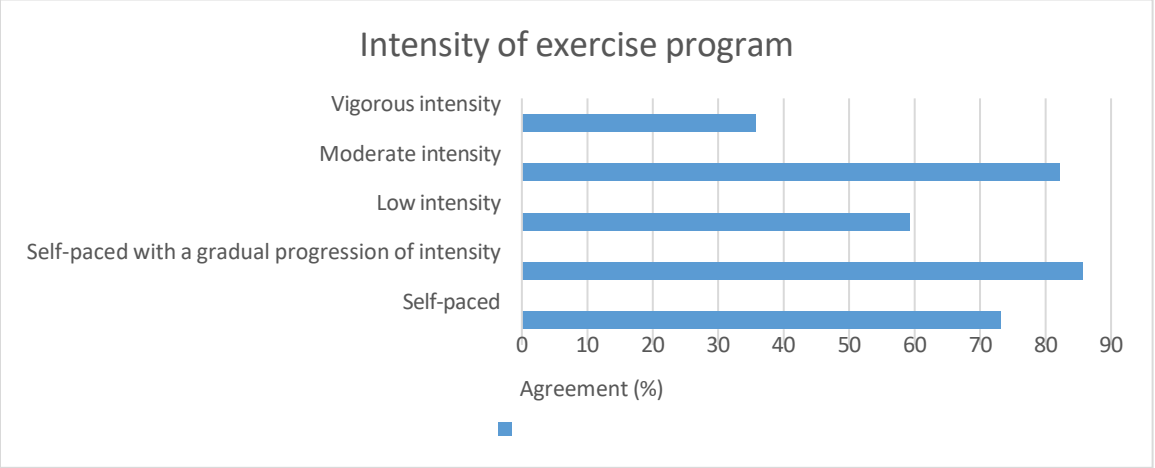

Figure 9.4: Intensity of exercise program

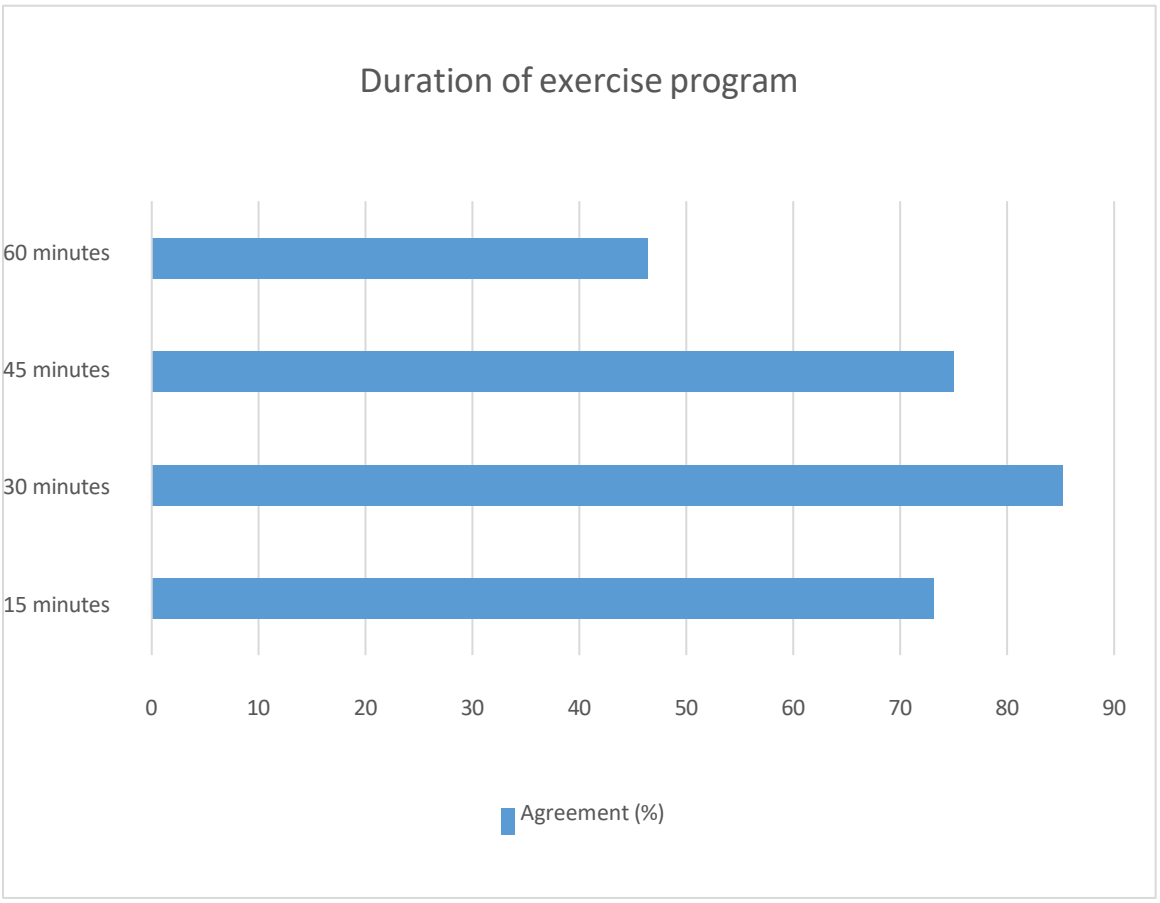

Figure 9.5: Duration of exercise program

Types of exercise: All suggested exercise types had over 80% agreement level, except for jump rope, in which 14.8% of the participants disagreed and 48.1% were neutral. All forms of strength training exercises suggested had over 70% agreement level.

Table 9.4: Types of exercise

Aerobic activity	Strongly disagree	Disagree	Neutral	Agree	Stronglyagree
Warm-up 5 – 10 minutes	0	0	2 (7.1)	7 (25)	19 (67.9)
Brisk walking	0	0	2 (7.1)	10 (35.7)	16 (57.1)
Low-impact aerobic dance activities	0	0	5 (17.9)	7 (25)	16 (57.1)
Jump rope	0	4 (14.8)	13 (48.1)	9 (33.3)	1 (3.7)

Cool down for 5-10 minutes	0	0	2 (7.1)	7 (25)	19 (67.9)
Strength training	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Seated upper body rotation with weight	1 (3.8)	1 (3.8)	4 (15.4)	13 (50)	7 (26.9)
Squats	0	0	5 (18.5)	13 (48.1)	9 (33.3)
Glute bridge	0	0	3 (11.5)	15 (57.7)	8 (30.8)
Push-ups	0	2 (7.7)	5 (19.2)	16 (61.5)	3 (11.5)
Straight leg raises with resistance band	0	0	3 (11.5)	13 (50)	10 (38.5)
Flexibility	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Yoga class	1 (3.6)	2 (7.1)	5 (17.9)	10 (35.7)	10 (35.7)
Dynamic lunges	0	0	4 (14.3)	16 (57.1)	8 (28.6)
Static calf stretches	0	0	3 (11.5)	13 (50)	10 (38.5)
Overhead triceps stretch	0	0	3 (11.1)	`15 (55.6)	9 (33.3)
Hamstring stretch	0	0	3 (10.7)	13 (46.4)	12 (42.9)
Cat cow pose	0	0	3 (12)	14 (56)	8 (32)
Shoulder rolls	0	0	3 (11.1)	14 (51.9)	10 (37)
Knee to chest	0	0	4 (14.8)	13 (48.1)	10 (37)

Equipment: All proposed exercise equipment had over 70% agreement level, except for pillows, which 44.4% of the participants responded to as neutral.

Table 9.5: Exercise equipment

Exercise equipment	**Agree (%)**
Exercise ball	85.7
Exercise Mat	81.5
Pillows	55.5
Resistance bands	92.8
Dumbbells	89.3
Towels	81.4
Balance board	74

Context: Concerning the factors to consider when designing a context-sensitive exercise program for a person living with HIV, participants had over 85% level of agreement on the listed factors

Table 9.6: Contextual factors that influence participation in exercise

Contextual factors	Agree (%)
Participant's financial capacity	85.7
Participant's motivation	100
Participant's functional requirements	100
Previous exercise/sports experience	88.5
Participant's availability	100
Participant's access to resources	96.4
Availability of professional support	92.9
Time of day	92.6

Setting: All suggested settings had over 70% agreement level, except for virtual based, which had a cumulative 60.8% agreement, 17.9% of the respondents disagreeing and 21.4% neutral.

Table 9.7: Exercise setting

Setting	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Home-based	0	0	1 (3.7)	5 (18.5)	21 (77.8)
Community-based	0	0	1 (3.7)	5 (18.5)	21 (77.8)
Clinic-based	0	4 (14.8)	2 (7.4)	9 (33.3)	12 (44.4)
Virtual	0	5 (17.9)	6 (21.4)	12 (42.9)	5 (17.9)

i. Synthesis of suggestions from round one

Table 7.8 below shows the synthesis of all additional comments by the experts. The suggestions were categorised into themes using thematic content analysis.

Table 9.8: Synthesis of suggestions from round one

Theme	Synthesis of suggestions
Safety precautions	Emphasise the importance of starting slowly and gradually increasing exercise intensity.
Adaptations for different fitness levels	Provide modifications for exercises to accommodate diverse fitness levels and physical abilities.
Exercise environment:	Discuss suitable locations for exercise, considering factors like accessibility, safety, and availability of resources.
Group vs. Individual exercise programs:	Compare the benefits and considerations of group and individual exercise programs, highlighting the potential social support and accountability in group settings.
Behavioural strategies for exercise promotion	Encourage individuals to restart if initial attempts are unsuccessful and address when it is appropriate not to exercise.
Addressing myths about exercise	Counter misconceptions about exercise for people living with HIV in Nigeria, focusing on non-weight loss benefits to prevent discouragement.
Multicomponent exercise	Emphasise the importance of including various types of exercises to target different muscle groups and aspects of fitness.
Prioritisation of low-cost equipment	Emphasise the importance of affordable or homemade equipment for individuals with financial constraints.
Individual goals, capacity, and interest	Emphasise the importance of tailoring exercise programs to meet individual needs, preferences, and capabilities while considering personal interests and goals.
Diverse settings for exercise	Emphasise the importance of individual preferences in choosing the exercise setting, acknowledging that what works best for one person may differ from others based on personal preferences and circumstances.
Documented instructions	If feasible, pictures/diagrams should be given to them.
Scheduled review and feedback	Recommends scheduled review and follow-up sessions to monitor progress and provide participant feedback, fostering accountability and motivation.
Supervision and safety	Advises on the importance of supervision by exercise professionals, particularly considering rapid health status changes, age-related factors, concurrent health conditions, and ensuring exercise safety.

DELPHI ROUND TWO

DEMOGRAPHIC CHARACTERISTICS

A response rate of 86% was attained in round two, with 24 of the 28 participants from round one responding in round two. The sections below outline the results of round two.

SECTION 1: EXERCISE INFORMATION BOOKLET

All the experts had over 85% agreement on the sub-sections of the exercise information booklet. Additional suggestions on enriching the content of the exercise information booklet were also provided.

Table 9.9: Exercise information booklet

Exercise information booklet FAQs	Agree (%)
Do the FAQs cover a comprehensive scope?	87.5
Have the contents of the FAQs been comprehensively addressed?	91.7
Is the overall content of the exercise information booklet comprehensive?	87.5

SECTION 2: PRE-EXERCISE SCREENING QUESTIONS

There was over 85% agreement by the experts on the pre-screening questions.

Table 9.10: Pre-exercise screening questions

Pre-exercise screening questions	Agree (%)
Do the pre-exercise screening questions cover a comprehensive scope?	87.5
Is the overall content of the exercise information booklet comprehensive?	91.3

SECTION 3: PROGRAM STRUCTURE

Synthesis and collective feedback of all panel members' Round 1 responses was used to develop the exercise program guide draft (Appendix 13)

Table 9.11: Program structure

Program structure	**Agree (%)**
Do the exercises described above cover a comprehensive scope?	91.7
Is the overall concept of the program structure comprehensive?	91.7
Does the physical activity goals worksheet address the intended objectives?	95.9
In general, are the contents of the exercise program suitable for people living with HIV in low-resource settings?	95.8

SECTION 4: IMPLEMENTATION STRATEGY

The experts had ≥ 80% consensus agreement on this section's items, indicating measures to ensure compliance and adherence to the exercise program.

Table 9.12: Implementation strategy

Implementation strategy	Agree (%)
Does the action plan for ‘adherence’ cover an effective approach?	82.4
Is the action plan for ‘compliance’ comprehensive?	91.3

ii. Synthesis of suggestions from Round 2

Figure 7.6 below shows the synthesis of all additional comments by the experts. The suggestions were categorised into themes using thematic content analysis.

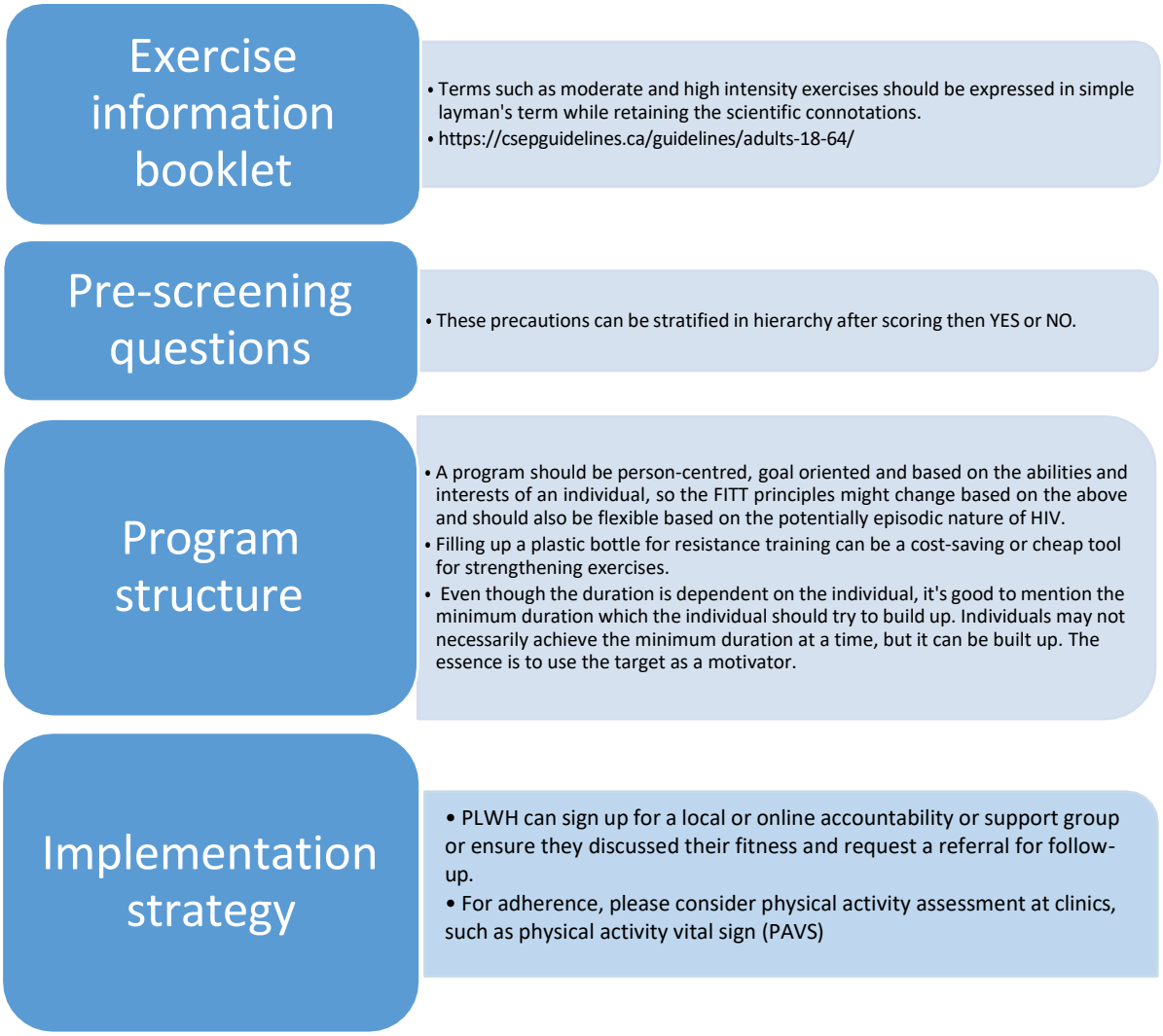

Figure 9.6: The synthesis of all additional comments by the experts

9.5 The developed physical activity program

This study aimed to develop a physical activity program for people living with HIV-related disability in Nigeria. Data were collected by cross-sectional survey, in-depth interviews of PLWH, a scoping review of relevant studies, and a modified Delphi study. The developed physical activity program was named ‘National Exercise Upgrade Program - NEXUP’ because it symbolizes a national initiative aimed at upgrading and enhancing the exercise and fitness levels of individuals with disabilities. The term "upgrade" signifies a positive transformation or improvement, reflecting the program's goal of promoting better health and well-being through physical activity. Additionally, "national" emphasizes the widespread reach and inclusivity of the program across Nigeria, highlighting its accessibility and potential impact on a broad scale. The NEXUP is thereby presented below:

NATIONAL EXERCISE UPGRADE PROGRAM (NEXUP) HANDBOOK

CONTENTS

PURPOSE	3
FREQUENTLY ASKED QUESTIONS	5
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AEROBIC ACTIVITIES	12
STRENGTH TRAINING ACTIVITIES	14
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PURPOSE

This handbook was developed to support people living with HIV in low-resource settings to improve their physical activity level. It shows you different exercises that can be done, gives you information about how to safely exercise, and stay motivated even if you do not have access to fancy gyms or equipment. The goal is to provide you with the tools you need to feel better and stay healthy, no matter where you live or what you can access.

We have included lots of different exercises for you to try out.
Start with the ones you like and find easy. Then, as you get stronger, you can try some of the other exercises too. Each week, aim to do a bit more than before. It is important to do exercises you enjoy. Remember to warm up before you start and stretch afterwards.
You can do these exercises at home, in your neighbourhood, or at a gym. We hope you will feel better and stronger with each week.

Safety first: Before you start any exercise, including using this handbook, talk to your healthcare professional to ensure it is safe.

FREQUENTLY ASKED QUESTIONS

Why exercise?

- Do you want to feel better, move better and sleep better? Experts now say that any physical activity counts toward better health - even just a few minutes!
- Staying active is important for people living with human immunodeficiency virus (HIV)

What are the benefits of exercise for people living with HIV/AIDS?

A well-designed physical activity program can help make your HIV treatment more effective and give you more energy.
Also, certain antiretroviral (ART) drugs increase your risk of developing health conditions such as unhealthy cholesterol, changes in body fat., type 2 diabetes, heart problems or weak bones. Both aerobic activity and strength training improve these health problems.

Note: There is no evidence that regular moderate exercise suppresses the immune system.

What types of exercise are suitable for people living with HIV/AIDS?

Aerobic activity and Strength training are very important for people with HIV because they can help slow down the loss of muscle or bone, sometimes caused by the virus or HIV medications.

Although Aerobic activity and strength training are at the heart of a program for those with HIV/AIDS, you may enjoy and benefit from other options such as playing outdoors, dancing, yoga, flexibility exercises, gardening, and balance training.

How much activity should you do?

Build up to doing at least 150 minutes a week of moderate-intensity activity (like a brisk walk, light bike, water exercise or dancing). Remember: Fit in 5 or 10 minutes here and there. Alternatively, go for 20-30 minutes. Be active, however, and wherever you can.

Will any medications you are taking affect how you respond to exercise?

Many HIV drugs can cause side effects, including diarrhoea, dizziness, headaches, fatigue, fever, muscle aches, nausea, and vomiting. Work with your healthcare team to adjust your activity program.

Planning your exercise program

Keep It Simple: Sit less and move around more! Take a walk, dance in the kitchen. Take the stairs. Find opportunities to move throughout the day. It all adds up.

Be Active with a Friend: Do activities that you enjoy and find an activity buddy at home or work. Those who exercise with a friend tend to stick with it longer than those who go it alone.

Motivation: Use an activity tracker or smartphone app to measure your progress and stay motivated.

Sustaining your exercise program

• Consider your fitness level before engaging in vigorous exercise. If you exercise at too high of an intensity, you will tire out quicker.

• Progress may be slow at first. Start at a comfortable effort level

• Total activity time is more important than intensity. Start low and go slow!

• If you have pain for more than 2 hours after activity, go shorter and easier next time.

• Warm up and cool down at a leisurely pace before and after exercise.

Note: Exercise is not only for people who want to lose weight. Being physically active can improve your brain health, reduce the risk of disease, strengthen your bones and muscles, and improve your ability to do everyday activities.

Special considerations before commencing your exercise program.

Complete a pre-exercise screening from your doctor, physiotherapist, or healthcare provider. Talk to your healthcare provider before commencing your exercise program, especially if you are having HIV-related symptoms or side effects from ARTs.

PRE-SCREENING QUESTIONS

The pre-screening assessment is to create a safe and tailored exercise plan that aligns with your health status, fitness goals, and preferences. Regular reassessments may also be recommended to adjust exercise programs as individuals progress or if there are changes in their health status.

Pre-exercise screening questions	Yes /No
Has your doctor ever told you that you have a heart condition, or have you ever suffered a stroke?	▫
Do you experience unexplained pains in your chest at rest or during physical activity/exercise?	▫
Do you ever feel faint or experience dizziness during physical activity/exercise that causes you to lose balance?	▫
Have you had an asthma attack requiring immediate medical attention at any time over the last 12 months?	▫
If you have diabetes (type 1 or type 2), have you had trouble controlling your blood glucose in the last three months?	▫
Do you have any diagnosed muscle, bone, or joint problems that you have been told could be made worse by participating in physical activity/exercise?	▫
Do you have shortness of breath at rest or with mild exertion? / Do you have trouble breathing when you lie down or sleep? / Do you feel unusual fatigue or shortness of breath with usual activities?	
Do you have any fear of exercise, or have you had any previous injuries from exercising?	
Do you have any other medical condition(s) that may make it dangerous for you to participate in physical activity/exercise?	

MY EXERCISE PROGRAM

This program is expected to be easy to learn, accessible and cost-effective to execute. WHO recommends that people living with HIV should:

- Do at least 150-300 minutes of moderate-intensity aerobic physical activity weekly.
- Do muscle-strengthening activities at moderate or greater intensity involving all major muscle groups two or more days a week, as these provide additional health benefits.
- For “moderate intensity”, this involves exercises where you can still talk, but you’re working hard enough that holding a conversation becomes more difficult. Your muscles would feel tired after completing a set of 8 to 12 repetitions while, for “greater intensity”, you should feel like you’re pushing yourself, and after 6 to 8 repetitions, you may need to rest because of the level of effort required. Talking during this level of intensity is difficult.
- As part of their weekly physical activity, PLWH should do varied multicomponent physical activity that emphasises functional balance and strength training at moderate or greater intensity three or more days a week to enhance functional capacity.
- The amount of time spent being sedentary should be limited. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits.

A key point in this handbook is to encourage you to adopt a physically active lifestyle based on your goals, capacity, interest, and access to resources.

Thus, the following exercises have been curated to suit the various settings in which the exercise can be conducted.

WARMING UP ACTIVITIES

These include activities that can be carried out to get your body warmed up. These activities require no equipment and can be conducted at home, the gym, the community, and the clinic.

Shadow punches (sitting)

Sit on a chair with your feet placed on the floor. Alternate stretching one arm at a time toward the ceiling with a clenched fist.

Shadow punches (standing)

Stand with your feet hip-width apart and your arms in a boxing position in front of your body. In turns, box by stretching your arms out with clenched fists in front of your body.

Marching on the spot (sitting)

Sit on a chair. Lift your feet alternately from the ground.

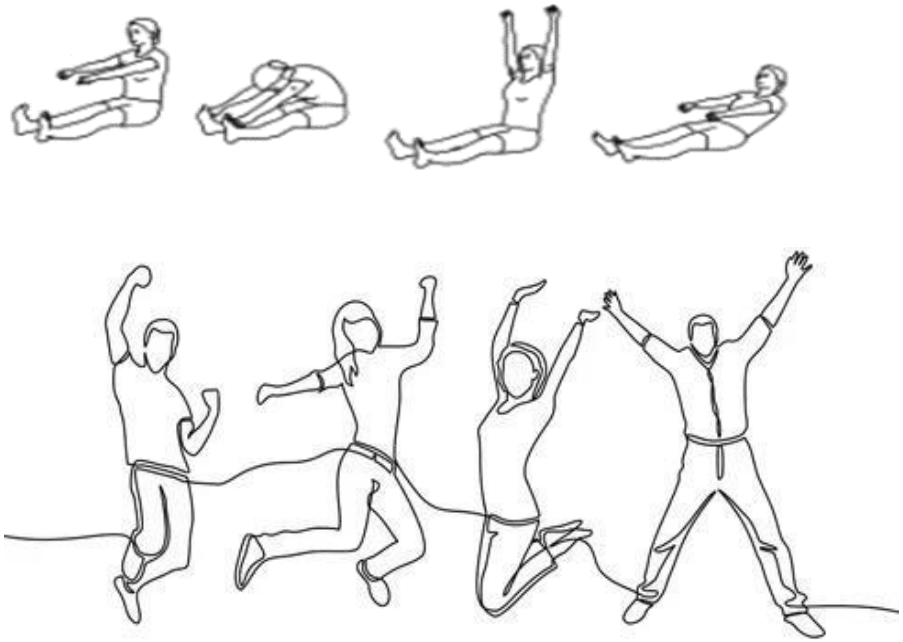
Marching on the spot

Stand with a chair in front of you and use the backrest to support yourself with one hand. Lift your feet alternately from the ground. Use your other arm for arm swing movement as you "walk".

Shoulder roll

Draw large circles with your shoulders. Roll the shoulders backwards, upwards, forwards, downwards and then back to the starting position in a fluid motion. Proceed directly with a new repetition without stopping.

Low-impact aerobic dance activities can also serve as warm-up exercises. You can engage in these exercises with or without music.



AEROBIC ACTIVITIES

These include activities that increase your breathing and heart rate by about –64-76% of the maximum heart rate. The examples below require no equipment and can be conducted at home, in a gym, community, or clinic.

Brisk walking

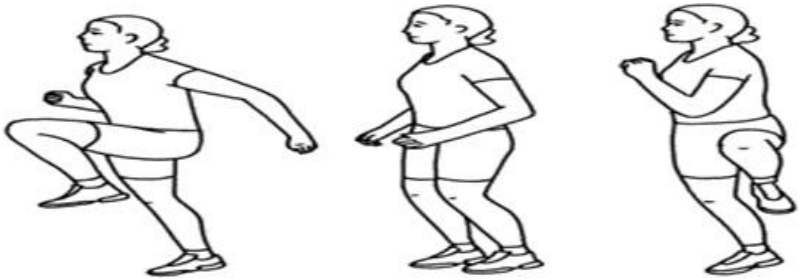
Keep a good posture and head straight. Use your arms actively, especially when setting up the speed. Keep your shoulders relaxed. Strike the ground first with your heel, roll through the step from heel to toe and push off with your toes.

Skipping

Start the exercise with a few jumps to find the rhythm. Jump up and down by actively using your ankle joint. Your shoulders must be relaxed during the entire exercise, and it is your wrists that create movement in the rope.

Jumping jacks

Jump to the side with both legs simultaneously as you lift your arms over your head.



Jump with knee lifts in different directions.

Jump forward with one knee moving forward and then sideways; repeat alternately.

STRENGTH TRAINING ACTIVITIES

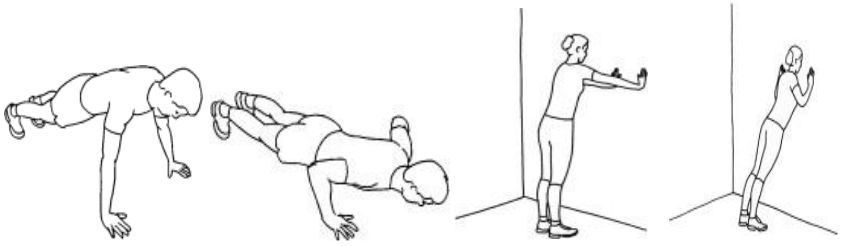
Strengthening exercises are designed to increase the strength of specific groups of muscles by loading the muscles. These activities can be carried out in different settings depending on the choice and availability of resources. For exercises that require weight or resistance, common household items such as a water bottle filled with water can replace gym equipment such as a dumbbell.

Glute bridge

Lie on your back with the soles of your feet on the floor and your arms out to the side. Tilt your pelvis backwards. Raise your pelvis from the floor until you lie on your shoulder blades only. Lower and raise slowly

Squat

Stand with a hip-width space between the legs. Bend down until approx. Ninety degrees in the knee, stretch the buttocks out as you would take a seat on a chair, and at the same time, move the arms forward.



Push up

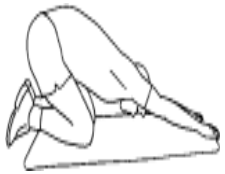
These can be done against the floor or the wall. Place both hands on the surface. Lower yourself towards the wall by bending your elbows. Press yourself out by extending your arms. Slowly return to the starting position. The exercise should be painless and performed with an even movement.

Rowing movements

Sit on a chair or lie on your back with your feet on the ground. Stretch your arms forward as you lean forward with your upper body. Move your trunk back again and pull your arms towards your chest at the same time. Slowly lower back and repeat.

FLEXIBILITY EXERCISES

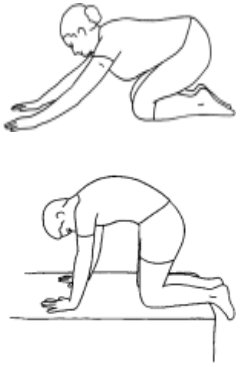
Flexibility exercises are designed to improve flexibility and mobility. It is best incorporated with rhythmic breathing exercises. These exercises can be done without any equipment or accessories.



Child's pose

Sit on your knees and lower your upper body toward your thighs. Stretch your arms forward above your head and feel your back stretch. Hold the position for 30 seconds.

Cat and cow stretch



Get down on your knees, resting on your hands. Tighten your stomach muscles. Slowly bend your back and ensure you feel the stretch in the back muscles. Repeat the exercise by making a curve with your back.

Back rotation exercise

Sit on the buttocks with spread legs. Place your palms against each other and bring them to the outside of your left knee. Stretch the arms and sit up straight. Sit on the buttocks with spread legs. Place your palms against each other and bring them to the outside of your left knee. Stretch the arms and sit up straight.

Dynamic hamstring stretch

Lie in a supine position with your legs bent. Grasp the underside of the thigh with both hands and pull the knee towards your chest. Alternately, stretch and bend the knee joint to stretch the hamstring muscle dynamically. You will feel the most tightness when your leg is straightened."

BALANCE EXERCISES

Balance exercises are designed to improve stability and coordination, helping you stay steady on your feet and reduce the risk of falls

Single leg stand on a balance cushion.

Stand on a pillow (or fold a mat and stand on that). Stand on one leg with the knee a little bent. Hold the other leg out in the air and grab hold of your hips with your hands. Try to keep your balance.

Plank

Position yourself on hands and toes, with your body forming a straight line from your shoulders to your ankles. Hold this position for some seconds

Knee Standing Balance

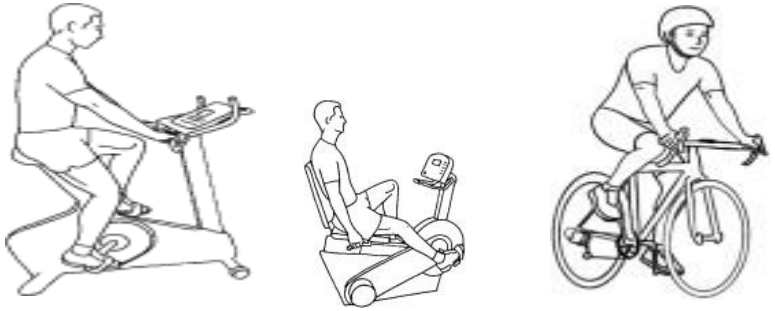
Stand on your knees on a mat with your hands placed in your side. Move one leg forward and place your foot on the mat. Slowly move it back to starting position.

EXERCISES WITH EQUIPMENT

Depending on availability and accessibility to exercise equipment and accessories, the following exercises can be conducted in the gym, community, or clinic. They can also be modified by replacing certain equipment with household items as appropriate.

Treadmill

You can choose a program and start the treadmill, or just press start. Press plus/minus to change speed, and arrow up/down to change inclination. To finish, press stop.

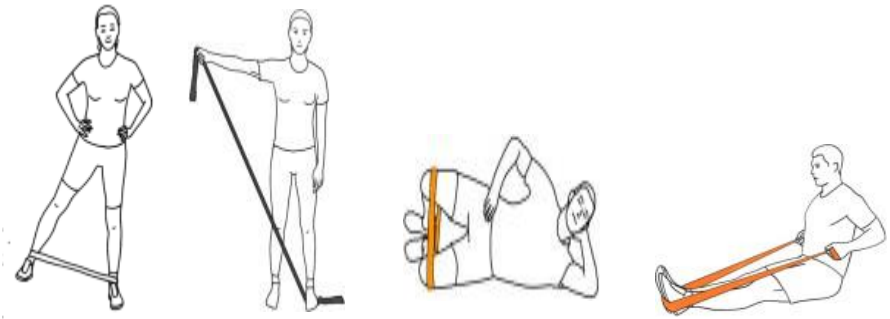


Cycling

You may choose a program and start the cycle or just press quick-start. To change the resistance, press plus or minus, and to finish, press stop.

Seated Upper Body Rotation with ball and weight plate

Sit on a big ball with your feet stable on the ground. Hold a weight plate in your hands and your arms extended in front of your chest. Move the weight plate from side to side by rotating your upper body.

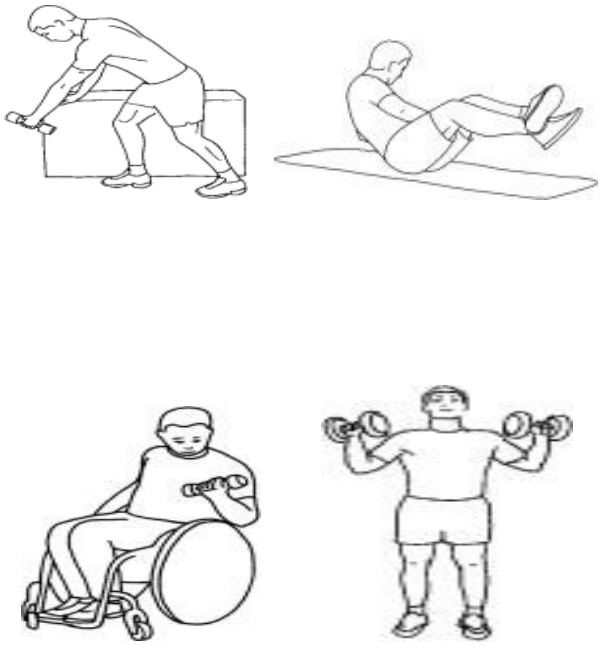


Exercise band

Various strengthening exercises can be conducted with a resistance band. Secure the band around the ankles, knee or foot. Stretch one leg out to the side with your toes pointing forward. Slowly go back to the starting position and repeat.

Hand weight/Dumbbell

Various strengthening exercises can be conducted with a dumbbell, kettlebell or any hand weight. Bend forward with a dumbbell in one hand, supporting your other hand on the bench. Let your arm with the dumbbell hang down and move it back and forth.



Sit on a mat holding a dumbbell in both hands. Slightly lean back and lift both legs off the ground. Rotate your body by moving the dumbbell from side to side.

EXERCISES AT HOME

Doing some activities at home as part of your daily routine

House chores

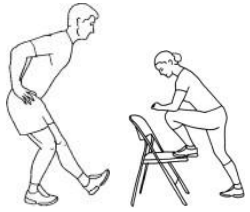
Doing housework such as fetching water from a well, pounding food, and handwashing clothes helps build upper body strength.

COOL DOWN AND STRETCH

You can finish your exercises by marching at a relaxed pace for 1-2 minutes, then perform the following stretches.

Chest stretch

Sit upright on a chair with a chair back. Lift your arms and place them behind your head. Lean backwards towards the chair back as far as you can. Exhale at the bottom position and relax before inhaling and bending forward as far as you can. Let your elbows lead the movement.



Calf stretch

Stand upright with the active leg placed on a chair or something similar; your knee is flexed. Put some weight on the leg with your elbow. Feel it stretch at the backside of your lower leg (calf). Hold the position, return to the starting position, and repeat.

HELPFUL TIPS

We have created four different categories, each with a few activities that you can pick from to mix and match. You can pick your favourite exercises to create your routine.

MY EXERCISE GOALS WORKSHEET

My goal

The things I currently do for physical activity are? (*what forms of exercises do you do at present?)*	
My goals for physical activity are? (*what do you aim to achieve by doing exercises?*)	
Activities I would like to try? (*from the exercises above, choose at least one from each category*)	
What could stop me from achieving my goal? (*are there any factors that could limit you from participating in exercise?*)	
What can I do to overcome this?	

My plan

When will I do my exercises?	Mon/Tue/Wed/Thur/FriSat/Sun
How many times in a week will I do my exercises?	
How many minutes per session of exercise?	
How much exercise will I do?	

Evaluation

Have I achieved my goal?	
What actions have I taken?	
What could I do differently next time?	

Exercise Diary

Date (e.g. Monday 2nd)	**Comments** (e.g. did not do a specific exercise)

9.6 Discussion

The primary aim of this Delphi study was to develop a physical activity program for people living with HIV in low-resource communities, with consideration of the Nigerian context. To consolidate expert knowledge about the physical activity program, participants were recruited across different areas of expertise to form an expert panel. The panel was to contribute to the program development process by evaluating the proposed program and providing recommendations to enhance the exercise program (Shang, 2023). The draft exercise program was divided into four sections based on the identified subgoals. The guide sections focused on educational content, the designed exercise program, and motivational strategies to improve exercise participation.

1. Educational content

While PLWHs may have general knowledge and awareness of exercise and its importance, experts from our study agreed that specific information regarding the role of exercise among PLWHs is important. As evidenced by comments from the qualitative study exploring barriers and facilitators of physical activity participation among PLWHs in Nigeria (Oladejo et al., 2024) (in press), if PLWHs are provided with information regarding exercise, they are more likely to proactively engage in behaviours that promote their overall health and well-being. Specific information on exercises for PLWH offers participants the much-needed awareness and knowledge about the health benefits of exercise, how to commence an active lifestyle, what is required to start the programme and how to achieve the programme's goals (Haseler et al., 2019).

The information provided emphasises the importance and benefits of exercise for people living with HIV/AIDS. The FAQs section challenges misconceptions about exercise, stressing that it is not solely for weight loss but offers numerous health benefits, including improved brain health, disease risk reduction, and enhanced functional capacity for daily activities. It also acknowledges that the recommended duration for physical activity is at least 150 minutes of moderate-intensity exercise per week (World Health Organisation, 2023). However, daily routines that include transportation activities and occupational activities such as walking to work, walking as an aspect of work (hawking), and doing housework such as fetching water from a well can be integrated to contribute to achieving the weekly target of 150 minutes of moderate-intensity exercise (Lee et al., 2021; Evans et al., 2022). Although not traditionally

considered exercise, these everyday activities significantly promote physical health and can supplement structured exercise routines in the Nigerian context.

2. Pre-exercise screening questions

Before commencing any exercise program, individuals should undergo a pre-exercise screening and consult with healthcare providers (ACSM, 2018; Armstrong et al., 2018), especially if experiencing HIV-related symptoms or ART side effects. Considering the lack of accessible healthcare providers, the experts suggested that a set of easy-to-understand pre-exercise screening questions should be compiled to help identify underlying health conditions or risks that could be exacerbated by physical activity. Screening questions allow healthcare providers to assess factors such as cardiovascular health, musculoskeletal issues, or medication side effects, which may impact the safety and suitability of exercise (Armstrong et al., 2018). Thus, by understanding an individual's health status and potential risks, healthcare providers can tailor exercise recommendations to accommodate specific needs and limitations. Furthermore, pre-exercise screening empowers individuals to participate in their health and well-being actively. This self-awareness fosters a sense of empowerment and autonomy, promoting long-term adherence to exercise programs and overall health management.

3. The designed exercise program

Within this Delphi study, the experts' opinion on the FITT of the exercise program was captured by administering structured questionnaires and conducting iterative rounds of feedback and consensus-building discussions (Shang, 2023). Most experts agree that the exercise program should incorporate aerobic exercises, strength training exercises, flexibility, and balance exercises. A recurrent suggestion by the experts is for the selected exercise to be based on the abilities and interests of an individual. It is of utmost importance that context-sensitive exercise programs are tailored to the needs of the target population (Ma et al., 2021). Regarding this, the experts recommended that in a low-resource setting, exercise regimens should be designed to necessitate minimal or no equipment. Readily available household items can be repurposed where equipment is necessary to fulfil the intended objectives. For example, filling up a plastic bottle for resistance training can be a cost-saving tool for strengthening exercises.

While acknowledging that the duration of exercise varies according to individual capabilities (Box et al., 2019; Rooney et al., 2023), it is beneficial to establish a minimum duration for individuals to aim for and gradually build upon. Attaining the minimum duration may not be immediate, but it serves as a motivational benchmark. Therefore, individuals are encouraged to self-regulate their duration and intensity, ensuring gradual progression over time. The setting in which the exercise is conducted depends entirely on the individual, with each location having advantages and disadvantages, necessitating careful consideration of factors such as accessibility, safety, and environmental conditions (Li et al., 2017). For example, while an individual might prefer to attend group exercise sessions in a community for the benefit of having an accountability or support group, this might not be feasible for someone who has limitations interacting in a social setting and would instead conduct their exercises at home (Morandi et al., 2022). The experts recommend that the exercise program design should include clear documentation with easily understandable exercise descriptions supplemented with pictorial representations where applicable. This suggestion is important because clear and comprehensive documentation facilitates understanding and adherence to the exercise program (Collado-Mateo et al., 2021), especially in low-resource settings where access to professional supervision may be limited.

4. Motivational strategies to improve participation in the exercises

Factors that could act as barriers and facilitators were identified in the context of the target population and ranged from individual characteristics to external environmental conditions. Availability and access to resources, such as exercise facilities, parks, or community programs, play a crucial role in determining participation levels (Collado-Mateo et al., 2021). The experts suggested that financial capacity plays a significant role as people with low socioeconomic power may face barriers to engaging in physical activity and have limited access to recreational facilities. In contrast, those with convenient access are more likely to participate regularly. Furthermore, professional support, including guidance from fitness trainers, physical therapists, or healthcare professionals, can positively influence participation by providing personalised exercise recommendations, monitoring progress, and addressing any concerns or barriers faced by participants (Cunningham and O'Sullivan, 2021; Collado-Mateo et al., 2021).

Thus, the exercise program was designed to prioritise individuals to take an active role in their health and well-being. By understanding their limitations and capabilities, individuals can

make informed decisions about participating in physical activity and adopt strategies to ensure adherence (Bullard et al., 2019; Collado-Mateo et al., 2021). The experts advised enhancing the exercise program's effectiveness using an exercise goals worksheet, which helps clarify objectives, establish realistic targets, and track progress over time. With their exercise goals tailored to their unique needs, preferences, and abilities, PLWH can use the exercise program to improve accountability and stay motivated to achieve their physical activity goals (Lachman et al., 2018).

9.7 Conclusion

Using a Delphi method, we have developed a program focused on improving physical activity levels through educational content, a designed exercise regimen, and motivational strategies. The educational component emphasised the importance of exercise, dispelling myths, and integrating daily activities into weekly activity targets. Pre-exercise screening questions were proposed to identify health risks and tailor exercise recommendations, promoting self-awareness and safety. The designed exercise program incorporated aerobic, strength, flexibility, and balance exercises, emphasising individual capabilities and minimal equipment requirements. Motivational strategies addressed barriers and facilitators, such as financial capacity and access to resources, aiming to empower individuals to take an active role in their health. An exercise goals worksheet was recommended to enhance accountability and motivation, facilitating goal setting and progress tracking. Overall, the program prioritised individual empowerment and tailored approaches to promote sustained participation in physical activity among people living with HIV in low-resource settings.

Chapter 10 Integrated discussion

10.1 Introduction

This chapter presents a consolidative discussion of the findings produced by this doctoral research study titled “HIV-Related Disability: Development of a Contextualised Physical activity Program”. Four studies were conducted, and six manuscripts were produced from the studies. The insights gained from these studies offer valuable contributions towards the developed physical activity program. For studies one and two, data were collected from seven HIV and AIDS testing and treatment centres in Lagos, Nigeria. Study three was a scoping review of available evidence, and study three was a modified Delphi process with an expert panel. A descriptive overview and key findings from the six manuscripts are provided, followed by a synthesised discussion of the results, including the study’s limits and strengths. The overall study results are from a collective of four studies whose results are represented as chapters in Table 10.1

10.2 Overview of studies

Four studies were conducted to address the study's aim, which is to develop a context-sensitive physical activity program for people living with HIV-related disability. The first study was a cross-sectional study with three objectives which were to explore the prevalence of HIV-related disability (chapter four), the health-related quality of life of PLWH (chapter five), and the physical activity level of PLWH (chapter six). In Chapter Seven, a qualitative study was conducted to explore the nuanced experiences of PLWH concerning contextual factors that influence their participation in physical activity. Chapter Eight mapped the range of rehabilitation strategies using a scoping review method. In Chapter Nine, the physical activity program was developed, and a Delphi study sought an expert panel's opinions to improve the program.

Table 10.1: Overview of studies

	Phase one			**Phase two**
	Study one	**Study two**	**Study three**	**Study four**
Objectives	To determine the pattern and prevalence of HIV-related disabilities, health status and physical activity level among people living with HIV in Nigeria	To determine the barriers and facilitators to physical activity participation among PLWH in Nigeria	To identify the implementation strategies adopted in the rehabilitation of disability experienced by PLWH	To develop the exercise-based intervention program
Data needed	The pattern of disability, medical symptoms, health status, physical activity level	Experiences on factors influencing physical activity participation	Rehabilitation programs for people living with HIV-related disability	Triangulated results from study one to three
Study design	Cross-sectional study	Qualitative study	Scoping review	Modified Delphi study
Study setting	HIV/AIDS Testing and Treatment Centres in Lagos	HIV/AIDS Testing and Treatment Centres in Lagos	Virtual	Virtual
Source of data	MSQ, WHODAS 2.0, MOS-HIV, IPAQ	One-on-one interview	Relevant data (published and unpublished).	Expert panel
Sample size	384 participants	Minimum of 15 participants	There is no limit on the number of studies to be included.	Minimum of 30 participants

	Study one	Study two	Study three	Study four
Inclusion criteria	Participants had to be adults (18 years and above) who had commenced ART at least six months before the commencement of the study.	Participants had to be adults (18 years and above) who had commenced ART at least six months before the commencement of the study.	Studies that include PLWH, who were 18 years and over. Studies on implementation strategies for rehabilitation of disability among PLWH conducted in a clinical (hospital and primary health care facility), home, or community-based setting.	Participants had to meet at least one of the following requirements: stakeholder in a clinical decision-making role, experts who work closely with PLWH, affiliation to HIV/AIDS clinic, membership in physical activity organisations, government entities or universities.
Procedure and instrumentation	Questionnaires collected information on the demographic data, medical symptoms experienced, the pattern of HIV-related disability, health-related quality of life and physical activity level.	PLWH were interviewed to understand their experiences of disability, their perceived barriers, and their facilitators of physical activity participation. The interviews were audio-recorded and transcribed verbatim.	The Joanna Briggs Institute Reviewers Manual 2020: Methodology for JBI Scoping Reviews was adopted	The Delphi study was used to obtain consensus among purposively sampled experts in physical activity, HIV, rehabilitation, and implementation.

	Study one	Study two	Study three	Study four
Data analysis	Descriptive statistics of the mean, standard deviation, and frequency. Inferential statistics	Thematic content analysis was used to identify themes from the qualitative data. The data was analysed and managed using MAXQDA software.	A narrative review of the number of studies found that addressed the research topic, study designs, and the variety of secondary health condition prevention strategies.	Descriptive analysis (frequencies and percentages). Answers to open-ended questions were coded through a content analysis approach. Based on the feedback and analysed results, the final output for each round was compiled.
Outcome	Disability level provided information on the severity of HIV-related disability. Physical activity level and perceived health status provided information on the relationship between their current health state and their rehabilitation needs.	Understanding the factors associated with physical activity participation was used to design a need-based rehabilitation programme.	Data from this phase provided knowledge on the research gaps that exist in the literature regarding the implementation of rehabilitation strategies in the management of HIV-related disability.	Consensus agreement on the developed context-sensitive physical activity program for PLWH

The study findings emanated from four studies whose key themes are outlined in Figure 10.1

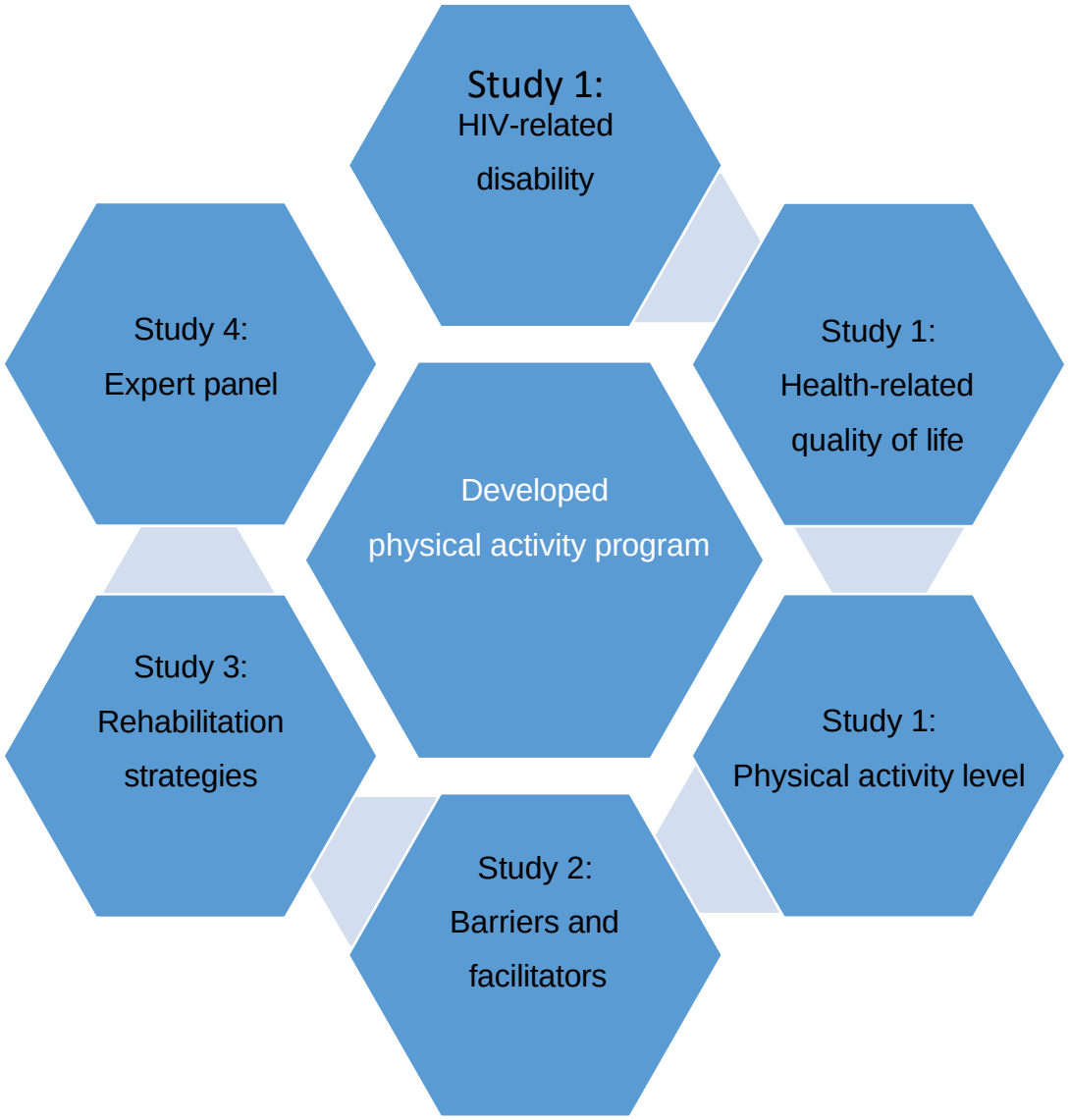


Figure 10.1: schematic diagram of the key themes in each study

The main findings from each study chapter are described below:

10.2.1 Chapter four - Prevalence and predictors of HIV-related disability among people living with HIV in Nigeria

The objectives of this study are:

1. To determine the prevalence of HIV-related disability among PLWH in Nigeria.
2. To analyse the sociodemographic factors that may influence the prevalence of disability among PLWH in Nigeria

The prevalence of HIV-related disability was identified. In this present study, over one-third (39.5%) of the participants reported having a disability as measured by the WHODAS 2.0. Compared to a similar survey conducted in the United Kingdom, where 70.5% of the participants reported moderate disability levels (Brown et al., 2022), the prevalence of HIV-related disability in our study is relatively lower. Likewise, studies from the United States and South Africa revealed disability prevalence of 86% and 51.3%, respectively (Kietrys et al., 2019). In an earlier study conducted among PLWH in Nigeria, 71.1% of the participants were reported to have mild to extreme disabilities (Olaleye et al., 2017). Several factors could be responsible for the disparity between our results and those of other countries. Factors such as differences in availability and accessibility to healthcare infrastructure, cultural perspectives of disability and variations in socioeconomic status could have influenced how PLWH in the United Kingdom, United States and South Africa reported their disability. It can be inferred that advancements in HIV care and treatment in Nigeria between 2017 and 2022 have led to a reduction in disability levels experienced by PLWH in Nigeria.

Among the six domains of the WHODAS 2.0, participants in our study experienced the most disability in the participation domain (31.7%) and had the least disability in the self-care domain (10.6%). The high prevalence of disability in the participation domain is a common finding in HIV studies, as evident in earlier studies conducted in Malawi (Banda, 2019), South Africa (Myezwa et al., 2018) and the Asia-Pacific region (Rajasuriar et al., 2022). The results of these studies show that despite the relatively low disability experienced in the self-care domain, the extent of participation restriction among PLWH is excellent, suggesting that PLWH may have fewer difficulties in performing basic activities of daily living but encounter severe limitations in other aspects of life that involve human relationships such as engaging in community activities, holding a job, and social inclusion. The implication of this further highlights the multidimensional nature of disability among PLWH (O'Brien et al., 2009).

Furthermore, an analysis of the predictors of HIV-related disability revealed that marital status and education level were sociodemographic factors significantly associated with disability. Understanding the nuanced relationship between sociodemographic variables and disability level is vital to healthcare professionals and policymakers aiming to develop tailored rehabilitation interventions. This study's result is important to this thesis's overall theme as we are better informed about the prevalence of functional limitation among PLWH and its impact on their overall quality of life. Recognising disability as a potential indicator of health status and quality of life underscores the importance of developing interventions to reduce HIV- related disability and improve quality of life.

The key findings from this study are outlined below:

- The prevalence of disability among PLWH and receiving antiretroviral therapy (ART) in the study sample was 39.5%.
- Disability levels were lower than expected based on previous literature, with the most disability reported in the participation domain and the least in the self-care domain.
- Marital status and education level were significantly associated with disability status among PLWH.
- The study highlighted the need for tailored interventions to address the unique challenges faced by PLWH in Nigeria.

Conclusion: With a prevalence rate of 39.5%, the findings highlight the importance of addressing disability as a critical aspect of HIV care and management. It is noteworthy that disability levels were lower than anticipated, with variations across different domains. The significant associations observed between disability status and factors such as marital status and education level reveal the significance of socio-demographic variables in shaping the experiences of PLWH.

10.2.2 Chapter five – Health-related quality of life and associated factors among people living with HIV in Lagos, Nigeria: A cross-sectional study.

The objectives of this study are:

1. To determine the health-related quality of life among PLWH in Nigeria.
2. To analyse the sociodemographic factors that may influence the health-related quality of life among PLWH in Nigeria

Health-related quality of life was assessed using the MOS-HIV, and findings from this study revealed that the total physical health score (PHS) and mental health score (MHS) of HIV/AIDS in Lagos, Nigeria were 54.2 ± 5.3 and 56.3 ± 6.7 respectively. To the best of our knowledge, this study was the first to assess HRQoL among PLWH in Nigeria using the MOS-HIV. When results were compared with findings from other studies in sub-Saharan Africa, it was revealed that participants in our study had better HRQoL (Palermo et al., 2013; Harding et al., 2014). In another study conducted in Belgium (Degroote et al., 2013), the reported PHS (55.6) and MHS (52.0) scores were similar to ours. Another study in Ireland reported that the mean PHS and MHS scores were 56.3 (46.8–60.3) and 50.8 (41.3–57.5) respectively (George et al., 2016). From these comparisons, it can be observed that HRQoL outcomes vary by country and region, and these distinctions may be ascribed to variances in healthcare infrastructure, access to treatment, and cultural perceptions of health.

When examining the subscales, several trends emerge. Participants in our study had the highest scores in the mental health and health distress domains, indicating better mental well-being compared to physical health. Similar to our study results is the finding by Zhong et al. (2023) conducted in China, where participants also scored the lowest in the general health perception domain. According to the health belief model, the perceived susceptibility and severity of a health condition, combined with several interpersonal and external factors, could cause poor perceptions of their health (Houlden et al., 2021). Factors that could act as a threat to the HRQoL of PLWH range from stigma, cultural factors, socioeconomic factors, and physical factors such as pain, fatigue, and adverse effects of ART medications (Zhu et al., 2019).

The impact of medical symptoms on overall quality of life is often underestimated. Similar to previous studies (Zhong et al., 2023; Zhu et al., 2019), this study found that most participants experienced a cluster of symptoms frequently reported among PLWH. Specifically, headaches, weight loss, and muscular pain were reported among 36.6%, 27.8% and 16.9% of the participants, respectively. Furthermore, the duration of HIV infection was an independent risk factor that was strongly linked with the PHS and MHS scores of PLWH in this study. Thus, irrespective of associated medical symptoms, HIV comorbidities or any complicating circumstances, the probability of developing physical and mental health issues increases as one gets older with HIV. The long-term implications of this serve as a public health concern requiring interventions that address ageing in HIV.

Aside from "duration of HIV", other factors associated with higher HRQOL in the univariate analysis conducted in this study were education level, marital status, and income level. With the majority (70%) of the participants educated only up to secondary school level and over half (59.3%) of the participants in our study earning less than ₦30,000 ($65.07) monthly, it is evident that PLWH in Nigeria encounters significant socioeconomic difficulties which in turn increases their susceptibility to HIV-related disability and serves as barriers towards achieving high HRQoL. The impact of education and financial level on the quality of life among PLWH in low-resource countries has been explored in previous studies (Diress et al., 2022; Nigusso and Mavhandu-Mudzusi, 2021; Zhong et al., 2023). Due to limited access to healthcare professionals, lack of access to income from social grants in Nigeria, and inadequate healthcare infrastructure, PLWH in Nigeria are faced with the double burden of living with HIV/AIDS and socioeconomic challenges. Thus, there is a significant public health need to develop easily accessible, low-cost solutions in response to the needs of PLWH.

The key findings from this study are outlined below:

- The mean Physical Health Summary Score (PHS) and Mental Health Summary Score (MHS) measured by the MOS-HIV were 54.2 ± 5.3 and 56.3 ± 6.7, respectively.
- Participants scored highest in the mental health and health distress domains, indicating better mental well-being compared to physical health.
- Socioeconomic disparities, including education and income levels, influence the quality of life among PLWH, highlighting the need for interventions to address these disparities.
- The duration of HIV infection was significantly associated with both the Physical Health Summary Score (PHS) and the Mental Health Summary Score (MHS)

Conclusion: The scores derived from the MOS-HIV revealed relatively favourable mental well-being compared to physical health among participants and strengthened the importance of holistic care approaches that address both physical and mental health needs in the management of HIV. Additionally, the influence of socioeconomic factors such as education and income levels and the duration of HIV infection on quality-of-life outcomes emphasise the importance of ongoing support and intervention efforts for PLWH throughout the disease trajectory.

10.2.3 Chapter six – Physical activity level among people living with HIV in Nigeria: evaluation of adherence to recommended levels.

The objectives of this study are:

1. To determine the physical activity level of people living with HIV in Nigeria
2. To identify sociodemographic factors associated with physical activity levels among people living with HIV in Lagos, Nigeria

The results of the cross-sectional survey conducted in this study revealed that 45.5% of people living with HIV in Nigeria had low physical activity levels. Similar findings were reported in China, where the level of low physical activity among PLWH was 46.2% (Zou et al., 2022). Despite this prevalence falling short of the World Health Organisation (WHO) recommended guidelines, even poorer scores were reported in Ethiopia, where 68% of PLWH were physically inactive (Tegene et al., 2022). With physical inactivity being one of the four modifiable risk factors (smoking, physical inactivity, alcohol use, and unhealthy diet) for non-communicable diseases, such low levels of participation in physical activity among PLWH is a public health concern. Regular physical activity has been demonstrated to reduce the impacts of HIV on both physical and mental health, thereby lowering the potential risk of disability and morbidity among PLWH.

The data in this study revealed that there exists a significant relationship between physical activity and sociodemographic factors such as gender, marital status, education, and income. For example, in our study, participants with no formal education had the lowest PA levels (60%), while 38% of the participants had moderate PA levels, irrespective of their income level. There is a robust body of literature on the association between socioeconomic factors and physical activity level (Rawal et al., 2020; Stalsberg and Pedersen, 2018; Talaei et al., 2013). Studies have shown that both low socioeconomic status and low physical activity are predictors of poor health (Cleland et al., 2012; Moore and Littlecott, 2015). The existence of disparities in PA across personal, social, and environmental factors is vital to note in the holistic assessment of PA among PLWH. As access to PA opportunities varies amongst individuals (Althoff et al., 2017), it is vital to design physical activity interventions that address the barriers that PLWH may face while being equally effective, affordable, and easily accessible.

To achieve public health goals, stakeholders and international organisations such as the WHO have consistently advocated for the promotion of physical activity among all individuals, specifically among people living with chronic conditions such as HIV (WHO, 2020). To maintain health and improve the overall quality of life, it is recommended that PLWH engage in the same types of exercises as seronegative populations while ensuring that they undertake at least 150 to 300 minutes of moderate-intensity or 75 to 150 minutes of vigorous-intensity aerobic physical activity each week, as well as strengthening exercises on at least two days a week (Montoya et al., 2019). However, just as participants in our study did not meet this global recommendation level, a systematic review and meta-analysis by Vancampfort et al. (2016) revealed that approximately 2000 PLWH from the 24 studies analysed reported insufficient physical activity participation. Several factors could be limiting PLWH from achieving their physical activity goals. physical activity goals.

The key findings from this study are outlined below:

- Approximately 45.5% of people living with HIV in Nigeria do not meet the recommended level of physical activity.
- Individuals with higher educational levels were more likely to be physically active.

Conclusion: Nearly half of PLWH do not meet the recommended level for physical activity. The observed association between higher educational levels and increased physical activity highlights the need for tailored approaches that consider socioeconomic factors in health promotion efforts.

10.2.4 Chapter seven - Barriers and facilitators to physical activity participation among PLWH in Nigeria

The objectives of this study are:

1. To explore the barriers to and facilitators of physical activity participation among people living with HIV
2. To understand the knowledge, attitude, and preferences of physical activity among PLWH

Factors that influence physical activity participation among PLWH were explored through semi-structured interviews (Chapter 5). Three primary themes that emerged from this qualitative study are discussed below:

Knowledge, attitude, and preference for physical activity

The results of the interviews shed light on participants' perceptions and understanding of the terms "exercise" and "physical activity". Interestingly, the term "exercise" was found to be more relatable to the participants compared to "physical activity," and it was used more frequently by all participants. This suggests that the term "exercise" may hold more familiarity and resonance among PLWH in Nigeria. Although the definition of physical activity by Caspersen et al. (1985) is the most widely used in literature, Piggin (2020) proposed a new definition of physical activity that is culturally and context-specific, highlighting that a holistic viewpoint of physical activity incorporates intrinsic and extrinsic characteristics peculiar to the individual experience of physical activity. Thus, participants in our study demonstrated a diverse range of interpretations regarding what constitutes exercise. While some were able to articulate various forms of physical activity, they were aware of, some described exercise as leisure-time activities to improve strength, achieve physical fitness, or lose weight. Participants in our study also expressed that household chores such as washing clothes, sweeping, and mopping were the exercises they engage in, while some listed more common activities like running, jogging, sit-ups, press-ups, and push-ups as types of exercise they know. This variation in the understanding of physical activity highlights the nuanced knowledge of the concept of exercise within the community.

Furthermore, a positive attitude towards exercise was observed in this study. Participants in our study exhibited a keen willingness to engage in physical activity to reap health benefits and enhance their overall health. Regarding types of exercise, our study participants expressed a preference for walking due to its accessibility, simplicity, and effectiveness. Additionally, they highlighted the practicality of incorporating walking into their daily routines, such as walking to deliver goods or carrying out errands. Thus, recognising the value of transportation and occupational physical activities is instrumental in understanding how PLWH in Nigeria perceive the concept of physical activity and exercise. There are various domains and settings in which physical activity can be conducted (Pelletier et al., 2023). While evaluating the physical activity profile of Nigeria, Oyeyemi et al. (2018) suggested that a multi-disciplinary stakeholder approach be adopted in developing and implementing physical activity

intervention plans. However, understanding the factors that promote and hinder physical activity behaviour is integral to achieving this aim (Garcia et al., 2022).

Barriers to physical activity

Despite acknowledging that they understood the health benefits of physical activity, participants in our study expressed several barriers inhibiting them from engaging in physical activity. Generally, barriers to physical activity participation can be divided into three broad categories, namely intrapersonal factors, interpersonal factors, and environmental factors (Ptomey et al., 2022). In our study, participants cited lack of time and fatigue as the most common intrapersonal limitations towards exercise. This finding is not surprising as the participants resided in Lagos, a metropolitan city in Nigeria widely noted for its fast-paced lifestyle (Popoola et al., 2020). Fatigue is considered one of the most prevalent symptoms among PLWH (Zhu et al., 2019). Other intrapersonal factors highlighted as limiting factors were lack of motivation and insufficient knowledge of the benefits of physical activity to PLWH.

Interpersonal factors that served as barriers among our participants were the absence of a solid social support network and the limitations posed by prevailing beliefs and behaviours regarding physical activity within social circles or communities. Considering that HIV is a lifelong condition, the role of external support (such as family, friends, and healthcare professionals) cannot be overemphasised (Øgård-Repål et al., 2021). For instance, one participant stated that he is only able to do exercises consistently when he has guidance from an instructor or motivation from a peer, underscoring the value of external motivation and guidance in fostering adherence to physical activity routines. However, where motivation, time and strength are present, some participants reported being limited by the absence of a conducive environment to exercise.

The findings from our study revealed the importance of addressing environmental barriers to physical activity in urban settings like Lagos. Participants in our study noted the lack of accessible designated recreational facilities. They expressed concerns about exercising outdoors due to personal safety, congested streets, and theft risk, a common challenge in urban mega-cities in Nigeria (Aliyu and Amadu, 2017). Aside from these barriers in the built environment, adverse weather conditions, such as extreme heat or humidity during the harmattan period, were also described as hindrances to exercise comfortably and often led to

shortened duration of physical activity sessions. Studies on environmental barriers to physical activity have investigated the impact of factors such as urban design, neighbourhood safety, access to recreational facilities, availability of sidewalks and bike lanes, transportation infrastructure, and natural environments like parks and green spaces (Garcia et al., 2022). Overall, the findings consolidate the importance of mitigating artificial barriers to physical activity and promoting the health of PLWH.

Facilitators of physical activity

The range of physical activity facilitators evident in the literature is similar to those expressed by participants in this study. The most common motivation for engaging in physical activity among participants in our study was for the perceived benefits in terms of physical fitness and overall health. This sentiment was particularly evident among younger participants, as one 19-year-old male explained that his desire to improve his physical appearance, build strength and achieve a muscular physique was his driving force for engaging in exercises. Amongst other health benefits, the role of physical activity in weight loss (Cox, 2017) and stress management (Churchill et al., 2021) was also echoed as a facilitator for physical activity among participants in our study.

Another sub-theme that emerged as a facilitator for physical activity was habit. Two participants attributed their current physical activity level to positive attitudes and behaviour towards physical activity developed during childhood and adolescence. Although longitudinal studies show a decline in physical activity levels as individuals transition from childhood to adulthood (Corder et al., 2017), Aira et al. (2021) emphasise the role of active commuting and membership in sports clubs towards maintaining physical activity levels. In our study, participants described their daily activities and highlighted how they incorporated physical activity into their daily transportation and occupational activities. Furthermore, the impact of social influence in shaping individuals' attitudes and behaviours towards physical activity was observed in our study as participants expressed that witnessing a peer engaging in exercises inspired them to do the same. Thus, social networks and support systems should be leveraged in interventions to promote and sustain physical activity among PLWH (Hunter et al., 2019).

The key findings from this study are outlined below:

- The majority of individuals living with HIV in Nigeria perceive physical activity as beneficial to their health.
- Commonly reported barriers to physical activity among people living with HIV include lack of time, fatigue, unsupportive environments, lack of funding, and other social commitments.
- Physical activity facilitators for individuals living with HIV include perceived benefits, habits, influence by others, and the health benefits of illness prevention and pain relief.

Conclusion: The recognition of physical activity as beneficial to health among the majority of PLWH underscores the importance of promoting active lifestyles within this population. However, the identification of various barriers, such as lack of time, fatigue, and unsupportive environments, highlights the need for targeted interventions to address these challenges. On a positive note, the identification of facilitators, such as perceived benefits, established habits, and social influences, offers promising avenues for promoting physical activity among PLWH.

10.2.5 Chapter eight - Rehabilitation programs for people living with HIV-related disability: A scoping review of intervention characteristics using the RE-AIM implementation framework.

The objectives of this study are:

1. To identify the various implementation strategies adopted in the rehabilitation of disability experienced by PLWH.
2. To understand the role of rehabilitation interventions in improving the health outcomes and quality of life of individuals living with HIV-related disabilities.

Our findings reveal that the majority of the studies addressing the prevalence and severity of HIV-related disability were conducted in high-income countries (Plancikova et al., 2020). Out of the 22 studies included in this review, only two studies were conducted in low- and middle-income countries. The range of rehabilitation strategies evident in the literature was similar to those used by the participants in our study. The most common rehabilitation intervention was physiotherapy. Various approaches were incorporated, including a walking program, aerobic

exercise, manual therapy, progressive resisted exercise, peer-led exercise, home exercise program, and rehabilitation class. Some of these interventions included a combination of

therapeutic exercises and another intervention strategy, such as occupational therapy (Parruti et al., 2007), psychotherapy (Merlin et al., 2018) or an educational component (Roos et al., 2014). Integrating rehabilitation strategies is vital towards addressing the multifaceted nature of HIV-related disabilities (Beichler et al., 2023; Chetty and Hanass-Hancock, 2015). Beyond addressing the physiological effects of HIV using ART and other medications, it is essential to implement holistic approaches that encompass psychosocial support, lifestyle modifications, and rehabilitation strategies to optimise the overall well-being and quality of life of PLWH.

While physiotherapy interventions aimed to address the physical impairments and mobility of PLWH (Pullen et al., 2014), therapeutic exercise programs and diet therapy were designed to improve strength, endurance, and overall physical function (Qin et al., 2024). Occupational therapy interventions focused on enhancing individuals' ability to perform daily activities and tasks independently (Armstead, 2019), sometimes coupled with psychological support and counselling to address mental health challenges and emotional well-being in individuals living with HIV. The incorporated educational programs provided information and education on HIV management, self-care, and health promotion to empower PLWH in managing their condition (Okonji et al., 2020).

Despite being the epicentre of HIV, low-resource countries remain underrepresented in global health research, possibly due to the lack of infrastructure, insufficient researchers, publication research, and policymakers' priority setting (Dimitris et al., 2021). Globally, stakeholders in public health have committed to improving the quality of life of people experiencing chronic disease (Barraclough et al., 2021). As PLWH now have better life expectancy due to ART use, HIV is now considered a chronic disease, requiring continuous care as PLWH age (WHO, 2021). Growing evidence suggests that rehabilitation care needs to be integrated into the overall healthcare plan of PLWH (Beichler et al., 2023).

The key findings from this study are outlined below:

- A variety of rehabilitation intervention strategies are used in managing HIV-related disability, including physiotherapy, therapeutic exercise, occupational therapy, supportive psychotherapy, education programs, and other approaches.
- The overlap between the interventions suggests that rehabilitation strategies are not mutually exclusive, and a multifaceted approach involving various rehabilitation disciplines produces positive outcomes that improve the quality of life among PLWH.
- The majority of the studies were conducted in high-income countries.

Conclusion: This scoping review examined the various approaches that have been adopted to provide comprehensive rehabilitation interventions tailored to the specific needs of people living with HIV. The study highlights the diverse range of rehabilitation approaches, including physiotherapy, therapeutic exercise, occupational therapy, supportive psychotherapy, and educational programs. Notably, the overlap between these interventions suggests that they are not mutually exclusive but rather complementary, emphasising the need for a holistic and integrated approach to rehabilitation.

10.2.6 Chapter nine - Development of a contextualised physical activity program for people living with HIV in Nigeria

The objectives of this study are:

1. To engage experts in the fields of HIV and rehabilitation in the process of developing the physical activity program.
2. To utilise insights and recommendations from health science experts through the Delphi method to identify priorities and develop practical solutions for enhancing physical activity among PLWH.
3. To integrate research findings and expert knowledge to create a physical activity program that is both effective and feasible for implementation in low-resource communities in Nigeria.

The prevalence of physical activity among PLWH in Nigeria is low. Considering their limited access to resources, this study aimed to develop a physical activity program for PLWH in Nigeria. Experts in HIV and rehabilitation were recruited to contribute to the program

development process. Literature has shown that an interprofessional approach should be adopted in developing interventions to improve the quality of life and health outcomes of PLWH (Beichler et al., 2023). Gaining insights and improvement recommendations from health science experts through the Delphi method can assist in identifying priorities and developing effective solutions through consensus (Shang, 2023). Thus, this study sought to draw on research findings and consolidate expert knowledge to create a program that would be effective and feasible in low-resource communities in Nigeria.

The draft exercise program was divided into three sections based on the identified subgoals, focusing on an educational component, the designed exercise program, and motivational strategies to improve exercise participation. The program included specific information on exercises for PLWH, emphasising the importance and benefits of exercise, challenging misconceptions, and providing recommendations on the recommended duration and types of physical activities. Adjunct interventions such as an education program have been shown to enhance physical activity participation among PLWH (Roos et al., 2014). The role of health literacy in influencing behaviour change cannot be under-estimated (Lindgren et al., 2018; Perazzo et al., 2017), as it extends beyond being able to read and write but also encompasses access to information and how PLWH use this information to make decisions to improve their life (Lindgren et al., 2018)—based on the results from the cross-sectional study, level of education emerged as a significant predictor of physical activity, and the interviews conducted revealed that several myths are hindering PLWH from participating in physical activity. Thus, consensus was attained among the experts regarding the importance of an educational component in the physical activity program, and their suggestions were incorporated into the developed content.

Additionally, the developed exercise program named National Exercise Upgrade Program (NEXUP) incorporated pre-exercise screening questions to ensure the safety and suitability of the exercise program for individuals with HIV, highlighting the importance of consulting healthcare providers before starting any exercise regimen. This content was included in the physical activity program for two reasons. Firstly, an analysis of the updated ACSM guidelines on exercise preparticipation screening (ACSM, 2018) highlighted that for PLWH in low-resource communities, attending the hospital for exercise testing and medical clearance by a physician not only adds to the financial burden and other associated stress that PLWH and healthcare system undergo, but the process could potentially hinder a person willing to be more

physically active from doing so (Armstrong et al., 2018). Thus, the updated guideline suggests that “medical clearance be reserved for inactive, asymptomatic individuals with known cardiovascular, metabolic or renal disease”. In contrast, asymptomatic PLWH with moderate physical activity can assess their participation risk using a self-screening toolkit (Bredin et al., 2013). Secondly, with the majority of the participants in the cross-sectional study experiencing various medical symptoms and reporting a high prevalence of HIV-related disability, it was important to ensure that an effective, safe, and efficient risk stratification strategy was adopted (Girwar et al., 2021).

Experts in our Delphi study suggested different types of exercises categorised into aerobic, strength training and flexibility exercises, as commonly evident in literature (Chetty et al., 2021). There was a consensus that the exercises should be conducted for at least 30 minutes, three times a week at moderate intensity with gradual progression. Although the frequency, intensity, type, and time (FITT) principle is the bedrock of current exercise prescription guidelines (Rooney et al., 2023), this program was designed to be person-centred, goal-oriented, and based on the abilities and interests of each individual. Therefore, rather than a “one-size-fits-all” approach (Burnet et al., 2019), the program was developed with flexibility in the FITT principles to accommodate the potentially episodic nature of HIV.

Commencing and sustaining an exercise program could be challenging, particularly with PLWH (Simonik et al., 2016). From the qualitative study, one of the mentioned barriers to physical activity participation was a lack of motivation. Technological advancements have made tracking physical activity easier and more precise with the production of mobile apps and wearables such as fitness trackers and smartwatches (Henriksen et al., 2018). However, the limited access to such resources among PLWH in Nigeria was considered, as the cross-sectional study revealed that over half of the participants in our study earned less than ₦30,000 ($19.16) monthly. Thus, to promote adherence, the experts suggested that a physical activity goals worksheet be included in the exercise program to enable PLWH to track their progress and stay motivated (Montoya et al., 2019).

The key findings from this study are outlined below:

- Key components of the physical activity program were identified and presented.
- The panel of experts reached a consensus on sections and terminologies identified as the content of the physical activity program.
- A detailed educational component addressing frequently asked questions by PLWH was provided.
- A physical activity goals worksheet is identified to track progress and enhance motivation.

Conclusion: This study identified vital components essential for the development of a tailored physical activity program for PLWH. The physical activity program (NEXUP) was developed through a collaborative effort of experts, considering the specific needs and challenges faced by people living with HIV in Nigeria. Through the consensus reached by a panel of experts, contents for a detailed educational component and a physical activity goals worksheet were developed and included in the program handbook.

10.3 Contribution of the studies towards the development of the physical activity program

This study aimed to develop a physical activity program for PLWH in Nigeria. Data were collected from four studies: a cross-sectional study, a qualitative study, a scoping review, and a modified Delphi study. The key findings of each study have been highlighted in the manuscript discussion section above. The purpose of this section is to analyse how each study contributes to the content of the developed physical activity program and summarise the key implications of the study as a whole.

Results from our cross-sectional study indicated that disability levels among PLWH in Nigeria are high, particularly in the participation domain. While this is a common finding in global studies (Brown et al., 2022; Myezwa et al., 2018; Nigusso and Mavhandu-Mudzusi, 2021), disability adversely affects the health-related quality of life (O'Brien et al., 2014) and physical activity level (Vancampfort et al., 2017) of PLWH as evident with participants in our study. In response to the rising prevalence of disability among PLWH, public health professionals recommend that rehabilitation interventions be incorporated into the overall package of care

for PLWH (O'Brien et al., 2020; O'Brien Ibáñez-Carrasco et al., 2014; Perazzo et al., 2018). The effectiveness of physical activity in improving health outcomes among PLWH has been proven in longitudinal studies (Willig et al., 2020). Despite the availability of this substantial evidence, PLWH in Nigeria are not meeting recommended physical activity levels, mostly due to several contextual barriers hindering participation. Addressing this implementation gap provides a significant rationale for undertaking this study. Thus, the cross-sectional study provides the foundational information required to define the purpose of the study.

The research background is a low-resource setting where there are limited infrastructural, insufficient healthcare providers, and financial resources to cater to the needs of PLWH. Thus, a significant feature of the physical activity program is that it is easily affordable, accessible, and effective. Considering that the majority of the participants from our study earned less than Nigeria ₦30,000 ($19.16) monthly, which is the minimum wage in Nigeria (₦30,000/$19.16) (Urama, 2019), the developed physical activity program must add no financial burden on the end-users. The cross-sectional study also revealed that education was a significant predictor of physical activity, and only 30% of the participants had a post-secondary level of education. Bearing in mind the impact of education in promoting understanding and adherence to health-related information among diverse populations (Perazzo et al., 2017), including those with varying literacy levels and cultural backgrounds, it was, therefore, necessary that the handbook was developed in an easy-to-understand design. Thus, the exercises were illustrated using graphics and descriptive words to ensure that the exercises were executed correctly.

From the in-depth interviews with the participants in our study, it was evident that PLWH in Nigeria are still being stigmatised in the community as a result of their status. Thus, considering this, the handbook was designed to include only the universal logo of HIV. The red ribbon is the globally accepted symbol indicating solidarity and support for PLWH (Relf et al., 2021). Including the symbol on the front page of the handbook helps to signify that the exercise program is designed for PLWH. This approach has been adopted in other public health interventions to address specific conditions among the population, such as in the exercise program by Salman et al. (2021) designed for people recovering from coronavirus (COVID-19). The COVID-19 symbol herewith is represented by a spherical structure with characteristic spike proteins protruding from its surface (Schaub et al., 2021)

The interviews revealed that PLWH in Nigeria had unfounded presumptions that physical activity is harmful to PLWH, and they hold other misconceptions which stood as barriers to their participation in physical activity (Kitilya et al., 2023). A frequently asked questions (FAQs) section was included in the physical activity handbook to disprove these myths. Counter-evidence and rational arguments were highlighted in this section to address the questions raised by PLWH (in the interviews) and experts (from the Delphi study). Another significant insight drawn from the interviews is that PLWH engaged in a lot of occupational and transportation physical activity. This information was considered during the design of the exercise program as the majority of the exercises required little or no equipment, and walking was illustrated as one of the exercises they could do. The handbook also explained that standard household tools could be used in place of actual exercise equipment, such as water bottles for strength training instead of dumbbells, stairs for endurance training in place of a treadmill, or towels for resistance exercises like towel rows.

The categorisation of the exercises into strength training, endurance and flexibility is based on knowledge gleaned from the literature review conducted during the study (Chetty et al., 2021). The scoping review of the literature helped us to identify the available evidence on rehabilitation strategies in the management of HIV-related disability. This was essential to understand what approaches have been adopted previously and how they were implemented (Pollock et al., 2021). Although the majority of the studies reviewed were from research conducted in high-income countries, analysing the methods implemented helped to identify what solutions could be adopted and modified to suit the needs of PLWH in a low-resource setting. Hence, the literature provided us with a template, knowledge, and exercise principles to consider when designing a physical activity program for PLWH (Li et al., 2017).

Furthermore, an understanding of how HIV-related pathology affects the various physiological systems was helpful in selecting the appropriate exercises (Montoya et al., 2019). The rationale for exercise selection included acknowledging that the existence of HIV-related disability may influence the exercise capacity of PLWH. For example, resistance training is effective in counteracting muscle wasting and improving muscle strength and mass in PLWH (Ibeneme et al., 2019). By targeting specific muscle groups affected by HIV-related cachexia, resistance exercises can enhance functional capacity and reduce the risk of frailty and falls (Ajidahun et al., 2020). Aerobic and endurance exercises such as walking, cycling, and swimming can

enhance aerobic capacity, promote weight management, and reduce the risk of cardiovascular disease among PLWH (Anderson and Durstine, 2019).

People living with HIV may also be affected by HIV-related neuropathy and joint stiffness, which can impair mobility and flexibility (Maharaj and Yakasai, 2018). Thus, stretching exercises and activities that promote joint mobility and range of motion can help alleviate these symptoms, enhance functional mobility, and reduce the risk of musculoskeletal injuries. In addition to the above- listed categories of exercises, balance, and coordination training exercises, such as standing on one leg or using balance balls, can improve proprioception, postural control and reduce fall risk in PLWH (O'Brien et al., 2016)

The FITT principle (Burnet et al., 2019) was also considered in the exercise design, although with some flexibility, as suggested by the expert panel who took into consideration that the physical activity program is need-based and a "one size fits all" approach would not suffice to address the various needs of each individual utilising the program handbook. The expert panel also critiqued the pre-exercise screening questions, the FAQs, and the program structure. Recommendations from the Delphi study included the suggestion to incorporate a physical activity goals worksheet to help track and motivate participants with their exercises (Simonik et al., 2016).

10.4 Application of the Health Belief Model to the study

Perceived Susceptibility: The model considers individuals' beliefs about their susceptibility to a health condition. In this study, PLWH perceived themselves as susceptible to HIV-related disability and its associated challenges, influencing their motivation to engage in physical activity to improve their health outcomes.

Perceived Severity: the severity of HIV-related disability and its impact on the overall well-being of PLWH is discussed. Understanding the severity of the condition can influence their willingness to participate in a physical activity program as a means of managing and mitigating these effects.

Perceived Benefits: The HBM emphasizes the importance of individuals recognizing the benefits of a recommended health action. In this context, PLWH who perceive the benefits of

physical activity in improving their health, managing disability, and enhancing their quality of life are more likely to engage in the prescribed exercise program.

Perceived Barriers: The model considers perceived barriers that may hinder individuals from taking action to improve their health. In this study, barriers such as lack of time, fatigue, unsupportive environments, and financial constraints identified among PLWH may impact their adherence to the physical activity program.

Cues to Action: The HBM suggests that individuals are prompted to take action by cues in their environment or personal experiences. The physical activity program developed in this study, such as educational components, exercise guidelines, and motivational strategies, can serve as cues to action for PLWH to engage in regular physical activity.

10.5 Summary of Chapter Ten

This chapter discussed the study findings of the four studies that culminated in achieving the aim of this doctoral research. Six manuscripts emerged from the outcome of the data sources and were triangulated to provide the context and content of the developed exercise program. In this chapter, we discussed the study findings against the available evidence in the literature. The next chapter will highlight the overall conclusions and recommendations for the study.

Chapter 11 Conclusion and Recommendation

11.1 Introduction

The purpose of this study was to develop a physical activity program for people living with HIV in low-resource communities. This study was delimited to PLWH in Lagos, Nigeria. Data were collected utilising a cross-sectional survey, one-on-one interviews, a scoping review of literature, and a modified Delphi process. In this chapter, the overall summary of the research is presented, and the implications of the study are outlined.

11.2 Overall summary of the research

The key findings of the overall study were:

1. PLWH in Nigeria experienced HIV-related disability, particularly in the participation domain
2. The HRQoL among PLWH was relatively good. However, PLWH had poor general health perceptions about their health.
3. The majority of PLWH did not meet the WHO-recommended guidelines for physical activity and were considered physically inactive.
4. Although the majority of PLWH perceived physical activity as beneficial to their health, commonly reported barriers to physical activity in PLWH were lack of time, fatigue, an unsupportive environment, lack of funding, and other social commitments. The physical activity facilitators included perceived benefits, habits, influence by others, and the health benefits of illness prevention and pain relief.
5. Current rehabilitation interventions implemented in the management of HIV-related disability adopt a multi-disciplinary approach and involve input from rehabilitation professionals, including physiotherapists, occupational therapists, psychologists, and community health workers.
6. Acknowledging the importance of individual preferences and contextual barriers to physical activity is vital in developing a contextualised physical activity program.

The findings of the study shed light on several key aspects of the experience of people living with HIV (PLWH) in Nigeria and provide valuable insights for developing interventions to improve their well-being. HIV-related disability is prevalent among PLWH in Nigeria. Although participants in our study consider having HIV itself as a disability, they also recognise the additional challenges and limitations associated with HIV-related impairments and health conditions. Their general health perception is further tainted by their low

socioeconomic status and the awareness of their limited access to advanced healthcare infrastructure. The role of rehabilitation services in addressing HIV-related disability and improving HRQoL is increasingly being explored in health sciences research.

Rehabilitation care for PLWH in Nigeria is challenging, as several barriers are hindering its implementation. The first objective of the study was to understand the prevalence of disability and HRQoL of PLWH and how these factors influence their physical activity level. In doing this, the perceived susceptibility and severity of the disability associated with HIV among this population is understood. One of the main conclusions from the survey was the impact of socioeconomic factors in accessing rehabilitation care. From a physiotherapist's perspective, understanding the contextual factors limiting participation in physical activity is essential in the development of a physical activity program. This formed the basis of the second study exploring the barriers and facilitators to physical activity participation among PLWH in Nigeria.

When these have been understood, exploring local and global solutions that have been implemented provides insight into what approaches have been successful and effective. A scoping review of the available literature revealed that the key components of the exercise program for PLWH encompasses aerobic exercises, strengthening exercises and flexibility exercises conducted in the home or community. The extracted exercises were modified and adapted to suit the specific context of PLWH in Nigeria. Synthesising these findings together using a triangulation approach strengthened the content and rationale of the developed physical activity program. In conclusion, the integrated insights from the survey, interviews, scoping review, and Delphi study provided a robust foundation for tailoring the physical activity program to address the multifaceted needs and preferences of individuals living with HIV.

11.3 Study implications

HIV care has progressed from only prevention and pharmacological approach to holistic management involving rehabilitation intervention over the last few years. Earlier studies on rehabilitation intervention were based on standardised approaches that may not have adequately addressed the diverse needs and contexts of PLWH. This study aimed to bridge this gap by exploring and developing a physical activity program tailored to the unique needs and contexts of PLWH, thereby contributing to more comprehensive and effective HIV care strategies.

Physiotherapists and other healthcare providers in the field of HIV need to proactively advocate for an increase in physical activity level, empowering PLWH to take charge of their health and well-being through regular exercise. The developed physical activity program (NEXUP) is intended to be adopted as a resource material included in the information pack given to PLWH in HIV/AIDS testing and treatment centres in Lagos, Nigeria. It can also be used as a much-needed exercise handbook for healthcare providers working with PLWH.

11.4 Strengths and limitations

Overall, while the study provides valuable insights into HIV-related disability and physical activity among PLWH in Nigeria, these strengths and limitations should be considered when interpreting the findings and implications of the research.

11.4.1 Strengths of the study

Comprehensive Approach: The study utilised a multi-method approach, including a cross-sectional study, qualitative study, scoping review, and modified Delphi study, providing a comprehensive understanding of HIV-related disability and physical activity among PLWH.
Contextual Relevance: By focusing on PLWH in Nigeria, the study addresses the specific needs and challenges faced by individuals in a low-resource setting, contributing valuable insights for tailored interventions in similar contexts.
Expert Input: The incorporation of expert opinions through the modified Delphi study ensured that diverse perspectives and best practices in the field informed the developed physical activity program.
Thematic Analysis: Thematic content analysis was used for data analysis, allowing for a deep exploration of qualitative data and identification of key themes related to HIV-related disability and physical activity.
Rehabilitation Strategies Mapping: The scoping review mapped out a range of rehabilitation strategies, providing a foundation for understanding the landscape of interventions available for managing HIV-related disability.

11.4.2 Limitations of the Study

Generalizability: The findings may have limited generalizability beyond the specific context of PLWH in Nigeria, as the study focused on a particular population in a low-resource setting.

Study participants: participants in study 1 and study 2 were individuals who were able to access care at HIV clinics in Lagos, Nigeria. These participants likely had the resources, physical ability, and support systems necessary to engage with healthcare services and manage their HIV status. However, the study did not include individuals who, due to physical dysfunction, lack of transportation, or absence of support, may have been unable to access such care. It is possible that the experiences, health-related quality of life (HRQoL), and barriers to physical activity for these individuals would differ significantly from those of the study participants. Excluding this population may limit the generalizability of the findings, as the challenges they face could provide additional insights into the broader context of managing HIV in low-resource settings.

Sample Size: The sample size in the cross-sectional and qualitative studies may have been limited, potentially impacting the representativeness of the findings and generalizability of the results.

Resource Constraints: The study was conducted in a low-resource setting, which may have posed challenges in terms of access to resources, funding, and infrastructure.

Educational Levels: The study identified education as a significant predictor of physical activity, highlighting potential biases in the sample population and the need for further exploration of socioeconomic factors influencing health outcomes.

Publication Bias: The scoping review noted a predominance of studies from high-income countries, indicating a potential publication bias and limited representation of research from low- and middle-income countries.

11.5 Recommendations for future research

Recommendations for future research include prioritizing the development and implementation of robust monitoring and evaluation systems. Future studies can contribute significantly to our understanding of disability among PLWH. This contribution provides local data for PLWH and healthcare researchers to have a better understanding of the pattern of disability, the domains where PLWH are mostly affected, its impact on their health and the effectiveness of physical activity in improving their overall health. Assessing the feasibility and acceptability of the developed physical activity program would help to evaluate its effectiveness. The program was designed with a flexible approach to accommodate amendments, modifications and adaptations as deemed fit. As PLWH continue to age, it is important to focus on minimising the burden of disability associated with HIV and ensure the improved overall health of PLWH in Nigeria.

Future research should endeavour to study how rehabilitation has been incorporated into mainstream HIV care.

11.6 Conclusion

This chapter identified the key themes in the research, which include the developed physical activity program, health-related quality of life, physical activity levels, rehabilitation strategies, barriers and facilitators, and HIV-related disability. The study findings aimed to address gaps in the literature regarding the implementation of rehabilitation strategies for PLWH. Strengths, limitations, and recommendations from the study were highlighted and discussed. Overall, the research contributes valuable insights into the development of tailored physical activity programs for PLWH, emphasising the significance of context-specific approaches and expert input in enhancing rehabilitation strategies for managing HIV-related disability.

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Appendices

Appendix 1: Information Sheet

STUDY TITLE: HIV-RELATED DISABILITY: DEVELOPMENT OF A CONTEXTUALISED PHYSICAL ACTIVITY PROGRAMME

Dear Sir/Ma

Introduction

I am Temitope Oladejo, a PhD candidate at the Department of Physiotherapy, University of Witwatersrand in Johannesburg, South Africa. I am conducting a study on HIV-related disability. The overall aim of this study is to develop a physical activity programme among people living with HIV-related disability. This is the first phase of the study, and the objective of this phase is to determine the pattern and prevalence of HIV-related disabilities, physical activity level and health status of people living with HIV in Nigeria. I am inviting you to take part in this study.

What participation would involve

Participants will volunteer to complete three questionnaires, namely the IPAQ, HDQ, and the MOS-HIV. Results from these questionnaires will provide information on the physical activity levels, the pattern of HIV-related disability, and the perceived health status, respectively. Participation in this study is voluntary. There are no consequences for your medical treatment at the hospital if you choose to withdraw at any time or refuse to participate. It takes about 30 minutes to complete the questionnaires.

Confidentiality

Personal information will be kept confidential. None of the questionnaires requires your name. Participant codes will be used to ensure anonymity, and all identifiers will be kept separately. Personal information would only be disclosed if required by law.

Payment

There is neither cost nor payment involved in participation in the study. However, participants who come in solely to take part in the study may have their reasonable travelling expenses reimbursed.

Risks and benefits

There are no known risks involved in participation. You may benefit from a clearer understanding of the disabilities associated with HIV.

Enquiries

I will be pleased to try to answer any study-related questions you may have.

Contact details of the Researcher

Temitope Oluwaseun Oladejo

Department of Physiotherapy,

University of the Witwatersrand, Johannesburg

Tel No. +2348025300362

E-Mail: temi.oladejo@yahoo.com

Contact details of the Supervisor

Professor Hellen Myezwa

Phone number: +27 83 469 6249

E mail: Hellen.Myezwa@wits.ac.za

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee") and the Lagos State University Teaching Hospital Ethics Committee. A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concerns over the way the study is being conducted, please contact:

Dr Clement Penny	Committee secretariat	
Committee Chairperson	0117172700/1234	Mrs Alakija
011 717 2301	Zanele.Ndlovu@wits.ac.za	08055262563
Clement.Penny@wits.ac.za	Rhulani.Mukansi@wits.ac.za	lasuthethics@gmail.com

Thank you for reading this information sheet

Appendix 2: Consent Form

PARTICIPANT CONSENT SHEET

Project title: HIV-related disability: development of a contextualised physical activity program

1. I have been given a Participant Information Sheet which explains the nature and processes involved in this study, which is attached hereto.

2. I was given time to read it or had it read to me in the language I best understand.

3. I was given time to ask any questions I wanted to and found any answers given to me to be reasonable and satisfactory.

4. I believe I fully understand why the study is being conducted and what the intended outcomes will be.

5. I understand that there will be no immediate benefit to me, should I agree to participate, nor will I receive any payment; conversely, participation will not cost me anything but my time.

6. I understand that, even if I initially consent to take part in the study, I may subsequently withdraw at any time and would not be required to give any reasons; if that happened, any data collected about me for the study would immediately be destroyed, unless I give consent for it to be retained.

7. I have been given a range of contact details, listed below. If I require further information or become concerned about any aspect of this study, I am free to speak to any of these contacts.

Contact details:

Temitope Oladejo, (Principal Investigator), Phone no. 08025300362, or by e-mail at temi.oladejo@yahoo.com,	Prof Hellen Myezwa, (Supervisor), Phone no. +27834696249 or by e-mail at hellen.myezwa@wits.ac.za

Professor CB Penny, Chairperson of the Human Research Ethics Committee (Medical) at the University of the Witwatersrand, on telephone no. 011 717 2301, or by e-mail at Clement.Penny@wits.ac.za.

Ms. Z Ndlovu or Mr Rhulani Mkansi, Committee Secretariat, telephone nos.: 011 717 2700 or 1234, or by e-mail at: Zanele.Ndlovu@wits.ac.za or Rhulani.Mkansi@wits.ac.za

Appendix 3: Approval of study title

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Mrs Sandra Benn
E-mail: sandra.benn@wits.ac.za

24 February 2021
Person No: 1710755
PAG

Mrs TO Oladejo
17, James Olaogun street, off Owutu road, Isawo
Ikorodu
Lagos
Nigeria
Nigeria

Dear Mrs Temitope Oladejo

Doctor of Philosophy: Approval of Title

We have pleasure in advising that your proposal entitled *HIV- related disability: development of a contextualised physical activity programme.* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

100 1922 2022

Appendix 4: Ethical Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R49 Ms T Oladejo

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M200906

NAME: (Principal Investigator)	Ms T Oladejo
DEPARTMENT:	School of Therapeutic Sciences Department of Physiotherapy Medical School University
PROJECT TITLE:	*HIV-related disability: development of a contextualised physical activity programme to improve health outcomes*
DATE CONSIDERED:	2020/10/02
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Professor H Myezwa; Drs A Ajidahun & S Ibeneme
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2021/04/15

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

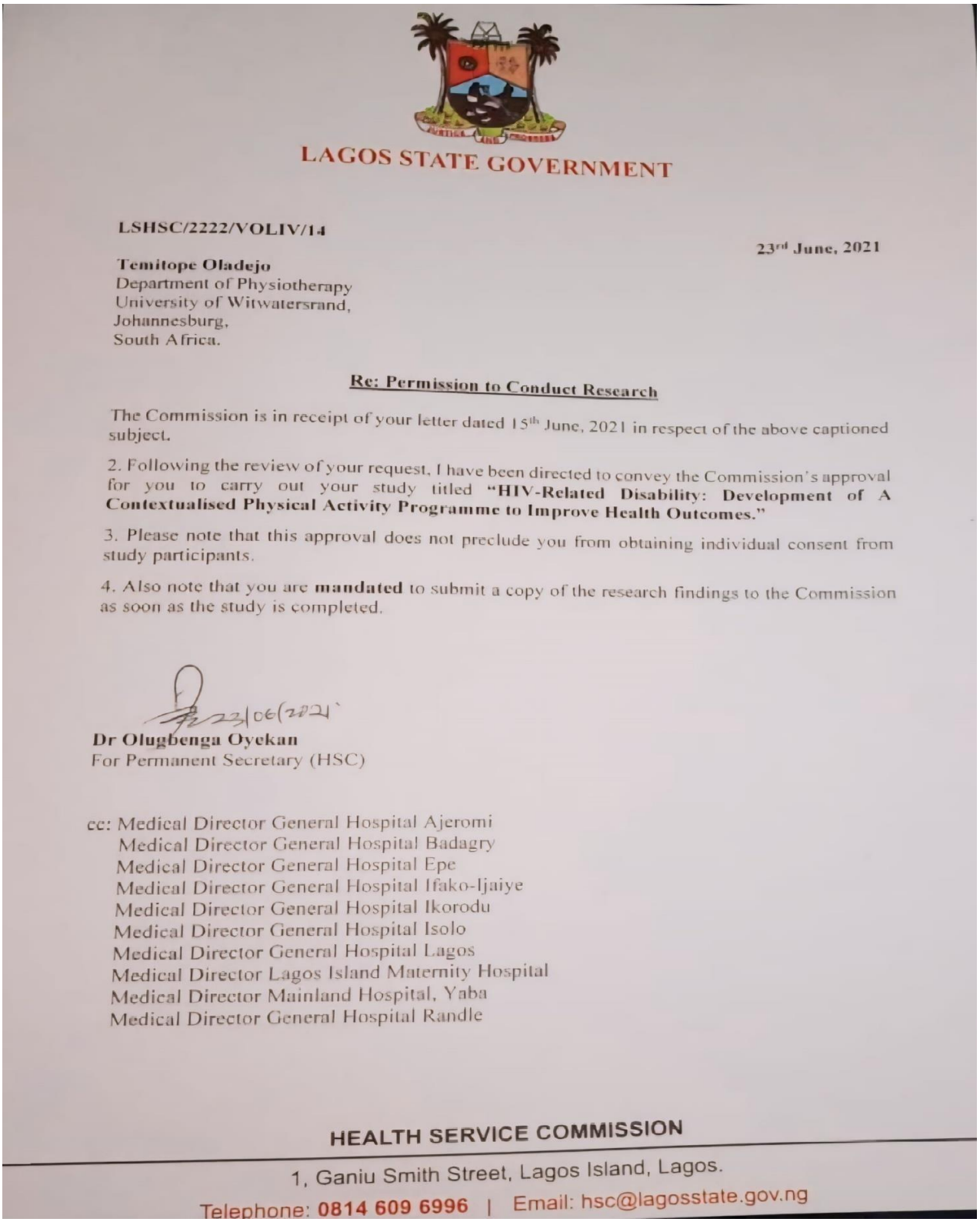
DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office secretariat on the 3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **September** and therefore reports and re-certification will be due in the month of **September** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator _____ Date _____

Appendix 5: Permission to conduct research



LAGOS STATE GOVERNMENT

LSHSC/2222/VOLIV/14

23rd June, 2021

Temitope Oladejo
Department of Physiotherapy
University of Witwatersrand,
Johannesburg,
South Africa.

Re: Permission to Conduct Research

The Commission is in receipt of your letter dated 15th June, 2021 in respect of the above captioned subject.

2. Following the review of your request, I have been directed to convey the Commission's approval for you to carry out your study titled **"HIV-Related Disability: Development of A Contextualised Physical Activity Programme to Improve Health Outcomes."**

3. Please note that this approval does not preclude you from obtaining individual consent from study participants.

4. Also note that you are **mandated** to submit a copy of the research findings to the Commission as soon as the study is completed.

23/06/2021

Dr Olugbenga Oyekan
For Permanent Secretary (HSC)

cc: Medical Director General Hospital Ajeromi
Medical Director General Hospital Badagry
Medical Director General Hospital Epe
Medical Director General Hospital Ifako-Ijaiye
Medical Director General Hospital Ikorodu
Medical Director General Hospital Isolo
Medical Director General Hospital Lagos
Medical Director Lagos Island Maternity Hospital
Medical Director Mainland Hospital, Yaba
Medical Director General Hospital Randle

HEALTH SERVICE COMMISSION

1, Ganiu Smith Street, Lagos Island, Lagos.

Telephone: 0814 609 6996 | Email: hsc@lagosstate.gov.ng

Appendix 6: Sociodemographic questionnaire

Sociodemographic characteristics Participants' ID: _____

1. How old are you? ___
2. What is your gender? _____
3. Marital status (Tick ➹ as appropriate)

Married	
Single	
Widowed	
Divorced/separated	

4. Education

Less than primary school	
Primary school	
Secondary school certificate	
Ordinary diploma	
Bachelor's degree / HND	
Postgraduate degree	

5. Monthly income category

Less than N 18, 000 per month	
Between N19, 000 - N 30, 000 per month	
Between N31,000 – N70,000 per month	
Between N71,000 – N100,000 per month	
More than N 100 000 per month	

Background information on HIV/AIDS

6. What were your symptoms before you knew your HIV status? (Tick ➹ all that apply)

Prolonged fever	
Prolonged Diarrhea	
Skin diseases	
Prolonged cough	
Tuberculosis	
Prolonged cough	
Meningitis	
Loss of weight	
Prolonged vomiting	
No symptoms	
Others (please specify)	

7. Which year were you diagnosed with HIV? --------
8. (a) Are you on antiretroviral therapy? Yes No

   b) If 'yes' to Q 8a, how long have you been on antiretroviral therapy?
9. Give details of your antiretroviral therapy.

First line	
Second line	
Not on ART (Pre-ART care)	

10. Most recent CD4 count and viral load

CD4 count	
Viral load	

11. Have you experienced any of the following symptoms in the last three months?

	Medical symptoms	Yes	No
1	Confusion		
2	Memory loss		
3	Breathlessness		
4	Fatigue		
5	Diarrhea		
6	Nausea		
7	Stomach pain		
8	Headache		
9	Change in taste		
10	Skin itching or changes		
11	Muscular pain		
12	Heartburn		
13	Sore mouth		
14	Vomiting		
15	Fever		
16	Kidney stones		

Appendix 7: WHO Disability Assessment Schedule (WHODAS 2.0)

In the past 30 days, how much difficulty did you have in….

	None	Mild	Moderate	Severe	Extreme/ Cannot do
Q1. Standing for long period such as 30 minutes	0	1	2	3	4
Q2. Taking care of your household responsibilities	0	1	2	3	4
Q3. Learning a new task, for example, learning how to get to a new place	0	1	2	3	4
Q4. How much of a problem did you have joining in community activities (for example, festivities, religious or other activities) in the same way as anyone else can	0	1	2	3	4
Q5. How much have you been emotionally affected by your health problems	0	1	2	3	4
Q6. Concentrating on doing something for ten minutes	0	1	2	3	4
Q7. Walking a long distance, such as a kilometer (or equivalent)	0	1	2	3	4
Q8. Washing your whole body	0	1	2	3	4
Q9. Getting dressed	0	1	2	3	4
Q10. Dealing with people you do not know	0	1	2	3	4
Q11. Maintaining a friendship	0	1	2	3	4
Q12. Your day-to-day work	0	1	2	3	4
WHODAS Disability Score = Sum of the above					☐

H1. Overall, in the past 30 days, how many days were these difficulties present?	***Record number of days*** _____
H2. In the past 30 days, for how many days were you totally unable to carry out your usual activities or work because of any health condition?	***Record number of days*** _____
H3. In the past 30 days, not counting the days that you were totally unable, for how many days did you cut back or reduce your usual activities or work because of any health condition?	***Record number of days*** _____

Appendix 8: Medical Outcome Study-HIV Health Survey (MOS-HIV)

MOS-HIV 35-ITEM INSTRUMENT

INSTRUCTIONS TO PATIENT: Please answer the following questions by placing a "x" in the appropriate box.

1. In general, would you say that your health is:

(check one)

- Excellent ..... 1 ☐
- Very Good ..... 2 ☐
- Good ..... 3 ☐
- Fair ..... 4 ☐
- Poor ..... 5 ☐

2. How much **bodily** pain have you generally had during **the past 4 weeks**?

(check one)

- None ..... 1 ☐
- Very Mild ..... 2 ☐
- Mild ..... 3 ☐
- Moderate ..... 4 ☐
- Severe ..... 5 ☐
- Very Severe ..... 6 ☐

3. During **the past 4 weeks**, how much did **pain** interfere with your normal work (including both work outside the home and housework)?

(check one)

- Not at all ..... 1 ☐
- A little bit ..... 2 ☐
- Moderately ..... 3 ☐
- Quite a bit ..... 4 ☐
- Extremely ..... 5 ☐

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4. The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

		(check one box on each line)		
		YES , Limited A Lot	**YES , Limited A Little**	**NO, Not Limited At All**
		1	**2**	**3**
a.	The kinds or amounts of **vigorous** activities you can do, like lifting heavy objects, running or participating in strenuous sports.	☐	☐	☐
b.	The kinds or amounts of **moderate** activities you can do, like moving a table, carrying groceries or bowling.	☐	☐	☐
c.	Walking uphill or climbing a few flights of stairs.	☐	☐	☐
d.	Bending, lifting or stooping.	☐	☐	☐
e.	Walking one block.	☐	☐	☐
f.	Eating, dressing, bathing, or using the toilet.	☐	☐	☐

5. Does your health **keep** you from working at a job, doing work around the house or going to school?

(check one)

Yes ..... 1 ☐

No ..... 2 ☐

6. Have you been unable to do **certain kinds or amounts** of work, housework, or schoolwork because of your health?

(check one)

Yes ..... 1 ☐

No ..... 2 ☐

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For <u>each</u> of the following questions, please check the box for the <u>one</u> answer that comes <u>closest</u> to the way you have been feeling <u>during the past 4 weeks</u>.

	(mark one box on each line)					
	All of the Time	**Most of the Time**	**A Good Bit of the Time**	**Some of the Time**	**A Little of the Time**	**None of the Time**
	1	**2**	**3**	**4**	**5**	**6**
7. How much of the time, during the past 4 weeks, has your **health limited your social activities** (like visiting with friends or close relatives)?	☐	☐	☐	☐	☐	☐
8. How much of the time, during the past 4 weeks:						
a. Have you been a very nervous person?	☐	☐	☐	☐	☐	☐
b. Have you felt calm and peaceful?	☐	☐	☐	☐	☐	☐
c. Have you felt downhearted and blue?	☐	☐	☐	☐	☐	☐
d. Have you been a happy person?	☐	☐	☐	☐	☐	☐
e. Have you felt so down in the dumps that nothing could cheer you up?	☐	☐	☐	☐	☐	☐

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	(check one box on each line)					
	All Of the Time	Most of the time	A Good Bit of the Time	Some of the Time	A Little of the Time	None of the Time
	1	2	3	4	5	6
9. How often during the **past four weeks**:						
a. Did you feel full of pep?	☐	☐	☐	☐	☐	☐
b. Did you feel worn out?	☐	☐	☐	☐	☐	☐
c. Did you feel tired?	☐	☐	☐	☐	☐	☐
d. Did you have enough energy to do the things you wanted to do?	☐	☐	☐	☐	☐	☐
e. Did you feel weighed down by your health problems?	☐	☐	☐	☐	☐	☐
f. Were you discouraged by your health problems?	☐	☐	☐	☐	☐	☐
g. Did you feel despair over your health problems?	☐	☐	☐	☐	☐	☐
h. Were you afraid because of your health?	☐	☐	☐	☐	☐	☐

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(check one box on each line)

	All of the Time	Most of the Time	A Good Bit of the Time	Some of the Time	A Little of the Time	None of the Time
	1	2	3	4	5	6
10. How much of the time, during the **past 4 weeks**:						
a. Did you have difficulty reasoning and solving problems, for example, making plans, making decisions, learning new things?	☐	☐	☐	☐	☐	☐
b. Did you forget things that happened recently, for example, where you put things and when you had appointments?	☐	☐	☐	☐	☐	☐
c. Did you have trouble keeping your attention on any activity for long?	☐	☐	☐	☐	☐	☐
d. Did you have difficulty doing activities involving concentration and thinking?	☐	☐	☐	☐	☐	☐

(check one box on each line)

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
	1	2	3	4	5
11. Please check the box that describes whether each of the following statements is true or false for you.					
a. I am somewhat ill.	☐	☐	☐	☐	☐
b. I am as healthy as anybody I know.	☐	☐	☐	☐	☐
c. My health is excellent.	☐	☐	☐	☐	☐
d. I have been feeling bad lately.	☐	☐	☐	☐	☐

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12. How has the quality of your life been during the **past 4 weeks**? That is, how have things been going for you?

(check one)

Very well; could hardly be better ..... 1 ☐

Pretty good ..... 2 ☐

Good and bad parts about equal ..... 3 ☐

Pretty bad ..... 4 ☐

Very bad; could hardly be worse ..... 5 ☐

13. How would you rate your physical health and emotional condition now compared to **4 weeks ago**?

(check one)

Much better ..... 1 ☐

A little better ..... 2 ☐

About the same ..... 3 ☐

A little worse ..... 4 ☐

Much worse ..... 5 ☐

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THANK YOU VERY MUCH

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Appendix 9: International Physical activity Questionnaire Short Form (IPAQ-SF)

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   _____ **days per week**

   ☐ No vigorous physical activities → ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

   _____ **hours per day**

   _____ **minutes per day**

   ☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

   _____ **days per week**

   ☐ No moderate physical activities → ***Skip to question 5***

SHORT LAST 7 DAYS SELF-ADMINISTERED version of the IPAQ. Revised August 2002.

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking → ***Skip to question 7***

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

This is the end of the questionnaire, thank you for participating.

SHORT LAST 7 DAYS SELF-ADMINISTERED version of the IPAQ. Revised August 2002.

Appendix 10: The Contributor Roles Taxonomy (CRediT)

The Contributor Roles Taxonomy (CRediT) (Allen et al., 2019b) was used to outline the authors' contribution to the study. The full explanation of the terms:

Term	**Definition**
Conceptualization	Ideas; formulation or evolution of overarching research goals and aims
Methodology	Development or design of methodology; creation of models
Validation	Verification, whether as a part of the activity or separate, of the overall replication/ reproducibility of results/experiments and other research outputs
Formal analysis	Application of statistical, mathematical, computational, or other formal techniques to analyse or synthesize study data
Data curation	Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later re-use
Writing – original draft	Preparation, creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation)
Writing – review and editing	Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision – including pre- or post-publication stages
Visualization	Preparation, creation and/or presentation of the published work, specifically visualization/data presentation
Supervision	Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team
Funding acquisition	Acquisition of the financial support for the project leading to this publication

Appendix 11: Semi-structured interview guide

1. SOCIOECONOMIC BACKGROUND

1.1 Age

1.2 Marital status?

- I. Married ii. Single iii. Widow/divorced

1.3 Education level?

i. Not educated ii. Primary iii. Secondary iv. Higher institution

1.4 Occupation?

1.5 Income range?

i. Below #30,000 ii. 31,000 – 70,000iii. 71,000- 100,000 iv. Above 100,000

2. BACKGROUND INFORMATION ON HIV/AIDS

2.1 How long have you been living with HIV?

2.2 How long have you been on anti-retroviral therapy drugs?

2.3 In what ways does HIV affect your health? (Probe: how does it affect your activities of daily living, such as washing, climbing stairs, going out, taking a job etc)

2.4 In what ways does the ART drugs affect your health?

2.5 Do you have any health issues as a result of the HIV or ART medications?

2.6 Do they make referral to physiotherapy/rehabilitation services in this center? If yes or no, are you aware of what services are offered? Is there an exercise group in this center?

2.7 Can you describe your day-to-day activities for me? What is your typical day like, what do you do on a daily basis?

3. PHYSICAL ACTIVITY

3.1 What types of exercises/physical activity are you aware of?

3.2 What is your most preferred form of physical activity? (walking, running, jogging, cycling, swimming, etc.)

3.3 Do you currently engage in any form of exercise or physical activity? If yes, can you describe it? How often do you do it? Do you do it with a group etc.? Was it prescribed etc.?

3.4 Do you believe the exercise helps you in any way? If yes, in what way?

3.5 What benefits or gains of physical activity are you aware of?

3.6 What motivates/ encourages you to engage in physical activity? what helps you?

3.7 What discourages you from engaging in exercise? What limits you from participating in physical activity? (Probe: pain, fear, health condition, unsafe environment, stigma, lack of time, lack of resources etc.) What stops you?

3.8 what would be a perfect situation that would help your exercises? If you were to exercise more, what would you need?

3.9 Would you prefer an exercise program suited to your needs? (Something not general, but tailored to your specific needs)

3.10 Is there anything you would like to add?

4. Are there any other issues which I have not covered, and which you feel are important to mention with regards to HIV, disability, or physical activity?

Appendix 12: Delphi study questionnaire

DEVELOPMENT OF A CONTEXTUALIZED PHYSICAL ACTIVITY PROGRAM FOR PEOPLE LIVING WITH HIV IN NIGERIA: A MODIFIED DELPHI STUDY

My name is Temitope Oladejo, I am a Ph.D. student at the University of the Witwatersrand, and currently engaged in a study titled "Development of a contextualized physical activity program for people living with HIV in Nigeria" under the supervision of Professor Hellen Myezwa (University of the Witwatersrand, School of Therapeutic Sciences), Prof Sam Ibeneme (University of Nigeria, Department of Medical Rehabilitation), and Dr Adedayo Tunde Ajidahun (University of the Witwatersrand, Department of Physiotherapy).

Background: As prevalence of HIV-related disability is increasing in Nigeria, it is vital to mitigate the burden of chronic diseases and comorbidities associated with HIV. Prior to this present study, we reviewed the existing literature on how physical activity programs are implemented in low-resource communities. We conducted a cross-sectional study to determine the physical activity level and pattern of HIV-related disability among PLWH in Nigeria. A scoping review was conducted to understand the various physical activity intervention programs that have been implemented in sub-Saharan Africa. Furthermore, we obtained information from PLWH through one-on-one interviews to understand the barriers and facilitators to physical activity participation. Findings from these studies were synthesized using a methodological triangulation approach. The results so far show that PLWH experience HIV-related disability, have low physical activity level and encounter several barriers to reaching their recommended physical activity levels. From the results above, contents of a contextualized physical activity program were developed.

Therefore, the next step is to use the results that have been gained from these studies to determine the extent to which experts agree with what has been identified and if there are additional suggestions. With this background, you are kindly requested to be part of a panel of experts to evaluate the draft format of the developed physical activity program.

Aim of the study: The aim of this study is to develop a physical activity intervention program for people living with HIV in Nigeria

Methods: The Delphi study will be used to obtain consensus among purposively sampled experts in the field of physical activity, HIV, rehabilitation, and implementation. Experts in this field such as researchers, doctors, physiotherapists, public health advisors, and policy makers will be invited to share their opinions to arrive at a consensus.

Description of procedures: RedCap® will be used to gather data. Informed consent to participate will be sought and obtained before proceeding with the survey. A two-round Delphi method will be used to reach consensus and if consensus is not reached a final third Delphi round will be carried out. Upon completion of the first round Delphi, statistical analysis will be performed, and you will receive a summary of the results in a feedback email. A two-week period will be allowed for the completion of the questionnaire. In addition, there will be a week period between the first and second round to allow the researcher and statistician to analyse the results and forward the summary of findings to you. Included in the questionnaire will be demographical questions followed by questions to establish the agreement of participating experts on included questions on a five-point Likert scale ranging from 1 -strongly agree, 2 - agree, 3 - neutral, 4 - disagree, 5 - strongly disagree.

Voluntary participation: Your participation is voluntary, and you will not be negatively affected by your choice. You have the right to withdraw from the research at any point. Explicit withdrawal must be sent to Temitope Oladejo, the lead researcher (contact details below), and only after receiving the written withdrawal will correspondence be stopped. Absent responses will be seen as non-interest and no further information will be sent. Experts not responding to the first round Delphi, but who indicated an interest to participate, will receive two reminders and questionnaire links in the form of emails before this will be viewed as non-participation. There will be no renumeration associated with your participation.

Participant responsibility: Your responsibility will include completing a RedCap® questionnaire in at least two rounds of the Delphi technique. Upon completion of each round Delphi, each participating expert will receive a summary of the results.

Anonymity: The results of the questionnaire will be kept confidential, and your name will not be seen on any documentation. The results will be published in an article and thesis, but anonymity will be maintained. Anonymity principles throughout the Delphi study will be assured by using numbers and separate emails.

Ethical clearance: I have received ethical clearance for this study from the University of the Witwatersrand Human Research Ethics Committee (Medical) (M200906) and the Lagos State University Teaching Hospital Health Research Ethics Committee (LREC/06/10/1547).

Yours sincerely,

Temitope Oladejo (PhD candidate)

1710755@students.wits.ac.za

Temi.oladejo@yahoo.com

Thank you for your prompt attention and co-operation.

Do you consent to participate in this study?

◯ Yes ◯ No

Project summary

Disability caused by HIV, HIV comorbidities, and long-term ART use are widely acknowledged as critical public health and development issues in sub-Saharan Africa. Rehabilitation healthcare professionals recommend physical activity as an effective nonpharmacological intervention to manage HIV-related disability and improve the quality of life of people living with HIV. Despite these guidelines, people living with HIV in Lagos, Nigeria do not meet the recommended level of physical activity. To develop an effective physical activity program, it is necessary to understand the contextual factors peculiar to people living with HIV in Lagos, Nigeria.

Prior to this present study, we reviewed the existing literature on how physical activity programs are implemented in low-resource communities. We conducted a cross-sectional study to determine the physical activity level and pattern of HIV-related disability among PLWH in Nigeria. Furthermore, we obtained information from PLWH through one-on-one interviews to understand the barriers and facilitators to physical activity participation. Key outcomes from these studies were synthesized using a methodological triangulation approach and are reported below:

Literature review

• Physical activity is an integral part of HIV rehabilitation and is effective in preventing HIV-related disability by reducing the impact of HIV on physical and mental health.

• Public health recommendations state that PLWH need at least 150 to 300 minutes per week of moderate-intensity (50 - 85% of VO_2 reserve) physical activity to accrue health benefits.

• Health care professionals such as Nurses/Physiotherapists educate PLWH on types and benefits of exercises.

• Implication for this study: The insights from the literature should guide the development of a physical activity programme for people living with HIV/AIDS. This programme should incorporate educational elements, evidence-based guidelines, and a holistic approach to health. Creating individualized exercise program, offering professional healthcare assistance, and encouraging community involvement are critical components of the program's success.

Study 1: Cross-sectional survey - "Physical activity level and pattern of HIV-related disability among PLWH in Nigeria"

• Majority of participants had a poor general health perception about their health status.

• Headache, fatigue, and muscular pain are common medical symptoms experienced by participants. Emotional problems, standing for longer than 30 mins and walking long distance were the top 3 areas participants experienced disability in.

• Participants experienced the most limitation in the participation domain (problems encountered because of the society in which they live rather than because of their own difficulties).

• 45.7% of PLWH in Nigeria have a low level of physical activity. Male participants showed higher physical activity than female participants (26% vs. 18.9%).

• There was a significant difference in physical activity levels by level of education.

• Majority of the participants earned less than the national minimum wage of ₦30,000 ($38.07).

• Implication for this study: The study's findings about individual differences, societal barriers, economic constraints, and health challenges should all be taken into account when

creating a physical activity programme for PLWH in Nigeria. Tailoring interventions to address these factors will enhance the program's effectiveness, promoting sustained engagement and overall health improvement.

Study 2: Qualitative study - "Barriers and facilitators to physical activity participation among PLWH in Nigeria"

• Knowledge of physical activity and its benefits exist, but participation in structured physical activity is poor.

• Occupational and transport physical activity are the most common forms of physical activity.

• Participation in physical activity is dependent on several individual and environmental factors. Barriers such as lack of time, fatigue, unsupportive environment, lack of funding and other social commitments are challenges to physical activity participation among PLWH. Perceived health benefits, habit, influence by others and pain relief are seen as major facilitators.

• When motivation is present, lack of safe environment, human congestion and lack of accessible facilities are limitations to physical activity participation.

• PLWH acknowledge that having medical support is essential in maintaining a good health-related quality of life but access to rehabilitation support is poor or non-existent. There is no existing referral pathway to physiotherapy in the HIV centres.

• Nurses, Doctors, Physiotherapists are perceived as authority figures by PLWH, and they take their recommendations seriously.

• Implication for this study: A holistic approach that considers individual, social, and environmental factors is essential for the program's success in promoting sustained physical activity participation among PLWH. Thus, findings from the qualitative study highlight the importance of addressing barriers, leveraging existing activities, incorporating facilitators, collaborating with healthcare professionals, and offering tailored interventions.

Study 3: Scoping review - "Rehabilitation interventions among PLWH-related disability"

• The ecological context is an important consideration in implementing physical activity intervention programme.

• Physical activity intervention programme for people living with HIV were conducted in home-based, clinic-based, and community-based settings.

• Physiotherapists and trained assistants supervised the implementation of the physical activity programmes in the clinic and community setting. Self-management approach is adopted in the home-based programmes.

• Walking is the most common exercise program for PLWH. Components of rehabilitation programs from other studies include moderate-intensity cycling, aerobic activity, stretching, resistance programs and treadmill walking exercises with a home program.

• The frequency and duration of exercise sessions vary from 30 to 40- minute sessions, three (going up to five) times weekly for several weeks.

• Majority of the studies in sub-Saharan Africa were implemented in South Africa

• Implication for this study: The development of a physical activity programme for PLWH should take into account the ecological context, provide a variety of exercise options, strike a balance between professional supervision and self-management, allow for variation in session frequency and duration, strive for broader geographic inclusion, prioritise cultural sensitivity, encourage collaborative implementation, and put a strong emphasis on long-term sustainability. To effectively promote physical activity and enhance the general well-being of people living with HIV/AIDS, the programme will need to adopt a flexible, inclusive, and culturally sensitive approach.

First round of Delphi study

Thank you for agreeing to participate in a Delphi study as described in the information sheet attached. This first round in the Delphi process will be the brainstorming round to obtain the understanding of the key components necessary for consideration in the process of developing the physical activity program for people living with HIV in a low resource setting. A 50% cut off point will be used in the first round as agreement. There are two parts in this first round of the Delphi study. The first part asks about your socio-demographic characteristics and the second part asks about the components necessary for the physical activity program in low resource settings in Nigeria. These questions are posed in the context of a low resource setting.

Delphi Survey: Questionnaire

A. PARTICIPANT CHARACTERISTICS

The following questions ask for demographic information that will enable analysis of survey responses with respect to participant characteristics. Multiple-choice and short-answer questions will be used to gather this information.

1 1. What is your age (in years)?

_____

2 2. What is your gender

◯ Male ◯ Female ◯ Other

3 3. What is your designation?

◯ Physiotherapist ◯ Doctor ◯ Policy Maker ◯ Other (specify)

4 4. Select your highest level of university qualification.

◯ Bachelor's degree ◯ Postgraduate diploma ◯ Master's degree ◯ Doctorate (PhD)

5 5. How many years of experience do you have in your field?

_____

6 6. What is your country of practice?

_____

7 7. What setting do you work in?

_____

B. PHYSICAL ACTIVITY PROGRAM

SECTION 1: EDUCATION PROGRAM

8. Exercise information booklet: As part of the education program, an exercise booklet adapted from the American College of Sports Medicine (ACSM)/Exercise is Medicine with infographic component addressing the following sections will be provided (please see appendix 1 for 'Being Active when you have HIV/AIDS booklet). Using the scale provided, please rate your level of agreement as to the importance of these educational sections.

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
8a	Why exercise?	☐	☐	☐	☐	☐
8b	What are the benefits of exercise for people living with HIV/AIDS?	☐	☐	☐	☐	☐
8c	What types of exercise are right for people living with HIV/AIDS?	☐	☐	☐	☐	☐
8d	How much activity should you do?	☐	☐	☐	☐	☐
8e	Special considerations prior to commencing your exercise program	☐	☐	☐	☐	☐
8f	Getting started: planning your exercise program	☐	☐	☐	☐	☐
8g	Sustaining your exercise program	☐	☐	☐	☐	☐

9 9. Are there other sub-sections you consider important to include in the information booklet? Please list them

_____

SECTION 2: PRE-EXERCISE SCREENING QUESTIONS

10. Pre-exercise screening questions: The following questions have been suggested to be important in identifying people who may have other medical conditions that put them at higher risk of an adverse event during physical activity/exercise. Using the scale provided, please rate your level of agreement as to the importance of these questions.

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
10a	Has your doctor ever told you that you have a heart condition or have you ever suffered a stroke	○	○	○	○	○
10b	Do you experience unexplained pains in your chest at rest or during physical activity/exercise	○	○	○	○	○
10c	Do you ever feel faint or experience dizziness during physical activity/exercise that causes you to lose balance?	○	○	○	○	○
10d	Have you had an asthma attack requiring immediate medical attention at any time over the last 12 months?	○	○	○	○	○
10e	If you have diabetes (type 1 or type 2) have you had trouble controlling your blood glucose in the last 3 months?	○	○	○	○	○
10f	Do you have any diagnosed muscle, bone, or joint problems that you have been told could be made worse by participating in physical activity/exercise?	○	○	○	○	○
10g	Do you have any other medical condition(s) that may make it dangerous for you to participate in physical activity/exercise?	○	○	○	○	○

11 11. Are there other pre-exercise screening questions you consider important to ask? Please list them.

SECTION 3: PROGRAM STRUCTURE

12. Frequency of exercise: The following frequencies have been suggested as important in designing a physical activity program for people living with HIV. Using the scale provided, please rate your level of agreement as to the importance of these frequencies.
Frequency of exercise program

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
12a	Once a week	○	○	○	○	○
12b	Two times a week	○	○	○	○	○
12c	Three times a week	○	○	○	○	○
12d	Four times a week	○	○	○	○	○
12e	Five times a week	○	○	○	○	○

13 13. Are there other frequencies you consider important? Please list them.

14. Intensity of exercise: In order to elicit improvements in maximal oxygen consumption (VO_2 max) the following levels of exercise intensities have been suggested as important in designing a physical activity program for people living with HIV. Using the scale provided, please rate your level of agreement as to the importance of these intensities.
Intensity of exercise program

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
14a	Self-paced	○	○	○	○	○
14b	Self-paced with a gradual progression of intensity	○	○	○	○	○
14c	Low intensity	○	○	○	○	○
14d	Moderate intensity	○	○	○	○	○
14e	Vigorous intensity	○	○	○	○	○

13 15. Are there other intensities you consider important? Please list them.

16. Duration per exercise session: The following lengths of time per session have been suggested as important in designing a physical activity program for people living with HIV. Using the scale provided, please rate your level of agreement as to the importance of these time durations for each session of physical activity.

Duration per session

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
15a	15 minutes	○	○	○	○	○
15b	30 minutes	○	○	○	○	○
15c	45 minutes	○	○	○	○	○
15d	60 minutes	○	○	○	○	○

17 17. Are there other lengths of time you consider important? Please list them.

_____

18. Type of exercise: The following types of exercise have been suggested as important in designing a physical activity program for people living with HIV ref. Using the scale provided, please rate your level of agreement as to the importance and inclusion of these types of exercise.

Aerobic activity

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
18a	Warm-up 5 - 10 minutes	○	○	○	○	○
18b	Brisk walking	○	○	○	○	○
18c	Low-impact aerobic dance activities	○	○	○	○	○
18d	Jump rope	○	○	○	○	○
18e	Cool down 5-10 minutes	○	○	○	○	○

19 19. Are there other aerobic activities you consider important? Please list them.

20. Strength training

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
20a	Seated upper body rotation with weight	○	○	○	○	○
20b	Squats	○	○	○	○	○
20c	Glute bridge	○	○	○	○	○
20d	Push-ups	○	○	○	○	○
20e	Straight leg raises with resistance band	○	○	○	○	○

21 21. Are there other strength training activities you consider important? Please list them.

_____

22. Flexibility

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
22a	Yoga class	○	○	○	○	○
22b	Dynamic lunges	○	○	○	○	○
22c	Static calf stretches	○	○	○	○	○
22d	Overhead triceps stretch	○	○	○	○	○
22e	Hamstring stretch	○	○	○	○	○
22f	Cat cow pose	○	○	○	○	○
22g	Shoulder rolls	○	○	○	○	○
22h	Knee to chest	○	○	○	○	○

23 23. Are there other flexibility activities you consider important? Please list them.

_____

24. Equipment: The following equipment has been suggested as important for people living with HIV implementing a physical activity program. Using the scale provided, please rate your level of agreement as to the importance of this equipment.

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
24a	Exercise ball	○	○	○	○	○
24b	Exercise Mat	○	○	○	○	○
24c	Pillows	○	○	○	○	○
24d	Resistance bands	○	○	○	○	○
24e	Dumbbells	○	○	○	○	○
24f	Towels	○	○	○	○	○
24g	Balance board	○	○	○	○	○

25 25. Are there other equipment you consider important? Please list them.

_____

26. Context: The following factors have been suggested as important to consider when designing a context-sensitive exercise program for a person living with HIV. Please rate your level of agreement as to the importance of these factors

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
26a	Participant's financial capacity	○	○	○	○	○
26b	Participant's motivation	○	○	○	○	○
26c	Participant's functional requirements	○	○	○	○	○
26d	Previous exercise/sport experience	○	○	○	○	○
26e	Participant's availability	○	○	○	○	○
26f	Participant's access to resources	○	○	○	○	○
26g	Availability of professional support	○	○	○	○	○
26h	Time of day	○	○	○	○	○

27 27. Are there other contextual factors you consider important? Please list them.

28. Setting: The following settings have been suggested as important to consider when selecting a context-sensitive exercise program for a person living with HIV. Based on the above designed program structure and contextual factors, please rate your level of agreement as to the importance of these locations

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
28a	Home-based	○	○	○	○	○
28b	Community-based	○	○	○	○	○
28c	Clinic-based	○	○	○	○	○
28d	Virtual	○	○	○	○	○

29 29. Are there other settings you consider important? Please list them.

_____

30 30. Are there other factors to be considered in developing the physical activity program for PLWHA?

_____

31 31. Are there other factors to be considered in implementing the physical activity program for PLWHA?

_____

32 32. Are there other factors to be considered in maintaining the physical activity program for PLWHA?

_____

33 33. General comment and suggestion

Appendix 13: Turnitin Report

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ORIGINALITY REPORT

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SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

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