

## **Critical gaps in current physical activity and HIV literature: A review**

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### **Abstract**

*The objective of this review was to investigate the role of physical activity (PA) on outcomes of adults living with HIV (ALWH) with the intention to try and establish gaps in literature for further research. The results of this review contribute to the HIV/AIDS body of literature. The review also synthesizes the evidence from the existing literature to show how PA interventions increase functional capacity in ALWH. The review revealed a new role for health providers as facilitators of PA interventions. More robust designs of studies are needed by health professionals to further investigate the impact of types and intensities of PA on health outcomes across the lifespan of ALWH. This review provides evidence to encourage and support PA in ALWH, offers directions for future research that will advance the extant HIV literature, and suggests policy interventions that could serve all populations with chronic conditions, including ALWH. In addition, it guides advance practice nurses in the care of ALWH by focusing on PA assessment and prescriptions as adjunct therapy. Finally, this review addresses critical gaps in the current HIV literature and the needs of a growing underrepresented population. The findings of this review may have implications for health practitioners in primary care regarding the assessment of PA in patients with HIV and the prescription of PA as an adjunct therapeutic strategy in the management of the disease. Combined, these studies offer insight into PA patterns in ALWH and the interdependencies of PA and environmental factors. The findings from this dissertation will illuminate effective strategies to support and measure PA in ALWH as part of long-term health promotion.*

**Keywords:** Elderly, Exercise, AIDS

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### **I. Introduction**

Worldwide in 2007 there were an estimated 33 million people living with HIV, 2.7 million newly infected people, and 2 million AIDs related deaths (UNAIDS, 2008). Majority of those living with HIV/AIDs live in Sub Saharan Africa (SSA) are employed and in their productive years, with skills and experiences that their families, workplaces and countries can ill afford to lose (ILO, 2009). By 2015, HIV/AIDs was expected to cause a 10% to 30% reduction in labour force in high prevalence countries. The Kenya AIDS Indicator Survey (KAIS) estimated the national HIV prevalence rate for adults aged 15-64 years to be 5.6%, which is equivalent to 1,192,000 million Kenyans (KAIS, 2012). As a result of the negative impact of HIV/AIDs in the workplace, the Government of Kenya, through the National Aids Control Council (NACC), recognized that a workplace policy framework on the pandemic is central to putting in place and implementing effective workplace programmes (GOK, 2009). The policy framework was formulated in 2005, demonstrating the Government's concern and commitment in the management of HIV/AIDs pandemic and providing guidance on the development of sector specific workplace policies (GOK, 2009). NAAC also mobilized government institutions to mainstream HIV programs in their activities forming part of the components to be evaluated on their performance.

Evidence has suggested that physical activity (PA) is safe and beneficial in promoting the health and medical stability of ALWH (Hand, Lyerly, Jagers, & Dudgeon, 2009; Jagers, 2018; Nixon et al., 2005; O'Brien, Tynan, Nixon, & Glazier, 2016; Yahiaoui et al., 2012). Specifically, PA can effectively mitigate the effects of cardiovascular disease (Hand et al., 2009; Kamitani et al., 2017; O'Brien et al., 2016), the leading cause of death among ALWH (Farahani et al., 2017), and symptoms of long-term HIV exposure and long-term ART (O'Brien et al., 2016; Webel et al., 2015; Yahiaoui et al., 2012). For example, ALWH who participate in PA have a reduced risk for heart disease, increased energy, improved regulation of bowel function, improved sleep, and lower stress (Hand et al., 2009; U.S. Department of Veterans Affairs, 2015; Yahiaoui et al., 2012). PA is also an important strategy for improving aerobic capacity, muscle strength, and flexibility in this population (Haskell et al., 2007; Jones & Carter, 2000; O'Brien et al., 2016; Poton et al., 2016).

The Centres for Disease Control and Prevention (2015) defined PA as any expenditure of energy by skeletal muscles to produce any bodily movement. PA is a broader concept than exercise, as exercise, a subset

of PA, is defined as a planned, structured, and repetitive activity (Caspersen et al., 1985). Recommended PA for ALWH includes 20 to 40 minutes of combined aerobic and resistance exercise at least 3 times per week (O'Brien et al., 2016; Yahiaoui et al., 2012). These recommendations were shown to reduce the severity of comorbidities (DirajjalFargo et al., 2016; Kamitani et al., 2017; Yahiaoui et al., 2012) and reduce inflammation associated with long-term HIV and long-term ART (d'Ettorre et al., 2014; Hand et al., 2009; Webel et al., 2015). Given the benefits of PA, regular participation for ALWH is essential; however, their PA participation has remained below recommended levels (Montoya et al., 2015; Simonik et al., 2016; Vancampfort et al., 2016a; Webel et al., 2015). Weekly PA recommendations make no mention of supervision, despite being based on studies of both supervised and unsupervised PA interventions (O'Brien et al., 2016; Yahiaoui et al., 2012).

Supervised PA has the potential to encourage ALWH to participate in PA regularly. Studies of adults with other chronic conditions (e.g., arthritis, obesity, kidney failure patients on dialysis, heart failure, diabetes, and cancer) were shown to have increased PA participation after involvement in a PA intervention supervised by a clinician or allied health professional (Akbaba, Yeldan, Guney, & Ozdinciler, 2016; Casla et al., 2014; Daul, Schafers, Daul, & Philipp, 2004; Klempfner et al., 2015; Kuru Colak et al., 2017; Negri et al., 2010; Nicolai et al., 2009). In some cases, regular participation in PA continued well beyond the end of the study (Azad, Bouchard, Mayhew, Carter, & Molnar, 2012; Casla et al., 2014; Trinh, Mutrie, Campbell, Crawford, & Courneya, 2014).

A few qualitative research studies conducted in South-African persons living with HIV (PLWH) indicated that barriers to physical activity include physical complaints, e.g., low-energy levels, psychological complaints such as increased stress levels, family responsibility such as being primary caregivers, and the fear of disclosure and stigmatization, the physical environment including adverse weather conditions, the social environment including domestic abuse and crime, and the workplace situation, e.g., being in a sedentary job (Roos et al., 2013, Ley, Barrio & Leach, 2015). Facilitators of physical activity included support and encouragement from friends and family, religious practices during worship and community environment, e.g., having access to parks and sport fields (Roos et al., 2013). In order to elaborate and confirm such qualitative findings, quantitative research in sub-Saharan Africa-specific settings and which is able to identify potential correlates of actual physical activity levels in PLWH is needed. This information can then be used to target future physical activity interventions for PLWH in sub-Saharan Africa. The purpose of our review was to investigate the role of physical activity (PA) on outcomes of adults living with HIV (ALWH) with the intention to try and establish gaps in literature for further research.

## **II. Methods And Material**

Literature review method was chosen which is very good way to get an overview of information and educational awareness services offered for caregivers in institutional settings and which ways can information and educational services on the meaning of outdoor physical activities for the ALWH. The writer is interested to first analyze what has been concluded by other researchers on the chosen topic. A literature review is a guideline of the topic information in a particular topic area. A literature search was made that determine what has been done and synthesize or pull together those elements which are similar or most pertinent to this thesis topic.

### **History of and Shift in HIV over Time**

The Centres for Disease Control and Prevention (CDC) published a landmark *Morbidity and Mortality Weekly Report* on June 5, 1981. This report was the first official publication that documented the first diagnoses of what would later be discovered as the start of the HIV and AIDS epidemic. Five homosexual males in Los Angeles, California were diagnosed in 1981 (CDC, 1981). In July 1981, the New York Times reported a "rare gay cancer" among 41 gay men, of which, 26 were from New York City (NYC) and the San Francisco Bay area (Altman, 1981). By 1982, the CDC coined the term "AIDS," to refer to the illness, although the cause was still unknown (CDC, 1982).

Over time, there has been a shift in the demographics of individuals living with HIV. Once considered a young person's disease as it affected young, mostly White, homosexual men at its discovery (Altman, 1981; CDC, 2001); this is no longer the case. While the incidence of HIV remains disproportionately higher among men who have sex with men, this disparity has come to include people of color and older adults. For example, approximately 65% of all new HIV diagnoses in 2017 comprised gay and bisexual adult men aged 20 years and older (CDC, 2019b, 2019c). Despite comprising 13% of the population, African Americans accounted for 43% of HIV incidence in 2017 (CDC, 2019a). Additionally, an age disparity exists among adults living with HIV (ALWH). At present, approximately 72% of ALWH are at least 40 years old and 56% are ages 50 and over (CDC, 2017b, 2018). Along with the shift in age demographics, the priority of care has shifted from strategies for survival, as it was during the early years of disease discovery, to include strategies for healthy aging, at present. For this dissertation, older adults living with HIV were defined as those aged 50 years and over.

The shift in the focus of care from survival to healthy aging in ALWH has been chronicled over time. In the decade after the first antiretroviral agent was created and approved by the FDA, eleven more antiretroviral medications followed (U.S. Department of Health and Human Services, 2018). This influx of medications demonstrated the sense of urgency to treat the greater than 500,000 cases of HIV/AIDS diagnosed by 1995 and decrease the rate of deaths attributed to it, which at the time had reached 300,000 (CDC, 1995). This approach was characteristic of the period's focus on the survival of ALWH. The success of antiretroviral therapy (ART) over the past four decades has resulted in increased longevity in ALWH (Samji et al., 2013) and changed HIV from a terminal diagnosis to a manageable, chronic disease (Clayson et al., 2006; Deeks, Lewin, & Havlir, 2013a).

Common strategies to promote healthy aging among ALWH include increasing PA, supportive nutrition interventions, and increased social support. In ALWH, PA interventions have been shown to reduce symptoms associated with poor cardiovascular health, reduce fatigue, and improve cognitive functioning (Dirajlal-Fargo et al., 2016; Dufour et al., 2016; Karmisholt & Gotzsche, 2005; Monroe et al., 2017; O'Brien, Tynan, Nixon, & Glazier, 2016a; Webel et al., 2016a). Supportive nutrition interventions, including increasing caloric intake with low CD4 counts, increasing protein and vitamin intake where deficient, and limiting alcohol consumption have been shown to reduce morbidity and mortality risk in ALWH (Justice et al., 2016; Kahler et al., 2017; Mangili, Murman, Zampini, & Wanke, 2006). It is also important to consider the role food insecurity plays in this population as it relates to PA participation. Food insecurity is defined as inconsistent food intake or inconsistent eating patterns due to a shortage of money or other resources (Office of Disease Promotion and Health Prevention, 2019). It affects approximately 50% of ALWH in urban dwellings (Feldman, Alexy, Thomas, Gambone, & Irvine, 2015; Weiser et al., 2013) and has been linked to impaired physical health and reduced PA (Feldman et al., 2015). Finally, engaging in positive social interactions, including maintaining positive and supportive friendships and social support networks, and maintaining a therapeutic patient-provider relationship, has been shown to alleviate symptom burden and management as well as improve quality of life (Bhatta, Liabsuetrakul, & McNeil, 2017; Iribarren et al., 2017; Webel, Sattar, Schreiner, & Phillips, 2016b; Webel et al., 2015b). In fact, positive social interactions and social support have been cited as key motivators of regular PA participation among ALWH (Galantino et al., 2005b; Mabweazara, Ley, & Leach, 2018; Voigt, Cho, & Schnall, 2018).

### **HIV and Inflammation**

The body's primary defence against pathogens is via the release of inflammatory mediators, such as cytokines and chemokines, by the immune cells (Chou & Effros, 2013; Gruver, Hudson, & Sempowski, 2007). During an acute HIV infection, an influx of cytokines and chemokines are released in the body (Stacey et al., 2009). The degree of HIV replication, or viral load, plays a role in this inflammatory response; that is, the higher the viral load, the greater the inflammatory biomarkers that respond to fight the disease (Deeks, 2011; Deeks, Tracy, & Douek, 2013b). The function of antiretroviral therapy, or ART, is to reduce HIV viral load, thereby reducing the likelihood of advancing to AIDS and reducing overall mortality from the disease (Cohen et al., 2011; HIV Causal Collaboration, 2010; Kitahata et al., 2009). Following this logic, it would be expected that prolonged use of ART would result in reduced viral load and reduced inflammatory response. However, this is not the case. Despite prolonged use of ART, elevated levels of inflammatory biomarkers persist in ALWH (Deeks et al., 2013a; Wing, 2016). Not only are these biomarkers present despite long-term ART, evidence suggests that circulating inflammatory biomarkers are present in higher concentrations in ALWH compared to HIV negative individuals (Deeks, 2011). This evidence suggests that both HIV and ART play a role in the sustained inflammatory response seen in ALWH.

Advances in ART have resulted in people with HIV living longer (Samji et al., 2013). However, this longevity is accompanied by decades of exposure to chronic inflammation (Deeks et al., 2013b). The consequence of this sustained immune response is acceleration toward immunosenescence, or, an aging of the immune system (Appay & Sauce, 2008). Immunosenescence contributes to the overall aging of an individual (Gruver et al., 2007) and is characterized by the body's inability to rid itself of cells that are damaged or no longer replicating (Lopez-Otin, Blasco, Partridge, Serrano, & Kroemer, 2013).

In addition to living longer, evidence suggests that, ALWH are also aging at an accelerated rate due to the effects of immunosenescence (Deeks, 2011; Horvath & Levine, 2015; Rickabaugh et al., 2015; Wing, 2016). By one estimate, the rate of aging in ALWH is approximately 14 years that of the uninfected population (Rickabaugh et al., 2015). The presence of chronic inflammation has been linked to cardiovascular disease, obesity, and type 2 diabetes, among others, in the HIV-positive and HIV-uninfected populations (Farahani, Mulinder, Farahani, & Marlink, 2017; Lopez-Otin et al., 2013; Schouten et al., 2014b; So-Armah et al., 2016). Of these diseases, cardiovascular disease is a leading cause of mortality in ALWH globally, accounting for approximately 15% of all non-AIDS causes of death in high-income countries (Farahani et al., 2017). Furthermore, the elder HIV population suffers from multiple comorbidities, frailty, and neurocognitive decline that also bear inflammation as a commonality (Piggott, Erlandson, & Yarasheski, 2016; Wing, 2016). Given the

dependencies among HIV, aging, and inflammation, understanding the relationship among them informs interventions that target reducing inflammation.

### **HIV, Inflammation, and Physical Activity**

Engaging in regular PA is safe and effective for ALWH (Nixon, O'Brien, Glazier, & Tynan, 2005; O'Brien et al., 2016a; Yahiaoui, McGough, & Voss, 2012). PA recommendations for all U.S. adults include 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity PA per week (Department of Health and Human Services [HHS], 2008). Regular participation in PA has been shown to reduce the effects of the inflammatory processes associated with both HIV and long-term ART (d'Ettorre et al., 2014). Dirajlal-Fargo et al. (2016) found that adults with HIV who engage in 2.5 hours of moderate intensity PA per week experience lower levels of inflammation. Other studies also support the use of PA as a strategy to reduce chronic inflammation in adults living with HIV (Bonato et al., 2017; d'Ettorre et al., 2014; Gleeson et al., 2011). Despite the known benefits of PA in this population, regular participation in PA remains below recommended levels (Vancampfort et al., 2016b; Webel et al., 2015a). For example, after removing walking as a means of PA, Webel et al. (2015a) found that ALWH engaged in 1.4 hours of PA per week, substantially less than the 2.5 hours recommended by HHS. Moreover, evidence suggests that ALWH, more than other populations with chronic conditions (e.g., diabetes, depression), are more likely to drop out of PA interventions (Vancampfort et al., 2017a). Understanding the relationship among HIV, inflammation, and PA provides insights that are helpful for targeting increased PA as a means to reduce HIV-associated inflammation and promote healthy aging in this population.

### **Gaps in the Literature**

The gaps in the current body of HIV/AIDS literature presented below.

#### **Lack of Data from Supervised PA Interventions in ALWH**

Recent systematic reviews and meta-analyses have been focused on the effects of PA interventions on ALWH (Gomes Neto, Conceicao, Oliveira Carvalho, & Brites, 2015; Gomes Neto, Ogalha, Andrade, & Brites, 2013; Gomes-Neto, Conceicao, Oliveira Carvalho, & Brites, 2013; Kamitani et al., 2017; O'Brien et al., 2016a; O'Brien, Tynan, Nixon, & Glazier, 2017; Poton, Polito, & Farinatti, 2016; Yahiaoui et al., 2012). These findings were reported in aggregate from interventions that were supervised by professionals and unsupervised interventions. The authors of these reviews showed that PA interventions improve general health outcomes in ALWH, such as health-related quality of life, mental health, and functional capacity, such as cardiovascular fitness and flexibility. These findings, however, do not clarify which PA interventions—supervised or unsupervised—have the greatest effect on health outcomes in ALWH. The American Heart Association defines functional capacity as the integrated efforts and health of an individual's pulmonary, cardiovascular, and skeletal muscles to perform activities of daily living (Arena et al., 2007). Little is known about the impact of supervised PA interventions on the functional capacity of ALWH.

#### **Lack of Data on the Impact of Environmental Factors on PA in ALWH**

As previously mentioned, evidence suggests that ALWH participate in PA at lower than recommended levels (Montoya, Wing, Knight, Moore, & Henry, 2015; Simonik et al., 2016b; Vancampfort et al., 2016b; Vancampfort et al., 2016c; Webel et al., 2015a). A recent systematic review identified factors associated with PA in ALWH, in which lower levels of PA were associated with older age, lower educational level, lower CD4 count, being on ART, presence of lipodystrophy (i.e., abnormal fat deposits), pain, depression, and opportunistic infections (Vancampfort et al., 2017c). In this review, the factors identified as impediments to PA were overwhelmingly individual factors. There was little discussion of influential factors outside the individual, such as environmental or social factors. Yet, to encourage PA among ALWH, it is important to assess the environment in which PA takes place.

Evidence suggests physical and social environments affect PA patterns (Gustat, Rice, Parker, Becker, & Farley, 2012; Smith et al., 2017; Zapata-Diomed, Herrera, & Veerman, 2016). For example, installation of a sidewalk increased both observed and self-reported PA in residents of a low-income neighbourhood (Gustat et al., 2012). In fact, these same residents reported significant increases in both moderate and vigorous-intensity PA after the sidewalk was installed ( $p < .001$ ). In densely populated neighbourhoods, like many neighbourhoods in New York City, installing sidewalks has been shown to be a cost-effective health intervention (United States Census Bureau, 2012; Veerman et al., 2016). To date, no studies have examined the relationship between aspects of one's physical and social environment and PA patterns in ALWH.

#### **Lack of a PA Instrument Validated in U.S. Sample of ALWH**

Regular PA is an important intervention for ALWH. Participation in PA by ALWH can reduce the risk of cardiovascular disease (a leading cause of death in this population), improve functional capacity, and mitigate the physical limitations of chronic comorbidities and frailty (Farahani et al., 2017; Hart et al., 2018; Kamitani et

al., 2017; O'Brien et al., 2016a; Piggott et al., 2016; Voigt et al., 2018). To measure PA and encourage it when deficient, a validated PA tool is needed. The Baecke Questionnaire (BQ), developed by Baecke, Burema, and Frijters (1982), was validated among a sample of Brazilian ALWH in 2006 (Florindo et al., 2006). The validation study was limited by a small sample size ( $n = 30$ ) and little description of the sample aside from mean years of education (14.4 years) and mean age (37.2 years). Given the validation study was conducted thirteen years ago in Brazil and that 72% of adults with HIV in the U.S. are over 40 years old, this instrument may not be appropriate for use with an aging HIV population in the U.S. Voorrips, Ravelli, Dongelmans, Deurenberg, and Van Staveren (1991) modified and validated the BQ for use in adults aged 65 years and older (hereafter as the modified BQ, or mBQ) in a sample of HIV-uninfected older adults. Therefore, the mBQ may be an appropriate tool to measure PA in older ALWH; however, it has yet to be tested in this population.

To establish validity of the mBQ, the physical function domain of the PROMIS-29 assessment may be used as a comparator. The PROMIS-29 is a self-reported survey of health-related quality of life measures (Cella et al., 2010). The seven domains of the PROMIS-29 measure depression, anxiety, physical function, pain interference, fatigue, sleep disturbance, and participation in social roles and activities. The physical function domain measures physical health using four polytomous response items, in which the higher the score, the better the physical functioning and physical health of the individual. Physical function is related to physical health, because individuals who display adequate physical functioning (i.e., mobility, dexterity, axial function, and the ability to carry out instrumental activities of daily living) are, in effect, physically healthy (Cella et al., 2010). The PROMIS-29 has been previously validated for use in ALWH (Schnall et al., 2017), so the physical function domain may serve as a quick measure of physical health in this population.

### **III. Conclusion**

PA participation is important for the overall health of ALWH. Older ALWH are the largest segment of the HIV/AIDS population; thus, it is particularly important to encourage their participation in PA, because they typically present with activity-limiting comorbidities and frailty. One way to increase PA in ALWH is to have health providers present during PA. As part of a PA assessment, providers should assess the social and physical environments in which PA takes place and use a valid instrument in older ALWH to establish a baseline measurement of PA. These two actions should be done prior to individually tailoring PA prescriptions to ALWH. Future studies should consider PA interventions with and without supervision to quantify the benefit of these interventions in this population. A special focus should be placed on the long-term impact and outcomes of supervised PA for elderly ALWH as the average age of ALWH continues to rise.

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##### **Confidentiality of data.**

The authors declare that they have followed the protocols of the university on the publication of the data.

##### **Right to privacy and informed consent.**

The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

##### **Competing interest**

The authors declare that they have no competing interests.

##### **Authors & contributions**

Micky Olutende Oloo and Martin Sisa Yauma conceived the paper, designed and performed the study. Prof Edwin Wamukoya conceived the paper and was the paper's peer reviewer. All authors read and approved the final manuscript.

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