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Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-026294
Article Type:	Research
Date Submitted by the Author:	24-Aug-2018
Complete List of Authors:	Johs, Nikolas; University of Colorado, School of Medicine Kellar-Guenther, Yvonne; Center for Public Health Innovation, CI International; University of Colorado, School of Public Health Jankowski , Catherine M. ; University of Colorado, College of Nursing Neff, Hadlai; University of Colorado, School of Public Health Erlandson, Kristine; University of Colorado, Medicine
Keywords:	HIV & AIDS < INFECTIOUS DISEASES, GERIATRIC MEDICINE, PUBLIC HEALTH

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Perceived Barriers and Benefits to Exercise by Self-Described Exercise Status, among Older Adults Living with HIV

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Word Count:

Abstract 286

Manuscript 3906

Running Head: Barriers and Benefits to Exercise in HIV

Key word: physical activity, exercise, aging, HIV, qualitative

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Abstract

Objectives: Although exercise interventions have been shown to improve health outcomes among older people with HIV (PLWH), this population remains highly sedentary. The purpose of this study was to examine the differences in perceived barriers and benefits to exercise among older PLWH by self-identified exercise status.

Design: Five focus groups were conducted among PLWH: two groups of exercising men, two groups of non-exercising men, and one group of women (mixed exercisers and non-exercisers). Themes were analyzed in relation to the social ecological model (SEM), utilizing a combination of grounded theory and content analysis.

Setting: Patients were recruited from an academic medical center HIV clinic and community locations.

Participants: PLWH aged 50 or older, diagnosed with HIV for at least two years, with no other health conditions that would preclude exercise.

Primary and Secondary Outcome Measures: Determine facilitators, barriers, and ideal environment for exercise or physical activity and whether these differ between older PLWH who self-identify as an exerciser or non-exerciser.

Results: Among 25 men (11 exercisers and 14 non-exercisers) and 4 women (3 non-exercisers and 1 exerciser), non-exercisers mentioned fewer benefits to exercise (n=46) than exercisers (n=75). Exercisers emphasized positive reinforcement, positive mood change and increased energy as benefits of exercise; interpersonal benefits of exercise were also discussed twice as often for exercisers than non-exercisers. Non-exercisers emphasized barriers to exercise including lack of motivation, lack of self-efficacy, and a negative perception of gym culture. Non-exercisers identified a need for age-appropriate activities as a feature of an ideal exercise

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environment. Both groups identified time, cost, and health-related challenges as barriers to exercise.

Conclusions: Unique exercise barriers and benefits by self-identified exercise status provide important insights into the design of future interventions to initiate and maintain exercise.

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Article Summary

Strengths and Limitations of This Study:

- We explore the perspectives of older men living with HIV on exercise among those with and without established exercise habits, which has not previously been reported in the literature

- This qualitative study used a combination of grounded theory and content analysis in the coding of transcripts, with an initial codebook informed from prior focus groups in this population as well as themes from the literature

- All coding was done by hand by individual investigators, and all codes were reviewed by a third team member until a group consensus was reached

- Results of the analysis were shared with members of the community advisory board for further validation of the data

- Due to difficulty in recruiting women, data saturation of themes was not reached in this group and was only peripherally used to inform interpretation of the data

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Introduction:

With the advent of highly active antiretroviral therapy, nearly half of people living with HIV (PLWH) now are over 50 years old, and this number is expected to increase to 70% by 2030 [1]. Higher rates of age-associated comorbidities among older PLWH, such as cardiovascular disease, osteoporosis, and neurocognitive disorders [2], are likely due in part to chronic inflammation, seen with even suppressed HIV [3]. Furthermore, older adults with HIV often face higher rates of depression, social isolation, and the impact of both age-related and HIV-related stigma, which contribute to health disparities [4-6]. Exercise or physical activity appears to be a safe and effective way to address many comorbidities in older PLWH [7]. Exercise interventions have been shown to improve cardiovascular fitness, bone density, body composition, functional status, neurocognitive function, and health-related quality of life in PLWH [8-11]. Despite the importance of physical activity and exercise to health among older PLWH, high rates of sedentary behavior are common [12].

The factors that drive health behaviors in a population are often described through the social ecological model (SEM). The SEM posits that health behavior is influenced by a number of personal, social, organizational, community, and policy level factors that interact, and cannot be fully understood or enacted upon without addressing all potential levels of influence [13 14]. Indeed, the SEM model has been used extensively in the exercise health behavior literature to investigate the many competing factors that influence physical activity [15-18]. Similarly, a number of qualitative studies have explored attitudes towards exercise or physical activity among diverse populations of PLWH and have identified factors influencing exercise or routine physical activity, such as physical health and self-efficacy (personal), social support and competing priorities such as caregiver responsibilities (social), and accessibility of safe environments for exercise (community) [19-24]. However, these studies did not distinguish the viewpoints of participants with, and without, established exercise habits. Thus, the focus of this qualitative study was to explore whether the facilitators, barriers, and ideal environment for exercise or

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physical activity differ between older PLWH who self-identify as an exerciser compared to a non-exerciser, with the hypothesis that many factors directly influencing exercise behavior would span the SEM levels. Identification of the key differences influencing behavior between PLWH who do and do not exercise will inform multi-level interventions to most effectively transition non-exercisers into self-identified exercisers.

Methods:

Participants were recruited from a University-based HIV primary care clinic and from local HIV community groups. Eligible participants were diagnosed with HIV for ≥ 2 years, aged ≥ 50 years, regularly seeing a physician for HIV care, taking antiretroviral therapy for ≥ 6 months, and did not have a major disability that would preclude exercise. Participants self-identified exercise behavior in response to the question, "are you currently exercising regularly, meaning more than 2 days per week, on most weeks?". All participants provided written informed consent. The study was approved by the Colorado Multi-Institutional Review Board and was registered on Clinical Trials.gov (NCT02404792).

Five focus groups were conducted in June 2016 including: two groups of men that self-identified as exercisers; two groups of men that self-identified as non-exercisers; and a group of women (exercisers and non-exercisers). The focus groups took place in a private conference room in an outpatient medical facility located near the clinic where the majority of participants obtained care. All five focus groups were conducted by a physician who works in the HIV primary care clinic (KME); notes were taken by a second investigator with no treatment relationship to the participants (NAJ). Participants completed a short demographic survey prior to the focus group session. Each session lasted approximately two hours. A semi-structured guide of open-ended questions informed by the literature and prior work by our group[25] was used to facilitate the discussion. All focus groups were audio-recorded and transcribed verbatim

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by a transcriptionist not involved in the study. Participants were provided with a $20 gift card after completion of the focus group.

The transcripts were analyzed individually by two members of the study team involved in the focus groups, and another team member who was not involved. First, rather than starting with a theory like SEM, the team created a codebook using grounded theory and content analysis approaches in combination to identify broad themes related to facilitators and barriers to exercise for older PLWH. A deductive approach was used, with a list of key domains developed from a prior set of focus groups (in PLWH), as well as prior literature for exercise barriers in older adults and PLWH[25]. New codes identified during the analysis were added to the coding scheme and, utilizing a constant-comparison approach, the early transcripts were reanalyzed after the final codebook was determined.

Coding and analyses were completed by hand, independently by each investigator, and then codes were compared; differences were resolved by group consensus. Categories were structured by benefits and motivators to exercise, barriers to exercise, ideal conditions for exercise, and other. These categories were then analyzed and compared between the self-identified exercisers and non-exercisers. In the results, it was noted when a code was mentioned by all four focus groups or by both focus groups of each type (exercisers or non-exercisers). Codes that were unique to only one type (exercisers or non-exercisers) were then compared to the literature to determine if saturation was reached. Challenges with recruitment of women to the study did not allow for subdivision into self-identified exercisers and non-exercisers, and because data saturation could not be reached, themes from this group were used to support findings of the other groups. Quotes from the interviews are provided for insight into the identified themes.

Patient and Public Involvement:

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Member checking involved review and discussion of the results with seven men who are part of our community advisory group. These men reflect characteristics of the focus group participants and provided input as to whether the focus group results resonated with their experiences.

Results:

Twenty-nine participants (Table 1) from 5 focus groups included 11 men who self-identified as exercisers (focus groups n=6, n=5), 14 men who self-identified as non-exercisers (focus groups n=8, n=6), and 4 women. Briefly, among the men, the median age was 57 years, the majority were white and college-educated men who have sex with men. The women had a median age of 56 years, the majority having some college education and sexual preference of men. Male participants had been living with HIV for approximately 20 years (range of 4 to 33 years), and female participants for 15 years (range 4 to 27 years).

Motivators to and Benefits of Exercise

A variety of motivators to exercise and benefits of exercise were reported by both exercising and non-exercising groups although, overall, non-exercisers mentioned far fewer benefits to exercise (n=46) than exercisers (n=75), Table 2. A shared theme was the benefit of being able to think more clearly, or a sense of self-reflection or meditation. For the exercisers, this was more often related to feeling mindful during exercise, “swimming is something like putting yourself in a meditative state. Which is relaxing and you know…it gives me a chance just to zone out by myself.” For the non-exercising group, they talked about how physical activity helped them to think more clearly, “…there is a physiological and mental aspect to it that is very refreshing. It [exercising] is good for your soul... It clears your mind”. Exercisers perceived a benefit on mood, mental health, and coping with stress. As one participant mentioned, “I was diagnosed bipolar about 18 years ago. And so I use exercise as a coping mechanism for when

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I'm depressed or when I'm manic…It grounds me". Exercise also helped to combat the effects of aging: "Well, I'm 60 and I didn't want anything headed south on me!".

The social aspects of exercise were recognized more commonly than the personal benefits in all groups, and nearly twice as often among exercisers: "…having a friend or a buddy to exercise with is a great motivator" (exerciser). Exercisers placed more importance on the motivating encouragement or positive reinforcement from family or peers: "Especially like people at church who I see every Sunday and they are like, keep doing it. Keep going. Keep going. You look great. But that positive reinforcement you know, building my self-esteem a little bit more and you know, remembering that makes me want to walk that half mile …Cause then I know it's paying off" (exerciser). Non-exercisers reported the influence of the social environment or the community on motivation to start exercise. For example, one participant mentioned how much more motivated he was to be active when his community was more active, "not everybody can live in the mountain towns [more physically active towns] and they don't want to. But anyway I had a great network of friends up there. Socially and sports-wise" (non-exerciser). Additional motivators and benefits are detailed in Table 2.

Barriers to Exercise

Physical health, fatigue, injuries or hospitalizations were mentioned among both groups, but more commonly identified as barriers among non-exercisers. One patient related the physical health barriers following a hospitalization: "I ended up being in the hospital for a week with septic shock…up until that time, I was 100% fine…and then the next thing I know, I'm in the ICU and obviously after a week in the hospital, I was much weaker. But when I came home it was like wait, why am I getting winded? So my mind said I should be able to continue doing things at the level I was before. But my body wasn't doing that" (non-exerciser). Other themes discussed by both groups included having a lack of time ("work is just really an impediment",

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non-exerciser), depression, and loss of a personal relationship ("when he left me, it zapped everything"; non-exerciser).

Prominent barriers discussed almost exclusively by the non-exercising group included: a lack of motivation or discipline, lack of a daily routine, or difficulty related to fatigue or other life struggles; "Sometimes it takes everything I have to get out of bed in the morning". Poor exercise self-efficacy was also more commonly discussed among non-exercisers than exercisers. One participant described a strong desire to be active for health reasons, but faced challenges to establishing a regular workout routine, "But the motivation to believe in myself and to have the ability to know that I can do it again, would probably be the hardest part for me." This also coincided with a lack of familiarity of exercise or lack of knowledge of newer technology, "First of all, there are technological advances that have happened since I spent any time in a gym. And I think…that when it comes to being inside a gym or something, I don't know what the best order of machines would be. Or what is going to work for you." Age-related barriers further contributed to low exercise self-efficacy. When one participant asked the group if he was the only one that felt fatigue, another replied, "I don't have a bundle of energy. I'm not bouncing off the walls, you know? Twenty years ago, I used to bounce off the walls cause I had so much [energy]…". One group particularly bemoaned a lack of age-appropriate activities at gyms: "…they are not going to be able to fine-tune something that is more appropriate for someone my age or with various health issues and things like that."

Uniquely identified in the non-exercising groups was a negative perception of gym culture. Participants expressed disdain for younger gym members who were perceived to be more focused on their looks than health ("posers" was the term used by one participant) and for the general environment: "Another thing that really turned me off was during a couple decades period of time, the gym culture changed dramatically from just being a work-out place, to being these entertainment centers with pounding music and all this fancy gym clothes…one day I just walked in and the music was pounding and I said, you know, you got all these frickin' queens

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posing like peacocks in the mirrors and I've had it." The gym was also perceived as a business more focused on selling a product than health, "I don't think they are interested in my health as much as they are trying to sell themselves and make money. I don't like that at all. Because they are not interested in me". In contrast to these negative perceptions expressed by non-exercisers, exercisers commented more on the aspects of community within the gym that they enjoyed.

Exercisers noted a lack of social support as a barrier to exercise. When talking about a time period prior to being an exerciser, a participant related, "I had never lived for me. It was always about my partner or my parents or my teachers, or my friends. My whole life - 50 years - had revolved around what somebody else wanted for me." Another expression of this theme was related to simply not having a social group with which to participate in activity, "…Before my partner passed away, we used to like to go up in the mountains and go hiking. But right now it is like…I don't know anybody around here that enjoys doing it. So this summer I haven't gone hiking at all. I take [my dog] out for his walks. But it's like…I just, you know…I don't know anybody to go hiking with so…".

Ideal Environment for Exercise

When participants were asked to describe ideal exercise conditions, many of the answers related back to the motivators and barriers (Table 2). For both groups, cost and access were important factors. Multiple groups mentioned benefits of the insurance-sponsored programs or reduced-cost community centers, or expressed intentions of investigating such programs. Type of exercise was also related to cost for some participants, "I actually kind of enjoy going out for a run. It doesn't cost me anything. It's free" (exerciser). Interpersonal and social factors were important factors for both groups, with every group describing an aspect of the social environment that they thought was important, whether an "exercise buddy" or a

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welcoming environment: “If someone was genuinely interested in working with me and when I say, generally interested in it from a social perspective. You know?” (non-exerciser).

We also posed the question of what would be the preferred exercise community. Opinions differed across groups: some felt that they would appreciate having a gym that catered to PLWH exclusively whereas others were opposed to this idea. Non-exercisers preferred a gym or program that catered to older adults: “…having people around you that are of a similar age. You know? You don't feel …I don't know if it's threatened or whatever, but you just feel more at ease. You know?” Non-exercisers were also more interested in the types of activities available at the gym and the facilities, and in particular, mentioned the importance of having age-appropriate activities. When describing an acceptable gym format, one participant stated, “what I liked about [the gym]… all the machines are in a circle and it's just for seniors”. This group also mentioned dedicated instruction as something that would be a part of their ideal gym, or clear instructions that would help them to get started if they were not familiar with a given exercise.

Other Factors Acting As Barriers to Exercise or Physical Activity

Throughout the discussion of physical activity and exercise, many other factors were acknowledged, though not directly in the context of exercise or physical activity. These topics related to life challenges that the participants faced, including drug abuse, feeling unsafe in their neighborhood, lack of affordable housing, mental health issues, or stigma related to HIV, sexual preference, or age. Every group had unprompted discussion about social isolation, or loss of friends or partners due to HIV or other reasons, “Now that I'm older, I don't have any 'gay friends' anymore. And I wonder, is it me? Or have they gone somewhere? I mean a lot of them died...But like, I don't have any gay friends. My friends are accepting of me even they know I

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am, but I don't have any. Do you all have any friends who are HIV positive?" This limited group of gay friends threatens the important social support motivator for exercise.

Discussion:

As the SEM is frequently used to inform the personal and societal factors that influence physical activity, we anticipated that our participants would identify the contribution of each level to their own exercise and physical activity behaviors [13 16 17]. We instead found that participants focused much more on the personal physical, mental, and social factors. While environment came up as a deterrent for non-exercisers (negative gym culture), policy was seldom recognized as an influence on physical activity. The lack of connection with the gay community was also mentioned, but participants did not connect that to physical activity. Furthermore, exercisers and non-exercisers recognized some similar, but also unique, barriers and facilitators to routine exercise or physical activity that are important to consider when designing lifestyle interventions for older PLWH.

Physical health was identified as both a major barrier and a motivating factor to exercise. The exercisers were more likely to mention the health-related benefits of exercise, report increased energy, and acknowledge the importance of exercise towards improving overall health, as has been reported previously in the general exercise literature [17]. Despite the medical advances of HIV management with antiretroviral therapy, older PLWH appear to experience age-associated comorbidities at a higher rate and at a younger age than the general population [2 26]. The physical barriers attributed to HIV and medications, generalized fatigue, or chronic pain by our participants are consistently identified as barriers to exercise among PLWH [19 22-24]. To engage older PLWH, exercise interventions must acknowledge and address these physical barriers.

All groups discussed the impact of depression and loss in their exercise behaviors (or life) but the positive impact of exercise on mood and mental health was most often recognized

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by the exercisers. These results are consistent with a recent meta-analysis that found aerobic and resistance exercise interventions had positive effects on various domains of mental health such as stress, anxiety and depressive symptoms in PLWH [27]. In contrast, mental health-related barriers to physical activity are well-described among other populations of PLWH [19 23 24], and depression has been correlated with decreased PA levels in both PLWH and in the general population [17 28]. Depression as a barrier to exercise is of particular relevance given that PLWH have up to three times the rate of depression as the general population [5]. Among the exercisers, the mental health benefits of exercise were an important factor in the maintenance of physical activity and thus is an important domain to emphasize in future exercise intervention studies.

One of the more striking differences between exercisers and non-exercisers was related to a lack of motivation and lack of self-efficacy for the non-exercisers. Self-efficacy has consistently been identified as one of strongest correlates with exercise behavior in adults in general [16-18 29 30] and PLWH [28]. Self-efficacy is commonly defined as an individual's confidence in their ability to complete a task or series of actions, in this case the ability to be able to exercise safely and effectively. Self-efficacy may interact with motivation to exercise, such that an individual with poor exercise self-efficacy has poor recognition of exercise benefits, less confidence in exercise ability, and therefore, less motivation to initiate exercise [31]. The non-exercising group identified a number of themes related to poor self-efficacy including changing technology in gyms, older age, and poor health. Similarly, non-exercisers identified interventions that may help overcome the lack of self-efficacy, including specific instruction and facilities catered to older adults.

The social aspects of exercise or physical activity were strong motivators or benefits among both groups: Exercisers were more likely to mention encouragement from others as an important motivator, whereas non-exercisers focused on the general social environment, rather than the exercise-specific environment. Social isolation and a desire to connect with other social

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groups were discussed by all participants, though not directly in the context of exercise. The importance of social support in exercise has been described among PLWH, whether as a "workout buddy", general community activities, or more social support in general [19 20 23 24]. Older PLWH have high rates of social isolation, and may have challenges related to loss of friends due to illness, or estrangement from family due to HIV or other stigma [6 32]. Social support has been associated with greater physical activity, and loneliness with decreased physical activity [33]. Effective exercise and physical activity promotion and maintenance among older PLWH may require an augmented social environment.

A unique finding was the negative perception of gym culture, recognized to the greatest extent among non-exercisers. The younger community at a gym was perceived as non-welcoming, and participants instead desired a genuine community that connected with them as individuals rather than as a depersonalized customer. There was little consensus among our focus groups regarding what an ideal exercise or physically active community would look like, particularly among the non-exercising group. In our previous work among older men with HIV enrolled in an exercise intervention, participants discussed the appeal of a gym community for older PLWH[25]. Here, however, we found this concept to be contentious, some citing a desire for connection with similar others (older and/or with HIV), but others relating a desire for privacy and concerns about disclosure due to HIV stigma, noted as a barrier to exercise in prior studies of PLWH [20 22]. Based on the data from these focus groups, the welcoming environment of a new gym or activity may be particularly important to those not currently exercising, and activities targeted for older adults may be beneficial. Aside from gym culture, the role of organizational, community, and policy factors (access, cost, indirect barriers such as insecure housing and affordable food, and the built environment) were discussed but not dominant. These commonly reported barriers to physical activity in the general population are a focus of public health and policy interventions [15 17 18 34 35].

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Our study has several limitations. The majority of our participants were white and college-educated men, limiting the generalizability of our findings. Themes that were mentioned by the women's group that merit further exploration include the importance of health-related barriers to exercise and placing higher value on an active lifestyle as opposed to structured exercise. Additionally, our participants were self-identified as exercisers or non-exercisers with no objective verification of their actual amount of type of physical activity. While many of the themes our participants discussed are supported by the literature, ideas about barriers due to gym culture and business models has not been reported to our knowledge, and our focus groups may not have been sufficient to provide saturation on these specific topics. When this data was reported to our community advisory group, they agreed that many corporate gyms had an unfriendly environment, but that perhaps smaller recreation centers might have more of a welcoming atmosphere that our participants desired.

Conclusions

In summary, inter- and intrapersonal factors, including an emphasis on social connection, were central to exercise behaviors among older adults with HIV whereas organizational, community, and policy level factors of the SEM were minor contributors. While addressing these higher-level SEM domains may be important for long-term and large-scale exercise and physical activity dissemination and maintenance, strategies to promote physical activity in older PLWH may need to focus on overcoming physical barriers and providing a safe and welcoming social environment.

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Funding Statement:

Funding: This research was funded through the National Institutes of Health, National Institute on Aging (K23 AG050260 to KME) and NCATS Colorado CTSA (UL1 TR002535). Contents are the authors' sole responsibility and do not necessarily represent official NIH views.

Data Statement section:

Although the transcripts have been de-identified, to protect participant confidentiality regarding some conversations that occurred during the focus groups, the transcripts are readily available. Codebooks or sections of the transcripts can be requested by contacting the corresponding author.

Author Contributions:

NAJ, HN, and KME developed the initial codebook, with input from CJM. KME led the interview sessions with additional input from NAJ and CJM. Data coding was completing by Sara Dunham (see below), NAJ, and KME, with input from CJM, YKG, and HN if consensus was not achieved. NAJ prepared the first manuscript draft; all authors contributed to, reviewed, and approve of the final manuscript.

Acknowledgements:

Sarah Dunham, MPH also coded data.

Competing Interests:

KME has received funding for research paid to the University of Colorado from Gilead Sciences, and has received funding for advisory panel from Viiv Healthcare.

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References

1. Smit M, Brinkman K, Geerlings S, et al. Future challenges for clinical care of an ageing population infected with HIV: a modelling study. *The Lancet Infectious Diseases* 2015;15(7):810-18.
2. Deeks SG. HIV infection, inflammation, immunosenescence, and aging. *Annual review of medicine* 2011;62:141-55.
3. Castillo-Mancilla JR, Brown TT, Erlandson KM, et al. Suboptimal adherence to combination antiretroviral therapy is associated with higher levels of inflammation despite HIV suppression. *Clinical Infectious Diseases* 2016:ciw650.
4. Kaufman MR, Cornish F, Zimmerman RS, et al. Health Behavior Change Models for HIV Prevention and AIDS Care: Practical Recommendations for a Multi-Level Approach. *Journal of Acquired Immune Deficiency Syndromes (1999)* 2014;66(Suppl 3):S250-S58. doi: 10.1097/QAI.0000000000000236
5. Do AN, Rosenberg ES, Sullivan PS, et al. Excess burden of depression among HIV-infected persons receiving medical care in the United States: data from the medical monitoring project and the behavioral risk factor surveillance system. *PLoS One* 2014;9(3):e92842.
6. Emlet CA. An examination of the social networks and social isolation in older and younger adults living with HIV/AIDS. *Health & social work* 2006;31(4):299-308.
7. Botros D, Somarriba G, Neri D, et al. Interventions to address chronic disease and HIV: strategies to promote exercise and nutrition among HIV-infected individuals. *Current HIV/AIDS Reports* 2012;9(4):351-63.
8. Jaggers J, Hand G, Dudgeon W, et al. Aerobic and resistance training improves mood state among adults living with HIV. *International journal of sports medicine* 2015;36(02):175-81.
9. Neto MG, Conceição CS, Carvalho VO, et al. Effects of combined aerobic and resistance exercise on exercise capacity, muscle strength and quality of life in HIV-infected patients: a systematic review and meta-analysis. *PloS one* 2015;10(9):e0138066.
10. O'Brien KK, Tynan A-M, Nixon SA, et al. Effectiveness of aerobic exercise for adults living with HIV: systematic review and meta-analysis using the Cochrane Collaboration protocol. *BMC infectious diseases* 2016;16(1):182.
11. Fazeli PL, Marquine MJ, Dufour C, et al. Physical Activity is Associated with Better Neurocognitive and Everyday Functioning Among Older Adults with HIV Disease. *AIDS Behav* 2015;19(8):1470-7. doi: 10.1007/s10461-015-1024-z [published Online First: 2015/03/04]
12. Vancampfort D, Mugisha J, De Hert M, et al. Sedentary Behavior in People Living With HIV: A Systematic Review and Meta-Analysis. *Journal of physical activity & health* 2017;14(7):571-77. doi: 10.1123/jpah.2016-0507 [published Online First: 2017/03/16]
13. Sallis JF, Owen N, Fisher E. Ecological models of health behavior. *Health behavior: Theory, research, and practice* 2015;5:43-64.
14. McLeroy KR, Bibeau D, Steckler A, et al. An ecological perspective on health promotion programs. *Health education quarterly* 1988;15(4):351-77.
15. Macera CA, Cavanaugh A, Bellettiere J. State of the art review: Physical activity and older adults. *American Journal of Lifestyle Medicine* 2017;11(1):42-57.
16. Trost SG, Owen N, Bauman AE, et al. Correlates of adults' participation in physical activity: review and update. *Medicine & Science in Sports & Exercise* 2002;34(12):1996-2001.
17. Bauman AE, Reis RS, Sallis JF, et al. Correlates of physical activity: why are some people physically active and others not? *Lancet (London, England)* 2012;380(9838):258-71. doi: 10.1016/s0140-6736(12)60735-1 [published Online First: 2012/07/24]

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18. Schutzer KA, Graves BS. Barriers and motivations to exercise in older adults. *Preventive medicine* 2004;39(5):1056-61.
19. Simonik A, Vader K, Ellis D, et al. Are you ready? Exploring readiness to engage in exercise among people living with HIV and multimorbidity in Toronto, Canada: a qualitative study. *BMJ open* 2016;6(3):e010029.
20. Ley C, Barrio MR, Leach L. Suppl 1: M6: social-ecological, motivational and volitional factors for initiating and maintaining physical activity in the context of HIV. *The open AIDS journal* 2015;9:96.
21. Webel AR, Perazzo JD, Dawson-Rose C, et al. A multinational qualitative investigation of the perspectives and drivers of exercise and dietary behaviors in people living with HIV. *Applied Nursing Research* 2017;37:13-18.
22. Nguyen AL, Lake JE, Reid MC, et al. Attitudes towards exercise among substance using older adults living with HIV and chronic pain. *AIDS care* 2017;29(9):1149-52. doi: 10.1080/09540121.2017.1325437
23. Roos R, Myezwa H, van Aswegen H. "Not easy at all but I am trying": barriers and facilitators to physical activity in a South African cohort of people living with HIV participating in a home-based pedometer walking programme. *AIDS care* 2015;27(2):235-39.
24. Montoya JL, Wing D, Knight A, et al. Development of an mHealth Intervention (iSTEP) to promote physical activity among people living with HIV. *Journal of the International Association of Providers of AIDS Care (JIAPAC)* 2015;14(6):471-75.
25. Neff HA, Kellar-Guenther Y, Jankowski CM, et al. Turning disability into ability: barriers and facilitators to initiating and maintaining exercise among older men living with HIV. *AIDS care* 2018:1-5.
26. Justice AC. HIV and aging: time for a new paradigm. *Current HIV/AIDS Reports* 2010;7(2):69-76.
27. Nosrat S, Whitworth JW, Ciccolo JT. Exercise and mental health of people living with HIV: A systematic review. *Chronic illness* 2017;13(4):299-319.
28. Vancampfort D, Mugisha J, Richards J, et al. Physical activity correlates in people living with HIV/AIDS: a systematic review of 45 studies. *Disability and Rehabilitation* 2018;40(14):1618-29. doi: 10.1080/09638288.2017.1306587
29. McAuley E, Szabo A, Gothe N, et al. Self-efficacy: implications for physical activity, function, and functional limitations in older adults. *American journal of lifestyle medicine* 2011;5(4):361-69.
30. Koeneman MA, Verheijden MW, Chinapaw MJM, et al. Determinants of physical activity and exercise in healthy older adults: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity* 2011;8(1):142. doi: 10.1186/1479-5868-8-142
31. Gray L, Chalabaev A, Durant J, et al. Exercise stereotypes and fatigue in people living with HIV: does self-efficacy play a mediating or a moderating role? *Archives of Public Health* 2018;76(1):23.
32. Schrimshaw EW, Siegel K. Perceived barriers to social support from family and friends among older adults with HIV/AIDS. *Journal of Health Psychology* 2003;8(6):738-52.
33. Smith GL, Banting L, Eime R, et al. The association between social support and physical activity in older adults: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity* 2017;14(1):56.
34. Prince SA, Reed JL, McFetridge C, et al. Correlates of sedentary behaviour in adults: a systematic review. *Obesity reviews : an official journal of the International Association for the Study of Obesity* 2017;18(8):915-35. doi: 10.1111/obr.12529 [published Online First: 2017/05/20]

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35. Thornton CM, Kerr J, Conway TL, et al. Physical Activity in Older Adults: an Ecological Approach. *Annals of Behavioral Medicine* 2017;51(2):159-69. doi: 10.1007/s12160-016-9837-1

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Table 1. Participant Characteristics

	Non-exercising Men (n=14)	Exercising Men (n=11)	Women (Non-exercises and exercisers, n=4)
Age	58 (53, 65)	57 (53, 61)	56 (53,61)
Race			
White	8 (57)	10 (91)	2 (50)
Black	3 (21)	1(9)	1 (25)
Other	3 (21)	0 (0)	1 (25)
Ethnicity			
Hispanic or Latino	2 (14)	1 (9)	1 (25)
Not Hispanic / Unknown	12 (86)	10 (91)	3 (75)
Education			
Some high school	0 (0)	0 (0)	1 (25)
High school or equivalent	2 (14)	4 (36)	0 (0)
Some college	5 (36)	3 (27)	3 (75)
College degree	2 (14)	3 (27)	0 (0)
Post-graduate work	5 (36)	1 (9)	0 (0)
Employment			
On disability	4 (29)	6 (55)	0 (0)
Unemployed	5 (36)	0 (0)	3 (75)
Retired	4 (29)	3 (27)	0 (0)
Full-time	2 (14)	2 (18)	0 (0)
Part-time	0 (0)	0 (0)	1 (25)
Years since HIV diagnosis	20 (11, 27)	20 (14, 27)	15 (4,27)
Sexual Preference			
Men	13 (93)	8 (73)	4 (100)
Women	1 (7)	2 (18)	0 (0)
Other	0 (0)	1 (9)	0 (0)
Self-Reported Co-morbidities			
Hypertension	4 (29)	4 (29)	2 (50)
Hyperlipidemia	2 (14)	4 (29)	0 (0)
Diabetes	2 (14)	0 (0)	0 (0)
Depression / anxiety	9 (64)	7 (64)	3 (75)
Osteoporosis	1 (7)	0 (0)	0 (0)

Presented as median with interquartile range (IQR) or frequency (%).

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Table 2. Themes, sub-themes, and frequency of times mentioned across focus groups.

			Count of Times Discussed in Each Group		
Main Theme	Sub-theme	Example	Exercisers (men only)	Non-exercisers (men only)	Women
Motivators and benefits to exercise					
Intrapersonal	Sense of accomplishment	"For me, yeah. It's a badge of something. It is an achievement" "and I was so proud of myself cause that was the first time that I'd danced in so long" "And I'll set, for instance on my stationary bike how far I'm going to go. And try to achieve that. And I really feel good when I achieve that goal. And probably move it up a little bit the next time"	10	5	0
	Health-related motivators	"But I guess one of my goals is that I am self-sufficient and able to live in my own home. We own our own home. I want to be able to stay in my own home. That's important to me" "So it is like yeah, I've got to exercise. Keep eating, but keep exercising so I don't blow up like a balloon. Because if I do, I'm not going to walk again" "If you want to live longer, you have to get a trainer and join a gym. He said lean muscle mass and organ tissue is the key."	23	6	12
	Positive mood change	"For me it is a lot of a reliever of stress. It gives you that freedom in your head. You feel much better, you know?" "And my partner many years ago suggested and encouraged me to find some kind of exercise that I enjoyed. And it was that encouragement that I discovered the pool. And I went over there and to this day, I believe that for some reason, just simply being in the water is like a safe zone for depression."	22	11	3
	Increased energy	"And by exercising, I find I get a lot more energy than if I'm just sitting around like a couch potato, not doing anything. So...I try to make it a regular part of my life" "I just have lived through a variety of things I could do to improve my vitality and I've found that exercise is the most energizing."	13	3	4
	Thinking is clearer	"[when asked to describe how he feels when exercising] Focused and present. Mindful and serene."	9	15	2
Interpersonal	Social activities outside of	"I've found that if you have a lot of people who are more active, you tend to be more active."	12	18	7

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	exercise	"I think the community part of it connects me. So I want to go [to the gym] at the same time cause I know the same people are going to be there. It gets me on that schedule." "And for many years, what got me over to the pool was knowing I would see people that I enjoyed being with. And then I would spend the first hour socializing and you know, we had a routine where we'd visit for quite a while"			
Barriers to exercise					
Intrapersonal	Physical health (medication side effects, fatigue, disability, other health responsibilities)	"Well, it's funny that you mention the chemo and stuff, because after I got done with the Interferon for the Hep C treatment, I noticed my energy level was zapped. And even to this day, I'm not back to where I was 7 1/2 years ago, prior to starting that, you know?" "And then I got really sick and I had a lot of problems with my legs and I wasn't really able to walk. And then I had to battle that, even though it was a missed diagnosis. I had a PIC line for 6 months, so I didn't work out for that period either. And so there were medical reasons and drug reasons why I didn't work out." "Well, you know…I'm not very active. I have a spinal thing going on. And…they are probably going to have to operate on. So I've been kind of out of the exercise program…I was in the hospital for about 9 months."	20	36	20
	Lack of motivation or self-efficacy	"I mean…trying to get motivated at an older age is difficult cause you do have to be motivated and you do have to be focused. But…it is just not there really…" "So I could go back into something that I feel like I'm comfortable in. But the motivation to believe in myself and to have the ability to know that I can do it again, would probably be the hardest part for me."	3	21	8
	Age-related barriers	"I think one of the biggest problems with gyms today, they are activities. And there are a lot of them that are …their focus is younger people. They don't have age related…they don't cater to, you know, the broader demographics of society" "That's why I don't play any hockey because it would take me a week to recuperate. When you are younger, it takes a couple hours and you are good to go."	3	17	9
Interpersonal	Social factors (caregiver burden, lack of social group, lack of support	"But I'm finding myself more and more and more just staying in the apartment for a number of reasons. Number one, I don't have anybody to do anything with." "Yeah. I have a problem with accountability. Doing it by myself is hard to do."	9	3	10

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	from family and friends)				
Environmental	Comfort at the gym	"I don't want to get naked at the gym anymore and I like getting naked to use the facility. I mean you know, you take a shower and you take a steam. But I just don't want to do it anymore." "But I got so embarrassed because there were probably mostly women. Elderly. And they would hand the pin at #10 to be able to do each machine. And I couldn't do 10. So I would …So I would sit down and watch the women. And they would see…I got so embarrassed…so I would deliberately put it back to 10 and I was done."	2	10	5
	Gym culture	"I always assume I am going to be sold. Like there is going to be a sales person there at the gym of some sort, that is going to sell me on some package or something… They aren't really concerned about my needs but what they can get out of me."	3	23	1
Ideal gym / next steps					
Facility level factors	Cost	"Back when I used to go to the gym, to the public gym, the charges were like 5.00 a year or something…but man, it is hundreds of dollars now." "Again, feel the same. I look at exercise…going to a gym. I wouldn't mind going to a gym…if I could afford it."	11	14	5
	Amenities (age appropriate and varied activities, instructions, good facilities)	"So maybe have like the ones that cater to the 20 to 30, maybe 30 to 40 and someone that caters to the 40 to 40 plus year olds?" "I'd much rather not ask questions about something. Like if the machine had a basic sign that it is used for this. And best to be used after this…kind of a 5 point user's manual." "I like a clean gym where things are working, you know? Where parking is easy."	3	11	2
Social factors	Who is at the gym	"I just want to be by myself at the gym…I mean if they had a gym for HIV, I still wouldn't go because why advertise it? "…having people around you that are of a similar age…you don't feel…I don't know if it's threatened or whatever, but you just feel more at ease. You know?" "I need a place where I can talk about HIV"	12	21	3
	Interpersonal interactions	"Yeah. Yeah. Again, the gym is not going to miss you, if you don't show up. But if you've got a buddy, he might give you a call and go where the hell are you?" "And I think that there is a social aspect to it. I don't like competition with other people. But I like being around other people and sharing the same kind of things that they do."	40	25	11

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		“Yeah. A little check in with people. How are you doing? How's your work out? And just whatever conversation it is. I like that.”			

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Reporting checklist for qualitative study.

Based on the SRQR guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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In your methods section, say that you used the SRQR reporting guidelines, and cite them as:

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		Reporting Item	Page Number
	#1	Concise description of the nature and topic of the study identifying the study as qualitative or indicating the approach (e.g. ethnography, grounded theory) or data collection methods (e.g. interview, focus group) is recommended	5-7
	#2	Summary of the key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results and conclusions	3-4
Problem formulation	#3	Description and signifcance of the problem / phenomenon studied: review of relevant theory and empirical work; problem statement	5-6
Purpose or research question	#4	Purpose of the study and specific objectives or questions	6
Qualitative approach and research paradigm	#5	Qualitative approach (e.g. ethnography, grounded theory, case study, phenomenolgy, narrative research) and	7

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		guiding theory if appropriate; identifying the research paradigm (e.g. postpositivist, constructivist / interpretivist) is also recommended; rationale. The rationale should briefly discuss the justification for choosing that theory, approach, method or technique rather than other options available; the assumptions and limitations implicit in those choices and how those choices influence study conclusions and transferability. As appropriate the rationale for several items might be discussed together.	
Researcher characteristics and reflexivity	#6	Researchers' characteristics that may influence the research, including personal attributes, qualifications / experience, relationship with participants, assumptions and / or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results and / or transferability	6
Context	#7	Setting / site and salient contextual factors; rationale	
Sampling strategy	#8	How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g. sampling saturation); rationale	6
Ethical issues pertaining to human subjects	#9	Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	6
Data collection methods	#10	Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources / methods, and modification of procedures in response to evolving study findings; rationale	6
Data collection instruments and technologies	#11	Description of instruments (e.g. interview guides, questionnaires) and devices (e.g. audio recorders) used for data collection; if / how the instruments(s) changed over the course of the study	6-7
Units of study	#12	Number and relevant characteristics of participants, documents, or events included in the study; level of	8, table 1

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		participation (could be reported in results)	
Data processing	#13	Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymisation / deidentification of excerpts	6-7
Data analysis	#14	Process by which inferences, themes, etc. were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale	6-7
Techniques to enhance trustworthiness	#15	Techniques to enhance trustworthiness and credibility of data analysis (e.g. member checking, audit trail, triangulation); rationale	7
Syntheses and interpretation	#16	Main findings (e.g. interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	8-12
Links to empirical data	#17	Evidence (e.g. quotes, field notes, text excerpts, photographs) to substantiate analytic findings	8-12
Intergration with prior work, implications, transferability and contribution(s) to the field	#18	Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application / generalizability; identification of unique contributions(s) to scholarship in a discipline or field	13
Limitations	#19	Trustworthiness and limitations of findings	16
Conflicts of interest	#20	Potential sources of influence of perceived influence on study conduct and conclusions; how these were managed	7
Funding	#21	Sources of funding and other support; role of funders in data collection, interpretation and reporting	17

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BMJ Open

Perceived Barriers and Benefits to Exercise by Self-Described Exercise Status, among Older Adults Living with HIV

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-026294.R1
Article Type:	Research
Date Submitted by the Author:	10-Dec-2018
Complete List of Authors:	Johs, Nikolas; University of Colorado, School of Medicine Kellar-Guenther, Yvonne; Center for Public Health Innovation, CI International; University of Colorado, School of Public Health Jankowski , Catherine M. ; University of Colorado, College of Nursing Neff, Hadlai; University of Colorado, School of Public Health Erlandson, Kristine; University of Colorado, Medicine
Primary Subject Heading:	HIV/AIDS
Secondary Subject Heading:	Public health, Qualitative research, Sports and exercise medicine
Keywords:	HIV & AIDS < INFECTIOUS DISEASES, GERIATRIC MEDICINE, PUBLIC HEALTH

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Perceived Barriers and Benefits to Exercise by Self-Described Exercise Status, among Older Adults Living with HIV

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Word Count:

Abstract 286

Manuscript 3990

Running Head: Barriers and Benefits to Exercise in HIV

Key word: physical activity, exercise, aging, HIV, qualitative

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Abstract

Objectives: Although exercise interventions have been shown to improve health outcomes among older people with HIV (PLWH), this population remains highly sedentary. The purpose of this study was to examine the differences in perceived barriers and benefits to exercise among older PLWH by self-identified exercise status.

Design: Five focus groups were conducted among PLWH: two groups of exercising men, two groups of non-exercising men, and one group of women (mixed exercisers and non-exercisers). Themes were analyzed in relation to the social ecological model (SEM), utilizing the constant comparative approach.

Setting: Patients were recruited from an academic medical center HIV clinic and community locations.

Participants: PLWH aged 50 or older, diagnosed with HIV for at least two years, with no other health conditions that would preclude exercise.

Primary and Secondary Outcome Measures: Determine facilitators, barriers, and ideal environment for exercise or physical activity and whether these differ between older PLWH who self-identify as an exerciser or non-exerciser.

Results: Among 25 men (11 exercisers and 14 non-exercisers) and 4 women (3 non-exercisers and 1 exerciser), non-exercisers mentioned fewer benefits to exercise (n=46) than exercisers (n=75). Exercisers emphasized positive reinforcement, positive mood change and increased energy as benefits of exercise; interpersonal benefits of exercise were also discussed twice as often for exercisers than non-exercisers. Non-exercisers emphasized barriers to exercise including lack of motivation, lack of self-efficacy, and a negative perception of gym culture. Non-exercisers identified a need for age-appropriate activities as a feature of an ideal exercise

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environment. Both groups identified time, cost, and health-related challenges as barriers to exercise.

Conclusions: Unique exercise barriers and benefits by self-identified exercise status provide important insights into the design of future interventions to initiate and maintain exercise.

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Article Summary

Strengths and Limitations of This Study:

- We explored the perspectives of older men living with HIV on exercise among those with and without established exercise habits, which has not previously been reported in the literature

- This qualitative codebook was created in two phases. First transcripts were read and coders created an initial coding scheme based on the patterns seen on first pass-through. Additional codes were then developed from prior focus groups in this population as well as themes from the literature and added prior to analysis.

- All coding was done by hand by individual investigators, and all codes were reviewed by a third team member until a group consensus was reached

- Results of the analysis were shared with members of the community advisory board for further validation of the data

- Due to difficulty in recruiting women, data saturation of themes was not reached in this group and was only peripherally used to inform interpretation of the data

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Introduction:

With the advent of highly active antiretroviral therapy, nearly half of people living with HIV (PLWH) now are over 50 years old, and this number is expected to increase to 70% by 2030 [1]. Higher rates of age-associated comorbidities among older PLWH, such as cardiovascular disease, osteoporosis, and neurocognitive disorders [2], are likely due in part to chronic inflammation, seen with even suppressed HIV [3]. Furthermore, older adults with HIV often face higher rates of depression, social isolation, and the impact of both age-related and HIV-related stigma, which contribute to health disparities [4-6]. Exercise or physical activity appears to be a safe and effective way to prevent negative health outcomes associated with comorbidities in older PLWH [7-14]. Exercise interventions have been shown to improve cardiovascular fitness, bone mineral density, body composition, functional status, neurocognitive function, and health-related quality of life in PLWH, [15-18] and exercise is recommended for older PLWH[19]. Despite the importance of physical activity and exercise to health among older PLWH, high rates of sedentary behavior are common [20 21].

The factors that drive health behaviors in a population are often described through the social ecological model (SEM). The SEM posits that health behavior is influenced by a number of personal, social, organizational, community, and policy level factors that interact, and cannot be fully understood or enacted upon without addressing all potential levels of influence [22 23]. Indeed, the SEM model has been used extensively in the exercise health behavior literature to investigate the many competing factors that influence physical activity [24-27]. Similarly, a number of qualitative studies have explored attitudes towards exercise or physical activity among diverse populations of PLWH and have identified factors influencing exercise or routine physical activity, such as physical health and self-efficacy (personal), social support and competing priorities such as caregiver responsibilities (social), and accessibility of safe environments for exercise (community) [28-33]. However, these studies did not distinguish the viewpoints of participants with, and without, established exercise habits. Thus, the focus of this qualitative

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study was to explore whether the facilitators, barriers, and ideal environment for exercise or physical activity differ between older PLWH who self-identify as an exerciser compared to a non-exerciser, with the hypothesis that many factors directly influencing exercise behavior would span the SEM levels. Identification of the key differences influencing behavior between PLWH who do and do not exercise will inform multi-level interventions to most effectively transition non-exercisers into self-identified exercisers.

Methods:

Participants were recruited from a University-based HIV primary care clinic and from local HIV community groups. Eligible participants were diagnosed with HIV for ≥ 2 years, aged ≥ 50 years, regularly seeing a physician for HIV care, taking antiretroviral therapy for ≥ 6 months, and did not have a major disability (e.g., non-ambulatory) that would preclude exercise. Participants self-identified exercise behavior in response to the question, “are you currently exercising regularly, meaning more than 2 days per week, on most weeks?”. All participants provided written informed consent. The study was approved by the Colorado Multi-Institutional Review Board and was registered on Clinical Trials.gov (NCT02404792).

Five focus groups were conducted in June 2016 including: two groups of men that self-identified as exercisers; two groups of men that self-identified as non-exercisers; and a group of women (both exercisers and non-exercisers, n=4). The focus groups took place in a private conference room in an outpatient medical facility located near the clinic where the majority of participants obtained care. All five focus groups were conducted by a physician who works in the HIV primary care clinic (KME); four of the participants were patients of the physician conducting the focus group. Notes were taken by a second investigator with no treatment relationship to the participants (NAJ). Participants completed a short demographic survey prior to the focus group session. Each session lasted approximately two hours. A semi-structured guide of open-ended questions informed by the literature and prior work by our group[34] was

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used to facilitate the discussion. All focus groups were audio-recorded and transcribed verbatim by a transcriptionist not involved in the study. Participants were provided with a $20 gift card after completion of the focus group.

The transcripts were analyzed individually by two members of the study team involved in the focus groups, and another team member who was not involved. First, rather than starting with a theory like SEM, the team created a codebook in two phases. First transcripts were read and coders created an initial coding scheme based on the patterns seen on first pass-through. Codes were then added using a deductive approach with a list of key domains developed from a prior set of focus groups (in PLWH), as well as prior literature for exercise barriers in older adults and PLWH[34]. New codes identified during the analysis were added to the coding scheme and, utilizing a constant-comparison approach, the early transcripts were reanalyzed after the final codebook was determined.

Coding and analyses were completed by hand, independently by each investigator, and then codes were compared; differences were resolved by group consensus. Categories were structured by benefits and motivators to exercise, barriers to exercise, ideal conditions for exercise, and other. These categories were then analyzed and compared between the self-identified exercisers and non-exercisers. In the results, it was noted when a code was mentioned by all four focus groups or by both focus groups of each type (exercisers or non-exercisers). Codes that were unique to only one type (exercisers or non-exercisers) were then compared to the literature to determine if saturation was reached. Challenges with recruitment of women to the study did not allow for subdivision into self-identified exercisers and non-exercisers, and because data saturation could not be reached, themes from this group were used to support findings of the other groups. Quotes from the interviews are provided for insight into the identified themes.

Patient and Public Involvement:

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Member checking involved review and discussion of the results with seven men who are part of our community advisory group. These men reflect characteristics of the focus group participants and provided input as to whether the focus group results resonated with their experiences.

Results:

Twenty-nine participants (Table 1) from 5 focus groups included 11 men who self-identified as exercisers (focus groups n=6, n=5), 14 men who self-identified as non-exercisers (focus groups n=8, n=6), and 4 women. Briefly, among the men, the median age was 57 years, the majority were white and college-educated men who have sex with men. The women had a median age of 56 years, the majority having some college education and sexual preference of men. Male participants had been living with HIV for approximately 20 years (range of 4 to 33 years), and female participants for 15 years (range 4 to 27 years).

Motivators to and Benefits of Exercise

A variety of motivators to exercise and benefits of exercise were reported by both exercising and non-exercising groups although, overall, non-exercisers mentioned far fewer benefits to exercise (n=46 mentions) than exercisers (n=75 mentions), Table 2. A shared theme was the benefit of being able to think more clearly, or a sense of self-reflection or meditation. For the exercisers, this was more often related to feeling mindful during exercise, “swimming is something like putting yourself in a meditative state. Which is relaxing and you know…it gives me a chance just to zone out by myself.” For the non-exercising group, they talked about how physical activity helped them to think more clearly, “…there is a physiological and mental aspect to it that is very refreshing. It [exercising] is good for your soul... It clears your mind”. Exercisers perceived a benefit on mood, mental health, and coping with stress. As one participant mentioned, “I was diagnosed bipolar about 18 years ago. And so I use exercise as a coping

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mechanism for when I'm depressed or when I'm manic…It grounds me". Exercise also helped to combat the effects of aging: "Well, I'm 60 and I didn't want anything headed south on me!".

The social aspects of exercise were recognized more commonly than the personal benefits in all groups, and nearly twice as often among exercisers: "…having a friend or a buddy to exercise with is a great motivator" (exerciser). Exercisers placed more importance on the motivating encouragement or positive reinforcement from family or peers: "Especially like people at church who I see every Sunday and they are like, keep doing it. Keep going. Keep going. You look great. But that positive reinforcement you know, building my self-esteem a little bit more and you know, remembering that makes me want to walk that half mile …Cause then I know it's paying off" (exerciser). Non-exercisers reported the influence of the social environment or the community on motivation to start exercise. For example, one participant mentioned how much more motivated he was to be active when his community was more active, "not everybody can live in the mountain towns [more physically active towns] and they don't want to. But anyway I had a great network of friends up there. Socially and sports-wise" (non-exerciser). Additional motivators and benefits are detailed in Table 2.

Barriers to Exercise

Physical health, fatigue, injuries or hospitalizations were mentioned among both groups, but more commonly identified as barriers among non-exercisers. One patient related the physical health barriers following a hospitalization: "I ended up being in the hospital for a week with septic shock…up until that time, I was 100% fine…and then the next thing I know, I'm in the ICU and obviously after a week in the hospital, I was much weaker. But when I came home it was like wait, why am I getting winded? So my mind said I should be able to continue doing things at the level I was before. But my body wasn't doing that" (non-exerciser). Other themes discussed by both groups included having a lack of time ("work is just really an impediment",

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non-exerciser), depression, and loss of a personal relationship ("when he left me, it zapped everything"; non-exerciser).

Prominent barriers discussed almost exclusively by the non-exercising group included: a lack of motivation or discipline, lack of a daily routine, or difficulty related to fatigue or other life struggles; "Sometimes it takes everything I have to get out of bed in the morning". Poor exercise self-efficacy was also more commonly discussed among non-exercisers than exercisers. One participant described a strong desire to be active for health reasons, but faced challenges to establishing a regular workout routine, "But the motivation to believe in myself and to have the ability to know that I can do it again, would probably be the hardest part for me." This also coincided with a lack of familiarity of exercise or lack of knowledge of newer technology, "First of all, there are technological advances that have happened since I spent any time in a gym. And I think…that when it comes to being inside a gym or something, I don't know what the best order of machines would be. Or what is going to work for you." Age-related barriers further contributed to low exercise self-efficacy. When one participant asked the group if he was the only one that felt fatigue, another replied, "I don't have a bundle of energy. I'm not bouncing off the walls, you know? Twenty years ago, I used to bounce off the walls 'cause I had so much [energy]…". One group particularly bemoaned a lack of age-appropriate activities at gyms: "…they are not going to be able to fine-tune something that is more appropriate for someone my age or with various health issues and things like that."

Uniquely identified in the non-exercising groups was a negative perception of gym culture. Participants expressed disdain for younger gym members who were perceived to be more focused on their looks than health ("posers" was the term used by one participant) and for the general environment: "Another thing that really turned me off was during a couple decades period of time, the gym culture changed dramatically from just being a work-out place, to being these entertainment centers with pounding music and all this fancy gym clothes…one day I just walked in and the music was pounding and I said, you know, you got all these frickin' queens

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posing like peacocks in the mirrors and I've had it." The gym was also perceived as a business more focused on selling a product than health, "I don't think they are interested in my health as much as they are trying to sell themselves and make money. I don't like that at all. Because they are not interested in me". In contrast to these negative perceptions expressed by non-exercisers, exercisers commented more on the aspects of community within the gym that they enjoyed.

Exercisers noted a lack of social support as a barrier to exercise. When talking about a time period prior to being an exerciser, a participant related, "I had never lived for me. It was always about my partner or my parents or my teachers, or my friends. My whole life - 50 years - had revolved around what somebody else wanted for me." Another expression of this theme was related to simply not having a social group with which to participate in activity, "…Before my partner passed away, we used to like to go up in the mountains and go hiking. But right now it is like…I don't know anybody around here that enjoys doing it. So this summer I haven't gone hiking at all. I take [my dog] out for his walks. But it's like…I just, you know…I don't know anybody to go hiking with so…".

Ideal Environment for Exercise

When participants were asked to describe ideal exercise conditions, many of the answers related back to the motivators and barriers (Table 2). For both groups, cost and access were important factors. Multiple groups mentioned benefits of the insurance-sponsored programs or reduced-cost community centers, or expressed intentions of investigating such programs. Type of exercise was also related to cost for some participants, "I actually kind of enjoy going out for a run. It doesn't cost me anything. It's free" (exerciser). Interpersonal and social factors were important factors for both groups, with every group describing an aspect of the social environment that they thought was important, whether an "exercise buddy" or a

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welcoming environment: “If someone was genuinely interested in working with me and when I say, generally interested in it from a social perspective. You know?” (non-exerciser).

We also posed the question of what would be the preferred exercise community. Opinions differed across groups: some felt that they would appreciate having a gym that catered to PLWH exclusively whereas others were opposed to this idea. Non-exercisers preferred a gym or program that catered to older adults: “…having people around you that are of a similar age. You know? You don't feel …I don't know if it's threatened or whatever, but you just feel more at ease. You know?” Non-exercisers were also more interested in the types of activities available at the gym and the facilities, and in particular, mentioned the importance of having age-appropriate activities. When describing an acceptable gym format, one participant stated, “what I liked about [the gym]… all the machines are in a circle and it's just for seniors”. This group also mentioned dedicated instruction as something that would be a part of their ideal gym, or clear instructions that would help them to get started if they were not familiar with a given exercise.

Other Factors Acting As Barriers to Exercise or Physical Activity

Throughout the discussion of physical activity and exercise, many other factors were acknowledged, though not directly in the context of exercise or physical activity. These topics related to life challenges that the participants faced, including drug abuse, feeling unsafe in their neighborhood, lack of affordable housing, mental health issues, or stigma related to HIV, sexual preference, or age. Every group had unprompted discussion about social isolation, or loss of friends or partners due to HIV or other reasons, “Now that I'm older, I don't have any 'gay friends' anymore. And I wonder, is it me? Or have they gone somewhere? I mean a lot of them died...But like, I don't have any gay friends. My friends are accepting of me even they know I

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am, but I don't have any. Do you all have any friends who are HIV positive?" This limited group of gay friends threatens the important social support motivator for exercise.

Discussion:

As the SEM is frequently used to inform the personal and societal factors that influence physical activity, we anticipated that our participants would identify the contribution of each level to their own exercise and physical activity behaviors [22 25 26]. We instead found that participants focused much more on the personal physical, mental, and social factors. While environment came up as a deterrent for non-exercisers (negative gym culture), policy was seldom recognized as an influence on physical activity. The most salient theme identified that may serve as an target for future policy-level changes would be access (cost and transportation) to a gym, which was identified as a barrier by both exercisers and non-exercisers. The lack of connection with the gay community was also mentioned, but participants did not directly connect that to physical activity. Furthermore, exercisers and non-exercisers recognized some similar, but also unique, barriers and facilitators to routine exercise or physical activity that are important to consider when designing lifestyle interventions for older PLWH.

Physical health was identified as both a major barrier and a motivating factor to exercise. The exercisers were more likely to mention the health-related benefits of exercise, report increased energy, and acknowledge the importance of exercise towards improving overall health, as has been reported previously in the general exercise literature [26]. Despite the medical advances of HIV management with antiretroviral therapy, older PLWH appear to experience age-associated comorbidities at a higher rate and at a younger age than the general population [2 35]. The physical barriers attributed to HIV and medications, generalized fatigue, or chronic pain by our participants are consistently identified as barriers to exercise among PLWH [28 31-33 36]. To engage older PLWH, exercise interventions must acknowledge and address these physical barriers.

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All groups discussed the impact of depression and loss in their exercise behaviors (or life) but the positive impact of exercise on mood and mental health was most often recognized by the exercisers. These results are consistent with a recent meta-analysis that found aerobic and resistance exercise interventions had positive effects on various domains of mental health such as stress, anxiety and depressive symptoms in PLWH [37]. In contrast, mental health-related barriers to physical activity are well-described among other populations of PLWH [28 32 33], and depression has been correlated with decreased PA levels in both PLWH and in the general population [26 38]. Depression as a barrier to exercise is of particular relevance given that PLWH have up to three times the rate of depression as the general population[5], and that perceived well-being may be associated with adherence to an exercise regimen[39]. Among the exercisers, the mental health benefits of exercise were an important factor in the maintenance of physical activity and thus is an important domain to emphasize in future exercise intervention studies.

One of the more striking differences between exercisers and non-exercisers was related to a lack of exercise motivation and exercise self-efficacy among the non-exercisers. Self-efficacy has consistently been identified as one of strongest correlates of exercise behavior in adults in general [25-27 40 41] and PLWH [38 39]. Self-efficacy is commonly defined as an individual's confidence in their ability to complete a task or series of actions, in this case the ability to exercise safely and effectively. Self-efficacy may interact with motivation to exercise, such that an individual with poor exercise self-efficacy has poor recognition of exercise benefits, less confidence in exercise ability, and therefore, less motivation to initiate exercise [42]. The non-exercising group identified a number of themes related to poor self-efficacy including changing technology in gyms, older age, and poor health. Similarly, non-exercisers identified interventions that may help overcome the lack of self-efficacy, including access to specific instruction or wellness facilities that cater to older adults.

The social aspects of exercise or physical activity were strong motivators or benefits among both groups: Exercisers were more likely to mention encouragement from others as an

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important motivator, whereas non-exercisers focused on the general social environment, rather than the exercise-specific environment. Social isolation and a desire to connect with other social groups were discussed by all participants, though not directly in the context of exercise. The importance of social support in exercise has been described among PLWH, whether as a "workout buddy", general community activities, or more social support in general [28 29 32 33]. Older PLWH have high rates of social isolation, and may have challenges related to loss of friends due to illness, or estrangement from family due to HIV or other stigma [6 43]. Social support has been associated with greater physical activity, and loneliness with decreased physical activity [44]. Effective physical activity initiation and maintenance among older PLWH may be strengthened by a robust social environment.

A unique finding was the negative perception of gym culture, recognized to the greatest extent among non-exercisers. The younger community at a gym was perceived as non-welcoming, and participants instead desired a genuine community that connected with them as individuals rather than as a depersonalized customer. There was little consensus among our focus groups regarding what an ideal exercise or physically active community would look like, particularly among the non-exercising group. In our previous work among older men with HIV enrolled in an exercise intervention, participants discussed the appeal of a gym community for older PLWH[34]. Here, however, we found this concept to be contentious, some citing a desire for connection with similar others (older and/or with HIV), but others relating a desire for privacy and concerns about disclosure due to HIV stigma, noted as a barrier to exercise in prior studies of PLWH [29 31]. Based on the data from these focus groups, the welcoming environment of a new gym or activity may be particularly important to those not currently exercising, and activities targeted for older adults may be beneficial. Aside from gym culture, the role of organizational, community, and policy factors (access, cost, indirect barriers such as insecure housing and affordable food, and the built environment) were discussed but not dominant. These commonly

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reported barriers to physical activity in the general population are a focus of public health and policy interventions [24 26 27 45 46].

Our study has several limitations. The majority of our participants were white college-educated men, limiting the generalizability of our findings. Themes that were mentioned by the women's group that merit further exploration include the importance of health-related barriers to exercise and placing higher value on an active lifestyle as opposed to structured exercise. Additionally, our participants were self-identified as exercisers or non-exercisers with no objective verification of their actual amount of type of physical activity. While many of the themes our participants discussed are supported by the literature, ideas about barriers due to gym culture and business models has not been reported to our knowledge, and our focus groups may not have been sufficient to provide saturation on these specific topics. When these results were reported to our community advisory group, they agreed that many corporate gyms had an unfriendly environment, but that perhaps smaller recreation centers might have more of a welcoming atmosphere that our participants desired.

Conclusions

In summary, inter- and intrapersonal factors, including an emphasis on social connection, were central to exercise behaviors among older adults with HIV whereas organizational, community, and policy level factors of the SEM were minor contributors. While addressing these higher-level SEM domains may be important for long-term and large-scale exercise and physical activity dissemination and maintenance, strategies to promote physical activity in older PLWH may need to focus on overcoming physical barriers and providing a safe and welcoming social environment.

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Funding Statement:

Funding: This research was funded through the National Institutes of Health, National Institute on Aging (K23 AG050260 to KME) and NCATS Colorado CTSA (UL1 TR002535). Contents are the authors' sole responsibility and do not necessarily represent official NIH views.

Data Statement section:

Although de-identified, transcribed data may provide personal information that could be linked to individual participants. Codebooks or sections of the transcripts that are not felt to be identifiable may be provided upon request of the corresponding author. Provision is dependent upon approval of the Institutional Review Board.

Author Contributions:

NAJ, HN, and KME developed the initial codebook, with input from CJM. KME led the interview sessions with additional input from NAJ and CJM. Data coding was completing by Sara Dunham (see below), NAJ, and KME, with input from CJM, YKG, and HN if consensus was not achieved. NAJ prepared the first manuscript draft; all authors contributed to, reviewed, and approved the final manuscript.

Acknowledgements:

Sarah Dunham, MPH also coded data.

Competing Interests:

KME has received funding for research paid to the University of Colorado from Gilead Sciences,

and has received funding for advisory panel from Viiv Healthcare.

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References

1. Smit M, Brinkman K, Geerlings S, et al. Future challenges for clinical care of an ageing population infected with HIV: a modelling study. *The Lancet Infectious Diseases* 2015;15(7):810-18.

2. Deeks SG. HIV infection, inflammation, immunosenescence, and aging. *Annual review of medicine* 2011;62:141-55.

3. Castillo-Mancilla JR, Brown TT, Erlandson KM, et al. Suboptimal adherence to combination antiretroviral therapy is associated with higher levels of inflammation despite HIV suppression. *Clinical Infectious Diseases* 2016:ciw650.

4. Kaufman MR, Cornish F, Zimmerman RS, et al. Health Behavior Change Models for HIV Prevention and AIDS Care: Practical Recommendations for a Multi-Level Approach. *Journal of Acquired Immune Deficiency Syndromes (1999)* 2014;66(Suppl 3):S250-S58. doi: 10.1097/QAI.0000000000000236

5. Do AN, Rosenberg ES, Sullivan PS, et al. Excess burden of depression among HIV-infected persons receiving medical care in the United States: data from the medical monitoring project and the behavioral risk factor surveillance system. *PLoS One* 2014;9(3):e92842.

6. Emlet CA. An examination of the social networks and social isolation in older and younger adults living with HIV/AIDS. *Health & social work* 2006;31(4):299-308.

7. Botros D, Somarriba G, Neri D, et al. Interventions to address chronic disease and HIV: strategies to promote exercise and nutrition among HIV-infected individuals. *Current HIV/AIDS Reports* 2012;9(4):351-63.

8. O'Brien KK, Tynan AM, Nixon SA, et al. Effectiveness of aerobic exercise for adults living with HIV: systematic review and meta-analysis using the Cochrane Collaboration protocol. *BMC Infect Dis* 2016;16:182. doi: 10.1186/s12879-016-1478-2 [published Online First: 2016/04/27]

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

9. O'Brien KK, Tynan AM, Nixon SA, et al. Effectiveness of Progressive Resistive Exercise (PRE) in the context of HIV: systematic review and meta-analysis using the Cochrane Collaboration protocol. *BMC Infect Dis* 2017;17(1):268. doi: 10.1186/s12879-017-2342-8 [published Online First: 2017/04/14]

10. Nixon S, O'Brien K, Glazier RH, et al. Aerobic exercise interventions for people with HIV/AIDS. *The Cochrane database of systematic reviews* 2001(1):Cd001796. doi: 10.1002/14651858.Cd001796 [published Online First: 2001/05/02]

11. Nixon S, O'Brien K, Glazier RH, et al. Aerobic exercise interventions for adults living with HIV/AIDS. *The Cochrane database of systematic reviews* 2002(2):Cd001796. doi: 10.1002/14651858.Cd001796 [published Online First: 2002/06/22]

12. O'Brien K, Nixon S, Glazier RH, et al. Progressive resistive exercise interventions for adults living with HIV/AIDS. *The Cochrane database of systematic reviews* 2004(4):Cd004248. doi: 10.1002/14651858.CD004248.pub2 [published Online First: 2004/10/21]

13. Nixon S, O'Brien K, Glazier RH, et al. Aerobic exercise interventions for adults living with HIV/AIDS. *The Cochrane database of systematic reviews* 2005(2):Cd001796. doi: 10.1002/14651858.CD001796.pub2 [published Online First: 2005/04/23]

14. O'Brien K, Nixon S, Tynan AM, et al. Aerobic exercise interventions for adults living with HIV/AIDS. *The Cochrane database of systematic reviews* 2010(8):Cd001796. doi: 10.1002/14651858.CD001796.pub3 [published Online First: 2010/08/06]

15. Jaggers J, Hand G, Dudgeon W, et al. Aerobic and resistance training improves mood state among adults living with HIV. *International journal of sports medicine* 2015;36(02):175-81.

16. Neto MG, Conceição CS, Carvalho VO, et al. Effects of combined aerobic and resistance exercise on exercise capacity, muscle strength and quality of life in HIV-infected patients: a systematic review and meta-analysis. *PloS one* 2015;10(9):e0138066.

For peer review only

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

17. O'Brien KK, Tynan A-M, Nixon SA, et al. Effectiveness of aerobic exercise for adults living with HIV: systematic review and meta-analysis using the Cochrane Collaboration protocol. *BMC infectious diseases* 2016;16(1):182.

18. Fazeli PL, Marquine MJ, Dufour C, et al. Physical Activity is Associated with Better Neurocognitive and Everyday Functioning Among Older Adults with HIV Disease. *AIDS Behav* 2015;19(8):1470-7. doi: 10.1007/s10461-015-1024-z [published Online First: 2015/03/04]

19. O'Brien KK, Solomon P, Trentham B, et al. Evidence-informed recommendations for rehabilitation with older adults living with HIV: a knowledge synthesis. *BMJ Open* 2014;4(5) doi: 10.1136/bmjopen-2013-004692

20. Vancampfort D, Mugisha J, De Hert M, et al. Sedentary Behavior in People Living With HIV: A Systematic Review and Meta-Analysis. *Journal of physical activity & health* 2017;14(7):571-77. doi: 10.1123/jpah.2016-0507 [published Online First: 2017/03/16]

21. Vancampfort D, Mugisha J, De Hert M, et al. Global physical activity levels among people living with HIV: a systematic review and meta-analysis. *Disabil Rehabil* 2018;40(4):388-97. doi: 10.1080/09638288.2016.1260645 [published Online First: 2016/12/09]

22. Sallis JF, Owen N, Fisher E. Ecological models of health behavior. *Health behavior: Theory, research, and practice* 2015;5:43-64.

23. McLeroy KR, Bibeau D, Steckler A, et al. An ecological perspective on health promotion programs. *Health education quarterly* 1988;15(4):351-77.

24. Macera CA, Cavanaugh A, Bellettiere J. State of the art review: Physical activity and older adults. *American Journal of Lifestyle Medicine* 2017;11(1):42-57.

25. Trost SG, Owen N, Bauman AE, et al. Correlates of adults' participation in physical activity: review and update. *Medicine & Science in Sports & Exercise* 2002;34(12):1996-2001.

For peer review only

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

26. Bauman AE, Reis RS, Sallis JF, et al. Correlates of physical activity: why are some people physically active and others not? *Lancet (London, England)* 2012;380(9838):258-71. doi: 10.1016/s0140-6736(12)60735-1 [published Online First: 2012/07/24]

27. Schutzer KA, Graves BS. Barriers and motivations to exercise in older adults. *Preventive medicine* 2004;39(5):1056-61.

28. Simonik A, Vader K, Ellis D, et al. Are you ready? Exploring readiness to engage in exercise among people living with HIV and multimorbidity in Toronto, Canada: a qualitative study. *BMJ open* 2016;6(3):e010029.

29. Ley C, Barrio MR, Leach L. Suppl 1: M6: social-ecological, motivational and volitional factors for initiating and maintaining physical activity in the context of HIV. *The open AIDS journal* 2015;9:96.

30. Webel AR, Perazzo JD, Dawson-Rose C, et al. A multinational qualitative investigation of the perspectives and drivers of exercise and dietary behaviors in people living with HIV. *Applied Nursing Research* 2017;37:13-18.

31. Nguyen AL, Lake JE, Reid MC, et al. Attitudes towards exercise among substance using older adults living with HIV and chronic pain. *AIDS care* 2017;29(9):1149-52. doi: 10.1080/09540121.2017.1325437

32. Roos R, Myezwa H, van Aswegen H. “Not easy at all but I am trying”: barriers and facilitators to physical activity in a South African cohort of people living with HIV participating in a home-based pedometer walking programme. *AIDS care* 2015;27(2):235-39.

33. Montoya JL, Wing D, Knight A, et al. Development of an mHealth Intervention (iSTEP) to promote physical activity among people living with HIV. *Journal of the International Association of Providers of AIDS Care (JIAPAC)* 2015;14(6):471-75.

For peer review only

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

34. Neff HA, Kellar-Guenther Y, Jankowski CM, et al. Turning disability into ability: barriers and facilitators to initiating and maintaining exercise among older men living with HIV. *AIDS care* 2018:1-5.

35. Justice AC. HIV and aging: time for a new paradigm. *Current HIV/AIDS Reports* 2010;7(2):69-76.

36. Brown D, Claffey A, Harding R. Evaluation of a physiotherapy-led group rehabilitation intervention for adults living with HIV: referrals, adherence and outcomes. *AIDS care* 2016;28(12):1495-505. doi: 10.1080/09540121.2016.1191611

37. Nosrat S, Whitworth JW, Ciccolo JT. Exercise and mental health of people living with HIV: A systematic review. *Chronic illness* 2017;13(4):299-319.

38. Vancampfort D, Mugisha J, Richards J, et al. Physical activity correlates in people living with HIV/AIDS: a systematic review of 45 studies. *Disability and Rehabilitation* 2018;40(14):1618-29. doi: 10.1080/09638288.2017.1306587

39. Petróczi A, Hawkins K, Jones G, et al. HIV Patient Characteristics that Affect Adherence to Exercise Programmes: An Observational Study. *The open AIDS journal* 2010;4:148-55. doi: 10.2174/1874613601004010148

40. McAuley E, Szabo A, Gothe N, et al. Self-efficacy: implications for physical activity, function, and functional limitations in older adults. *American journal of lifestyle medicine* 2011;5(4):361-69.

41. Koeneman MA, Verheijden MW, Chinapaw MJM, et al. Determinants of physical activity and exercise in healthy older adults: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity* 2011;8(1):142. doi: 10.1186/1479-5868-8-142

42. Gray L, Chalabaev A, Durant J, et al. Exercise stereotypes and fatigue in people living with HIV: does self-efficacy play a mediating or a moderating role? *Archives of Public Health* 2018;76(1):23.

For peer review only

43. Schrimshaw EW, Siegel K. Perceived barriers to social support from family and friends among older adults with HIV/AIDS. *Journal of Health Psychology* 2003;8(6):738-52.

44. Smith GL, Banting L, Eime R, et al. The association between social support and physical activity in older adults: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity* 2017;14(1):56.

45. Prince SA, Reed JL, McFetridge C, et al. Correlates of sedentary behaviour in adults: a systematic review. *Obesity reviews : an official journal of the International Association for the Study of Obesity* 2017;18(8):915-35. doi: 10.1111/obr.12529 [published Online First: 2017/05/20]

46. Thornton CM, Kerr J, Conway TL, et al. Physical Activity in Older Adults: an Ecological Approach. *Annals of Behavioral Medicine* 2017;51(2):159-69. doi: 10.1007/s12160-016-9837-1

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Table 1. Participant Characteristics

	Exercising Men (n=11)	Non-exercising Men (n=14)	Women (Non-exercisers and Exercisers, n=4)
Age[a]	57 (53, 61)	58 (53, 65)	56 (53,61)
Race[b]			
White	10 (91)	8 (57)	2 (50)
Black	1(9)	3 (21)	1 (25)
Other	0 (0)	3 (21)	1 (25)
Ethnicity[b]			
Hispanic or Latino	1 (9)	2 (14)	1 (25)
Not Hispanic / Unknown	10 (91)	12 (86)	3 (75)
Education[b]			
Some high school	0 (0)	0 (0)	1 (25)
High school or equivalent	4 (36)	2 (14)	0 (0)
Some college	3 (27)	5 (36)	3 (75)
College degree	3 (27)	2 (14)	0 (0)
Post-graduate work	1 (9)	5 (36)	0 (0)
Employment[b]			
On disability	6 (55)	4 (29)	0 (0)
Unemployed	0 (0)	5 (36)	3 (75)
Retired	3 (27)	4 (29)	0 (0)
Full-time	2 (18)	2 (14)	0 (0)
Part-time	0 (0)	0 (0)	1 (25)
Years since HIV diagnosis[a]	20 (14, 27)	20 (11, 27)	15 (4,27)
Sexual Preference[b]			
Men	8 (73)	13 (93)	4 (100)
Women	2 (18)	1 (7)	0 (0)
Other	1 (9)	0 (0)	0 (0)
Self-Reported Co-morbidities[b,c]			
Hypertension	4 (29)	4 (29)	2 (50)
Hyperlipidemia	4 (29)	2 (14)	0 (0)
Diabetes	0 (0)	2 (14)	0 (0)
Depression / anxiety[b]	7 (64)	9 (64)	3 (75)
Osteoporosis[b]	0 (0)	1 (7)	0 (0)

Presented as a) median with interquartile range (IQR) or b) frequency (%).
c. language used on the survey instrument for self-reported co-morbidities was as follows: Have you ever been told by a doctor that you have any of the following medical problems? High blood pressure, high cholesterol, diabetes, depression or anxiety, osteoporosis.

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Table 2. Themes, sub-themes, and frequency of times mentioned across focus groups.

			Count of Times Discussed in Each Group		
Main Theme	Sub-theme	Example	Exercising Men N=11	Non-exercising Men N=14	Women (Exercisers and Non-exercisers) N=4
Motivators and benefits to exercise					
Intrapersonal	Sense of accomplishment	"For me, yeah. It's a badge of something. It is an achievement" "and I was so proud of myself cause that was the first time that I'd danced in so long" "And I'll set, for instance on my stationary bike how far I'm going to go. And try to achieve that. And I really feel good when I achieve that goal. And probably move it up a little bit the next time"	10	5	0
	Health-related motivators	"But I guess one of my goals is that I am self-sufficient and able to live in my own home. We own our own home. I want to be able to stay in my own home. That's important to me" "So it is like yeah, I've got to exercise. Keep eating, but keep exercising so I don't blow up like a balloon. Because if I do, I'm not going to walk again" "If you want to live longer, you have to get a trainer and join a gym. He said lean muscle mass and organ tissue is the key."	23	6	12
	Positive mood change	"For me it is a lot of a reliever of stress. It gives you that freedom in your head. You feel much better, you know?" "And my partner many years ago suggested and encouraged me to find some kind of exercise that I enjoyed. And it was that encouragement that I discovered the pool. And I went over there and to this day, I believe that for some reason, just simply being in the water is like a safe zone for depression."	22	11	3
	Increased energy	"And by exercising, I find I get a lot more energy than if I'm just sitting around like a couch potato, not doing anything. So...I try to make it a regular part of my life" "I just have lived through a variety of things I could do to improve my vitality and I've found that exercise is the most energizing."	13	3	4
	Thinking is clearer	"[when asked to describe how he feels when exercising] Focused and present. Mindful and serene."	9	15	2

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Interpersonal	Social activities outside of exercise	"I've found that if you have a lot of people who are more active, you tend to be more active." "I think the community part of it connects me. So I want to go [to the gym] at the same time cause I know the same people are going to be there. It gets me on that schedule." "And for many years, what got me over to the pool was knowing I would see people that I enjoyed being with. And then I would spend the first hour socializing and you know, we had a routine where we'd visit for quite a while"	12	18	7
Barriers to exercise					
Intrapersonal	Physical health (medication side effects, fatigue, disability, other health responsibilities)	"Well, it's funny that you mention the chemo and stuff, because after I got done with the Interferon for the Hep C treatment, I noticed my energy level was zapped. And even to this day, I'm not back to where I was 7 1/2 years ago, prior to starting that, you know?" "And then I got really sick and I had a lot of problems with my legs and I wasn't really able to walk. And then I had to battle that, even though it was a missed diagnosis. I had a PIC line for 6 months, so I didn't work out for that period either. And so there were medical reasons and drug reasons why I didn't work out." "Well, you know…I'm not very active. I have a spinal thing going on. And…they are probably going to have to operate on. So I've been kind of out of the exercise program…I was in the hospital for about 9 months."	20	36	20
	Lack of motivation or self-efficacy	"I mean…trying to get motivated at an older age is difficult cause you do have to be motivated and you do have to be focused. But…it is just not there really…" "So I could go back into something that I feel like I'm comfortable in. But the motivation to believe in myself and to have the ability to know that I can do it again, would probably be the hardest part for me."	3	21	8
	Age-related barriers	"I think one of the biggest problems with gyms today, they are activities. And there are a lot of them that are …their focus is younger people. They don't have age related…they don't cater to, you know, the broader demographics of society" "That's why I don't play any hockey because it would take me a week to recuperate. When you are younger, it takes a couple hours and you are good to go."	3	17	9

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Interpersonal	Social factors (caregiver burden, lack of social group, lack of support from family and friends)	"But I'm finding myself more and more and more just staying in the apartment for a number of reasons. Number one, I don't have anybody to do anything with." "Yeah. I have a problem with accountability. Doing it by myself is hard to do."	9	3	10
Environmental	Comfort at the gym	"I don't want to get naked at the gym anymore and I like getting naked to use the facility. I mean you know, you take a shower and you take a steam. But I just don't want to do it anymore." "But I got so embarrassed because there were probably mostly women. Elderly. And they would hand the pin at #10 to be able to do each machine. And I couldn't do 10. So I would …So I would sit down and watch the women. And they would see…I got so embarrassed…so I would deliberately put it back to 10 and I was done."	2	10	5
	Gym culture	"I always assume I am going to be sold. Like there is going to be a sales person there at the gym of some sort, that is going to sell me on some package or something… They aren't really concerned about my needs but what they can get out of me."	3	23	1
Ideal gym / next steps					
Facility level factors	Cost	"Back when I used to go to the gym, to the public gym, the charges were like 5.00 a year or something…but man, it is hundreds of dollars now." "Again, feel the same. I look at exercise…going to a gym. I wouldn't mind going to a gym…if I could afford it."	11	14	5
	Amenities (age appropriate and varied activities, instructions, good facilities)	"So maybe have like the ones that cater to the 20 to 30, maybe 30 to 40 and someone that caters to the 40 to 40 plus year olds?" "I'd much rather not ask questions about something. Like if the machine had a basic sign that it is used for this. And best to be used after this…kind of a 5 point user's manual." "I like a clean gym where things are working, you know? Where parking is easy."	3	11	2
Social factors	Who is at the gym	"I just want to be by myself at the gym…I mean if they had a gym for HIV, I still wouldn't go because why advertise it? "…having people around you that are of a similar age…you don't feel…I don't know if it's threatened or whatever, but you just feel more at ease. You know?" "I need a place where I can talk about HIV"	12	21	3

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	Interpersonal interactions	“Yeah. Yeah. Again, the gym is not going to miss you, if you don't show up. But if you've got a buddy, he might give you a call and go where the hell are you?” “And I think that there is a social aspect to it. I don’t like competition with other people. But I like being around other people and sharing the same kind of things that they do.” “Yeah. A little check in with people. How are you doing? How's your work out? And just whatever conversation it is. I like that.”	40	25	11

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Reporting checklist for qualitative study.

Based on the SRQR guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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In your methods section, say that you used the SRQR reporting guidelines, and cite them as:

O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. Standards for reporting qualitative research: a synthesis of recommendations. Acad Med. 2014;89(9):1245-1251.

		Reporting Item	Page Number
	#1	Concise description of the nature and topic of the study identifying the study as qualitative or indicating the approach (e.g. ethnography, grounded theory) or data collection methods (e.g. interview, focus group) is recommended	5-7
	#2	Summary of the key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results and conclusions	3-4
Problem formulation	#3	Description and signifcance of the problem / phenomenon studied: review of relevant theory and empirical work; problem statement	5-6
Purpose or research question	#4	Purpose of the study and specific objectives or questions	6
Qualitative approach and research paradigm	#5	Qualitative approach (e.g. ethnography, grounded theory, case study, phenomenolgy, narrative research) and	7

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		guiding theory if appropriate; identifying the research paradigm (e.g. postpositivist, constructivist / interpretivist) is also recommended; rationale. The rationale should briefly discuss the justification for choosing that theory, approach, method or technique rather than other options available; the assumptions and limitations implicit in those choices and how those choices influence study conclusions and transferability. As appropriate the rationale for several items might be discussed together.	
Researcher characteristics and reflexivity	#6	Researchers' characteristics that may influence the research, including personal attributes, qualifications / experience, relationship with participants, assumptions and / or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results and / or transferability	6
Context	#7	Setting / site and salient contextual factors; rationale	
Sampling strategy	#8	How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g. sampling saturation); rationale	6
Ethical issues pertaining to human subjects	#9	Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	6
Data collection methods	#10	Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources / methods, and modification of procedures in response to evolving study findings; rationale	6
Data collection instruments and technologies	#11	Description of instruments (e.g. interview guides, questionnaires) and devices (e.g. audio recorders) used for data collection; if / how the instruments(s) changed over the course of the study	6-7
Units of study	#12	Number and relevant characteristics of participants, documents, or events included in the study; level of	8, table 1

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		participation (could be reported in results)	
Data processing	#13	Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymisation / deidentification of excerpts	6-7
Data analysis	#14	Process by which inferences, themes, etc. were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale	6-7
Techniques to enhance trustworthiness	#15	Techniques to enhance trustworthiness and credibility of data analysis (e.g. member checking, audit trail, triangulation); rationale	7
Syntheses and interpretation	#16	Main findings (e.g. interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	8-12
Links to empirical data	#17	Evidence (e.g. quotes, field notes, text excerpts, photographs) to substantiate analytic findings	8-12
Intergration with prior work, implications, transferability and contribution(s) to the field	#18	Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application / generalizability; identification of unique contributions(s) to scholarship in a discipline or field	13
Limitations	#19	Trustworthiness and limitations of findings	16
Conflicts of interest	#20	Potential sources of influence of perceived influence on study conduct and conclusions; how these were managed	7
Funding	#21	Sources of funding and other support; role of funders in data collection, interpretation and reporting	17

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A Qualitative Focus Group Study of Perceived Barriers and Benefits to Exercise by Self-Described Exercise Status among Older Adults Living with HIV

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-026294.R2
Article Type:	Research
Date Submitted by the Author:	03-Jan-2019
Complete List of Authors:	Johs, Nikolas; University of Colorado, School of Medicine Kellar-Guenther, Yvonne; Center for Public Health Innovation, CI International; University of Colorado, School of Public Health Jankowski , Catherine M. ; University of Colorado, College of Nursing Neff, Hadlai; University of Colorado, School of Public Health Erlandson, Kristine; University of Colorado, Medicine
Primary Subject Heading:	HIV/AIDS
Secondary Subject Heading:	Public health, Qualitative research, Sports and exercise medicine
Keywords:	HIV & AIDS < INFECTIOUS DISEASES, GERIATRIC MEDICINE, PUBLIC HEALTH

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A Qualitative Focus Group Study of Perceived Barriers and Benefits to Exercise by Self-Described Exercise Status among Older Adults Living with HIV

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Word Count:

Abstract 286

Manuscript 3990

Running Head: Barriers and Benefits to Exercise in HIV

Key word: physical activity, exercise, aging, HIV, qualitative

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Abstract

Objectives: Although exercise interventions have been shown to improve health outcomes among older people with HIV (PLWH), this population remains highly sedentary. The purpose of this study was to examine the differences in perceived barriers and benefits to exercise among older PLWH by self-identified exercise status.

Design: Five focus groups were conducted among PLWH: two groups of exercising men, two groups of non-exercising men, and one group of women (mixed exercisers and non-exercisers). Themes were analyzed in relation to the social ecological model (SEM), utilizing the constant comparative approach.

Setting: Patients were recruited from an academic medical center HIV clinic and community locations.

Participants: PLWH aged 50 or older, diagnosed with HIV for at least two years, with no other health conditions that would preclude exercise.

Primary and Secondary Outcome Measures: Determine facilitators, barriers, and ideal environment for exercise or physical activity and whether these differ between older PLWH who self-identify as an exerciser or non-exerciser.

Results: Among 25 men (11 exercisers and 14 non-exercisers) and 4 women (3 non-exercisers and 1 exerciser), non-exercisers mentioned fewer benefits to exercise (n=46) than exercisers (n=75). Exercisers emphasized positive reinforcement, positive mood change and increased energy as benefits of exercise; interpersonal benefits of exercise were also discussed twice as often for exercisers than non-exercisers. Non-exercisers emphasized barriers to exercise including lack of motivation, lack of self-efficacy, and a negative perception of gym culture. Non-exercisers identified a need for age-appropriate activities as a feature of an ideal exercise

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environment. Both groups identified time, cost, and health-related challenges as barriers to exercise.

Conclusions: Unique exercise barriers and benefits by self-identified exercise status provide important insights into the design of future interventions to initiate and maintain exercise.

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Article Summary

Strengths and Limitations of This Study:

- We explored the perspectives of older men living with HIV on exercise among those with and without established exercise habits, which has not previously been reported in the literature

- This qualitative codebook was created in two phases. First transcripts were read and coders created an initial coding scheme based on the patterns seen on first pass-through. Additional codes were then developed from prior focus groups in this population as well as themes from the literature and added prior to analysis.

- All coding was done by hand by individual investigators, and all codes were reviewed by a third team member until a group consensus was reached

- Results of the analysis were shared with members of the community advisory board for further validation of the data

- Due to difficulty in recruiting women, data saturation of themes was not reached in this group and was only peripherally used to inform interpretation of the data

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Introduction:

With the advent of highly active antiretroviral therapy, nearly half of people living with HIV (PLWH) now are over 50 years old, and this number is expected to increase to 70% by 2030 [1]. Higher rates of age-associated comorbidities among older PLWH, such as cardiovascular disease, osteoporosis, and neurocognitive disorders [2], are likely due in part to chronic inflammation, seen with even suppressed HIV [3]. Furthermore, older adults with HIV often face higher rates of depression, social isolation, and the impact of both age-related and HIV-related stigma, which contribute to health disparities [4-6]. Exercise or physical activity appears to be a safe and effective way to prevent negative health outcomes associated with comorbidities in older PLWH [7-14]. Exercise interventions have been shown to improve cardiovascular fitness, bone mineral density, body composition, functional status, neurocognitive function, and health-related quality of life in PLWH, [15-18] and exercise is recommended for older PLWH[19]. Despite the importance of physical activity and exercise to health among older PLWH, high rates of sedentary behavior are common [20 21].

The factors that drive health behaviors in a population are often described through the social ecological model (SEM). The SEM posits that health behavior is influenced by a number of personal, social, organizational, community, and policy level factors that interact, and cannot be fully understood or enacted upon without addressing all potential levels of influence [22 23]. Indeed, the SEM model has been used extensively in the exercise health behavior literature to investigate the many competing factors that influence physical activity [24-27]. Similarly, a number of qualitative studies have explored attitudes towards exercise or physical activity among diverse populations of PLWH and have identified factors influencing exercise or routine physical activity, such as physical health and self-efficacy (personal), social support and competing priorities such as caregiver responsibilities (social), and accessibility of safe environments for exercise (community) [28-33]. However, these studies did not distinguish the viewpoints of participants with, and without, established exercise habits. Thus, the focus of this qualitative

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study was to explore whether the facilitators, barriers, and ideal environment for exercise or physical activity differ between older PLWH who self-identify as an exerciser compared to a non-exerciser, with the hypothesis that many factors directly influencing exercise behavior would span the SEM levels. Identification of the key differences influencing behavior between PLWH who do and do not exercise will inform multi-level interventions to most effectively transition non-exercisers into self-identified exercisers.

Methods:

Participants were recruited from a University-based HIV primary care clinic and from local HIV community groups. Eligible participants were diagnosed with HIV for ≥ 2 years, aged ≥ 50 years, regularly seeing a physician for HIV care, and taking antiretroviral therapy for ≥ 6 months. Exclusion criteria included inability to provide consent, inability to speak English, or inability to participate in *any* form of exercise. Participants self-identified exercise behavior in response to the question, "are you currently exercising regularly, meaning more than 2 days per week, on most weeks?". All participants provided written informed consent. The study was approved by the Colorado Multi-Institutional Review Board and was registered on Clinical Trials.gov (NCT02404792).

Five focus groups were conducted in June 2016 including: two groups of men that self-identified as exercisers; two groups of men that self-identified as non-exercisers; and a group of women (both exercisers and non-exercisers, n=4). The focus groups took place in a private conference room in an outpatient medical facility located near the clinic where the majority of participants obtained care. All five focus groups were conducted by a physician who works in the HIV primary care clinic (KME); four of the participants were patients of the physician conducting the focus group. Notes were taken by a second investigator with no treatment relationship to the participants (NAJ). Participants completed a short demographic survey prior to the focus group session. Each session lasted approximately two hours. A semi-structured

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guide of open-ended questions informed by the literature and prior work by our group[34] was used to facilitate the discussion. All focus groups were audio-recorded and transcribed verbatim by a transcriptionist not involved in the study. Participants were provided with a $20 gift card after completion of the focus group.

The transcripts were analyzed individually by two members of the study team involved in the focus groups, and another team member who was not involved. First, rather than starting with a theory like SEM, the team created a codebook in two phases. First transcripts were read and coders created an initial coding scheme based on the patterns seen on first pass-through. Codes were then added using a deductive approach with a list of key domains developed from a prior set of focus groups (in PLWH), as well as prior literature for exercise barriers in older adults and PLWH[34]. New codes identified during the analysis were added to the coding scheme and, utilizing a constant-comparison approach, the early transcripts were reanalyzed after the final codebook was determined.

Coding and analyses were completed by hand, independently by each investigator, and then codes were compared; differences were resolved by group consensus. Categories were structured by benefits and motivators to exercise, barriers to exercise, ideal conditions for exercise, and other. These categories were then analyzed and compared between the self-identified exercisers and non-exercisers. In the results, it was noted when a code was mentioned by all four focus groups or by both focus groups of each type (exercisers or non-exercisers). Codes that were unique to only one type (exercisers or non-exercisers) were then compared to the literature to determine if saturation was reached. Challenges with recruitment of women to the study did not allow for subdivision into self-identified exercisers and non-exercisers, and because data saturation could not be reached, themes from this group were used to support findings of the other groups. Quotes from the interviews are provided for insight into the identified themes.

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Patient and Public Involvement:

Member checking involved review and discussion of the results with seven men who are part of our community advisory group. These men reflect characteristics of the focus group participants and provided input as to whether the focus group results resonated with their experiences.

Results:

Twenty-nine participants (Table 1) from 5 focus groups included 11 men who self-identified as exercisers (focus groups n=6, n=5), 14 men who self-identified as non-exercisers (focus groups n=8, n=6), and 4 women. Briefly, among the men, the median age was 57 years, the majority were white and college-educated men who have sex with men. The women had a median age of 56 years, the majority having some college education and sexual preference of men. Male participants had been living with HIV for approximately 20 years (range of 4 to 33 years), and female participants for 15 years (range 4 to 27 years).

Motivators to and Benefits of Exercise

A variety of motivators to exercise and benefits of exercise were reported by both exercising and non-exercising groups although, overall, non-exercisers mentioned far fewer benefits to exercise (n=46 mentions) than exercisers (n=75 mentions), Table 2. A shared theme was the benefit of being able to think more clearly, or a sense of self-reflection or meditation. For the exercisers, this was more often related to feeling mindful during exercise, “swimming is something like putting yourself in a meditative state. Which is relaxing and you know…it gives me a chance just to zone out by myself.” For the non-exercising group, they talked about how physical activity helped them to think more clearly, “…there is a physiological and mental aspect to it that is very refreshing. It [exercising] is good for your soul... It clears your mind”. Exercisers perceived a benefit on mood, mental health, and coping with stress. As one participant

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mentioned, “I was diagnosed bipolar about 18 years ago. And so I use exercise as a coping mechanism for when I'm depressed or when I'm manic…It grounds me”. Exercise also helped to combat the effects of aging: “Well, I'm 60 and I didn't want anything headed south on me!”.

The social aspects of exercise were recognized more commonly than the personal benefits in all groups, and nearly twice as often among exercisers: “…having a friend or a buddy to exercise with is a great motivator” (exerciser). Exercisers placed more importance on the motivating encouragement or positive reinforcement from family or peers: “Especially like people at church who I see every Sunday and they are like, keep doing it. Keep going. Keep going. You look great. But that positive reinforcement you know, building my self-esteem a little bit more and you know, remembering that makes me want to walk that half mile …Cause then I know it's paying off” (exerciser). Non-exercisers reported the influence of the social environment or the community on motivation to start exercise. For example, one participant mentioned how much more motivated he was to be active when his community was more active, “not everybody can live in the mountain towns [more physically active towns] and they don't want to. But anyway I had a great network of friends up there. Socially and sports-wise” (non-exerciser). Additional motivators and benefits are detailed in Table 2.

Barriers to Exercise

Physical health, fatigue, injuries or hospitalizations were mentioned among both groups, but more commonly identified as barriers among non-exercisers. One patient related the physical health barriers following a hospitalization: “I ended up being in the hospital for a week with septic shock…up until that time, I was 100% fine…and then the next thing I know, I'm in the ICU and obviously after a week in the hospital, I was much weaker. But when I came home it was like wait, why am I getting winded? So my mind said I should be able to continue doing things at the level I was before. But my body wasn't doing that” (non-exerciser). Other themes discussed by both groups included having a lack of time (“work is just really an impediment”,

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non-exerciser), depression, and loss of a personal relationship ("when he left me, it zapped everything"; non-exerciser).

Prominent barriers discussed almost exclusively by the non-exercising group included: a lack of motivation or discipline, lack of a daily routine, or difficulty related to fatigue or other life struggles; "Sometimes it takes everything I have to get out of bed in the morning". Poor exercise self-efficacy was also more commonly discussed among non-exercisers than exercisers. One participant described a strong desire to be active for health reasons, but faced challenges to establishing a regular workout routine, "But the motivation to believe in myself and to have the ability to know that I can do it again, would probably be the hardest part for me." This also coincided with a lack of familiarity of exercise or lack of knowledge of newer technology, "First of all, there are technological advances that have happened since I spent any time in a gym. And I think…that when it comes to being inside a gym or something, I don't know what the best order of machines would be. Or what is going to work for you." Age-related barriers further contributed to low exercise self-efficacy. When one participant asked the group if he was the only one that felt fatigue, another replied, "I don't have a bundle of energy. I'm not bouncing off the walls, you know? Twenty years ago, I used to bounce off the walls 'cause I had so much [energy]…". One group particularly bemoaned a lack of age-appropriate activities at gyms: "…they are not going to be able to fine-tune something that is more appropriate for someone my age or with various health issues and things like that."

Uniquely identified in the non-exercising groups was a negative perception of gym culture. Participants expressed disdain for younger gym members who were perceived to be more focused on their looks than health ("posers" was the term used by one participant) and for the general environment: "Another thing that really turned me off was during a couple decades period of time, the gym culture changed dramatically from just being a work-out place, to being these entertainment centers with pounding music and all this fancy gym clothes…one day I just walked in and the music was pounding and I said, you know, you got all these frickin' queens

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posing like peacocks in the mirrors and I've had it." The gym was also perceived as a business more focused on selling a product than health, "I don't think they are interested in my health as much as they are trying to sell themselves and make money. I don't like that at all. Because they are not interested in me". In contrast to these negative perceptions expressed by non-exercisers, exercisers commented more on the aspects of community within the gym that they enjoyed.

Exercisers noted a lack of social support as a barrier to exercise. When talking about a time period prior to being an exerciser, a participant related, "I had never lived for me. It was always about my partner or my parents or my teachers, or my friends. My whole life - 50 years - had revolved around what somebody else wanted for me." Another expression of this theme was related to simply not having a social group with which to participate in activity, "…Before my partner passed away, we used to like to go up in the mountains and go hiking. But right now it is like…I don't know anybody around here that enjoys doing it. So this summer I haven't gone hiking at all. I take [my dog] out for his walks. But it's like…I just, you know…I don't know anybody to go hiking with so…".

Ideal Environment for Exercise

When participants were asked to describe ideal exercise conditions, many of the answers related back to the motivators and barriers (Table 2). For both groups, cost and access were important factors. Multiple groups mentioned benefits of the insurance-sponsored programs or reduced-cost community centers, or expressed intentions of investigating such programs. Type of exercise was also related to cost for some participants, "I actually kind of enjoy going out for a run. It doesn't cost me anything. It's free" (exerciser). Interpersonal and social factors were important factors for both groups, with every group describing an aspect of the social environment that they thought was important, whether an "exercise buddy" or a

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welcoming environment: “If someone was genuinely interested in working with me and when I say, generally interested in it from a social perspective. You know?” (non-exerciser).

We also posed the question of what would be the preferred exercise community. Opinions differed across groups: some felt that they would appreciate having a gym that catered to PLWH exclusively whereas others were opposed to this idea. Non-exercisers preferred a gym or program that catered to older adults: “…having people around you that are of a similar age. You know? You don't feel …I don't know if it's threatened or whatever, but you just feel more at ease. You know?” Non-exercisers were also more interested in the types of activities available at the gym and the facilities, and in particular, mentioned the importance of having age-appropriate activities. When describing an acceptable gym format, one participant stated, “what I liked about [the gym]… all the machines are in a circle and it's just for seniors”. This group also mentioned dedicated instruction as something that would be a part of their ideal gym, or clear instructions that would help them to get started if they were not familiar with a given exercise.

Other Factors Acting As Barriers to Exercise or Physical Activity

Throughout the discussion of physical activity and exercise, many other factors were acknowledged, though not directly in the context of exercise or physical activity. These topics related to life challenges that the participants faced, including drug abuse, feeling unsafe in their neighborhood, lack of affordable housing, mental health issues, or stigma related to HIV, sexual preference, or age. Every group had unprompted discussion about social isolation, or loss of friends or partners due to HIV or other reasons, “Now that I'm older, I don't have any 'gay friends' anymore. And I wonder, is it me? Or have they gone somewhere? I mean a lot of them died...But like, I don't have any gay friends. My friends are accepting of me even they know I

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am, but I don't have any. Do you all have any friends who are HIV positive?" This limited group of gay friends threatens the important social support motivator for exercise.

Discussion:

As the SEM is frequently used to inform the personal and societal factors that influence physical activity, we anticipated that our participants would identify the contribution of each level to their own exercise and physical activity behaviors [22 25 26]. We instead found that participants focused much more on the personal physical, mental, and social factors. While environment came up as a deterrent for non-exercisers (negative gym culture), policy was seldom recognized as an influence on physical activity. The most salient theme identified that may serve as an target for future policy-level changes would be access (cost and transportation) to a gym, which was identified as a barrier by both exercisers and non-exercisers. The lack of connection with the gay community was also mentioned, but participants did not directly connect that to physical activity. Furthermore, exercisers and non-exercisers recognized some similar, but also unique, barriers and facilitators to routine exercise or physical activity that are important to consider when designing lifestyle interventions for older PLWH.

Physical health was identified as both a major barrier and a motivating factor to exercise. The exercisers were more likely to mention the health-related benefits of exercise, report increased energy, and acknowledge the importance of exercise towards improving overall health, as has been reported previously in the general exercise literature [26]. Despite the medical advances of HIV management with antiretroviral therapy, older PLWH appear to experience age-associated comorbidities at a higher rate and at a younger age than the general population [2 35]. The physical barriers attributed to HIV and medications, generalized fatigue, or chronic pain by our participants are consistently identified as barriers to exercise among PLWH [28 31-33 36]. To engage older PLWH, exercise interventions must acknowledge and address these physical barriers.

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All groups discussed the impact of depression and loss in their exercise behaviors (or life) but the positive impact of exercise on mood and mental health was most often recognized by the exercisers. These results are consistent with a recent meta-analysis that found aerobic and resistance exercise interventions had positive effects on various domains of mental health such as stress, anxiety and depressive symptoms in PLWH [37]. In contrast, mental health-related barriers to physical activity are well-described among other populations of PLWH [28 32 33], and depression has been correlated with decreased PA levels in both PLWH and in the general population [26 38]. Depression as a barrier to exercise is of particular relevance given that PLWH have up to three times the rate of depression as the general population[5], and that perceived well-being may be associated with adherence to an exercise regimen[39]. Among the exercisers, the mental health benefits of exercise were an important factor in the maintenance of physical activity and thus is an important domain to emphasize in future exercise intervention studies.

One of the more striking differences between exercisers and non-exercisers was related to a lack of exercise motivation and exercise self-efficacy among the non-exercisers. Self-efficacy has consistently been identified as one of strongest correlates of exercise behavior in adults in general [25-27 40 41] and PLWH [38 39]. Self-efficacy is commonly defined as an individual's confidence in their ability to complete a task or series of actions, in this case the ability to exercise safely and effectively. Self-efficacy may interact with motivation to exercise, such that an individual with poor exercise self-efficacy has poor recognition of exercise benefits, less confidence in exercise ability, and therefore, less motivation to initiate exercise [42]. The non-exercising group identified a number of themes related to poor self-efficacy including changing technology in gyms, older age, and poor health. Similarly, non-exercisers identified interventions that may help overcome the lack of self-efficacy, including access to specific instruction or wellness facilities that cater to older adults.

The social aspects of exercise or physical activity were strong motivators or benefits among both groups: Exercisers were more likely to mention encouragement from others as an

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important motivator, whereas non-exercisers focused on the general social environment, rather than the exercise-specific environment. Social isolation and a desire to connect with other social groups were discussed by all participants, though not directly in the context of exercise. The importance of social support in exercise has been described among PLWH, whether as a "workout buddy", general community activities, or more social support in general [28 29 32 33]. Older PLWH have high rates of social isolation, and may have challenges related to loss of friends due to illness, or estrangement from family due to HIV or other stigma [6 43]. Social support has been associated with greater physical activity, and loneliness with decreased physical activity [44]. Effective physical activity initiation and maintenance among older PLWH may be strengthened by a robust social environment.

A unique finding was the negative perception of gym culture, recognized to the greatest extent among non-exercisers. The younger community at a gym was perceived as non-welcoming, and participants instead desired a genuine community that connected with them as individuals rather than as a depersonalized customer. There was little consensus among our focus groups regarding what an ideal exercise or physically active community would look like, particularly among the non-exercising group. In our previous work among older men with HIV enrolled in an exercise intervention, participants discussed the appeal of a gym community for older PLWH[34]. Here, however, we found this concept to be contentious, some citing a desire for connection with similar others (older and/or with HIV), but others relating a desire for privacy and concerns about disclosure due to HIV stigma, noted as a barrier to exercise in prior studies of PLWH [29 31]. Based on the data from these focus groups, the welcoming environment of a new gym or activity may be particularly important to those not currently exercising, and activities targeted for older adults may be beneficial. Aside from gym culture, the role of organizational, community, and policy factors (access, cost, indirect barriers such as insecure housing and affordable food, and the built environment) were discussed but not dominant. These commonly

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reported barriers to physical activity in the general population are a focus of public health and policy interventions [24 26 27 45 46].

Our study has several limitations. The majority of our participants were white college-educated men, limiting the generalizability of our findings. Themes that were mentioned by the women's group that merit further exploration include the importance of health-related barriers to exercise and placing higher value on an active lifestyle as opposed to structured exercise. Additionally, our participants were self-identified as exercisers or non-exercisers with no objective verification of their actual amount of type of physical activity. While many of the themes our participants discussed are supported by the literature, ideas about barriers due to gym culture and business models has not been reported to our knowledge, and our focus groups may not have been sufficient to provide saturation on these specific topics. When these results were reported to our community advisory group, they agreed that many corporate gyms had an unfriendly environment, but that perhaps smaller recreation centers might have more of a welcoming atmosphere that our participants desired.

Conclusions

In summary, inter- and intrapersonal factors, including an emphasis on social connection, were central to exercise behaviors among older adults with HIV whereas organizational, community, and policy level factors of the SEM were minor contributors. While addressing these higher-level SEM domains may be important for long-term and large-scale exercise and physical activity dissemination and maintenance, strategies to promote physical activity in older PLWH may need to focus on overcoming physical barriers and providing a safe and welcoming social environment.

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Funding Statement:

Funding: This research was funded through the National Institutes of Health, National Institute on Aging (K23 AG050260 to KME) and NCATS Colorado CTSA (UL1 TR002535). Contents are the authors' sole responsibility and do not necessarily represent official NIH views.

Data Statement section:

Although de-identified, transcribed data may provide personal information that could be linked to individual participants. Codebooks or sections of the transcripts that are not felt to be identifiable may be provided upon request of the corresponding author. Provision is dependent upon approval of the Institutional Review Board.

Author Contributions:

NAJ, HN, and KME developed the initial codebook, with input from CJM. KME led the interview sessions with additional input from NAJ and CJM. Data coding was completing by Sara Dunham (see below), NAJ, and KME, with input from CJM, YKG, and HN if consensus was not achieved. NAJ prepared the first manuscript draft; all authors contributed to, reviewed, and approved the final manuscript.

Acknowledgements:

Sarah Dunham, MPH also coded data.

Competing Interests:

KME has received funding for research paid to the University of Colorado from Gilead Sciences,

and has received funding for advisory panel from Viiv Healthcare.

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References

1. Smit M, Brinkman K, Geerlings S, et al. Future challenges for clinical care of an ageing population infected with HIV: a modelling study. *The Lancet Infectious Diseases* 2015;15(7):810-18.

2. Deeks SG. HIV infection, inflammation, immunosenescence, and aging. *Annual review of medicine* 2011;62:141-55.

3. Castillo-Mancilla JR, Brown TT, Erlandson KM, et al. Suboptimal adherence to combination antiretroviral therapy is associated with higher levels of inflammation despite HIV suppression. *Clinical Infectious Diseases* 2016:ciw650.

4. Kaufman MR, Cornish F, Zimmerman RS, et al. Health Behavior Change Models for HIV Prevention and AIDS Care: Practical Recommendations for a Multi-Level Approach. *Journal of Acquired Immune Deficiency Syndromes (1999)* 2014;66(Suppl 3):S250-S58. doi: 10.1097/QAI.0000000000000236

5. Do AN, Rosenberg ES, Sullivan PS, et al. Excess burden of depression among HIV-infected persons receiving medical care in the United States: data from the medical monitoring project and the behavioral risk factor surveillance system. *PLoS One* 2014;9(3):e92842.

6. Emlet CA. An examination of the social networks and social isolation in older and younger adults living with HIV/AIDS. *Health & social work* 2006;31(4):299-308.

7. Botros D, Somarriba G, Neri D, et al. Interventions to address chronic disease and HIV: strategies to promote exercise and nutrition among HIV-infected individuals. *Current HIV/AIDS Reports* 2012;9(4):351-63.

8. O'Brien KK, Tynan AM, Nixon SA, et al. Effectiveness of aerobic exercise for adults living with HIV: systematic review and meta-analysis using the Cochrane Collaboration protocol. *BMC Infect Dis* 2016;16:182. doi: 10.1186/s12879-016-1478-2 [published Online First: 2016/04/27]

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

9. O'Brien KK, Tynan AM, Nixon SA, et al. Effectiveness of Progressive Resistive Exercise (PRE) in the context of HIV: systematic review and meta-analysis using the Cochrane Collaboration protocol. *BMC Infect Dis* 2017;17(1):268. doi: 10.1186/s12879-017-2342-8 [published Online First: 2017/04/14]

10. Nixon S, O'Brien K, Glazier RH, et al. Aerobic exercise interventions for people with HIV/AIDS. *The Cochrane database of systematic reviews* 2001(1):Cd001796. doi: 10.1002/14651858.Cd001796 [published Online First: 2001/05/02]

11. Nixon S, O'Brien K, Glazier RH, et al. Aerobic exercise interventions for adults living with HIV/AIDS. *The Cochrane database of systematic reviews* 2002(2):Cd001796. doi: 10.1002/14651858.Cd001796 [published Online First: 2002/06/22]

12. O'Brien K, Nixon S, Glazier RH, et al. Progressive resistive exercise interventions for adults living with HIV/AIDS. *The Cochrane database of systematic reviews* 2004(4):Cd004248. doi: 10.1002/14651858.CD004248.pub2 [published Online First: 2004/10/21]

13. Nixon S, O'Brien K, Glazier RH, et al. Aerobic exercise interventions for adults living with HIV/AIDS. *The Cochrane database of systematic reviews* 2005(2):Cd001796. doi: 10.1002/14651858.CD001796.pub2 [published Online First: 2005/04/23]

14. O'Brien K, Nixon S, Tynan AM, et al. Aerobic exercise interventions for adults living with HIV/AIDS. *The Cochrane database of systematic reviews* 2010(8):Cd001796. doi: 10.1002/14651858.CD001796.pub3 [published Online First: 2010/08/06]

15. Jaggers J, Hand G, Dudgeon W, et al. Aerobic and resistance training improves mood state among adults living with HIV. *International journal of sports medicine* 2015;36(02):175-81.

16. Neto MG, Conceição CS, Carvalho VO, et al. Effects of combined aerobic and resistance exercise on exercise capacity, muscle strength and quality of life in HIV-infected patients: a systematic review and meta-analysis. *PloS one* 2015;10(9):e0138066.

For peer review only

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

17. O'Brien KK, Tynan A-M, Nixon SA, et al. Effectiveness of aerobic exercise for adults living with HIV: systematic review and meta-analysis using the Cochrane Collaboration protocol. *BMC infectious diseases* 2016;16(1):182.

18. Fazeli PL, Marquine MJ, Dufour C, et al. Physical Activity is Associated with Better Neurocognitive and Everyday Functioning Among Older Adults with HIV Disease. *AIDS Behav* 2015;19(8):1470-7. doi: 10.1007/s10461-015-1024-z [published Online First: 2015/03/04]

19. O'Brien KK, Solomon P, Trentham B, et al. Evidence-informed recommendations for rehabilitation with older adults living with HIV: a knowledge synthesis. *BMJ Open* 2014;4(5) doi: 10.1136/bmjopen-2013-004692

20. Vancampfort D, Mugisha J, De Hert M, et al. Sedentary Behavior in People Living With HIV: A Systematic Review and Meta-Analysis. *Journal of physical activity & health* 2017;14(7):571-77. doi: 10.1123/jpah.2016-0507 [published Online First: 2017/03/16]

21. Vancampfort D, Mugisha J, De Hert M, et al. Global physical activity levels among people living with HIV: a systematic review and meta-analysis. *Disabil Rehabil* 2018;40(4):388-97. doi: 10.1080/09638288.2016.1260645 [published Online First: 2016/12/09]

22. Sallis JF, Owen N, Fisher E. Ecological models of health behavior. *Health behavior: Theory, research, and practice* 2015;5:43-64.

23. McLeroy KR, Bibeau D, Steckler A, et al. An ecological perspective on health promotion programs. *Health education quarterly* 1988;15(4):351-77.

24. Macera CA, Cavanaugh A, Bellettiere J. State of the art review: Physical activity and older adults. *American Journal of Lifestyle Medicine* 2017;11(1):42-57.

25. Trost SG, Owen N, Bauman AE, et al. Correlates of adults' participation in physical activity: review and update. *Medicine & Science in Sports & Exercise* 2002;34(12):1996-2001.

For peer review only

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

26. Bauman AE, Reis RS, Sallis JF, et al. Correlates of physical activity: why are some people physically active and others not? *Lancet (London, England)* 2012;380(9838):258-71. doi: 10.1016/s0140-6736(12)60735-1 [published Online First: 2012/07/24]

27. Schutzer KA, Graves BS. Barriers and motivations to exercise in older adults. *Preventive medicine* 2004;39(5):1056-61.

28. Simonik A, Vader K, Ellis D, et al. Are you ready? Exploring readiness to engage in exercise among people living with HIV and multimorbidity in Toronto, Canada: a qualitative study. *BMJ open* 2016;6(3):e010029.

29. Ley C, Barrio MR, Leach L. Suppl 1: M6: social-ecological, motivational and volitional factors for initiating and maintaining physical activity in the context of HIV. *The open AIDS journal* 2015;9:96.

30. Webel AR, Perazzo JD, Dawson-Rose C, et al. A multinational qualitative investigation of the perspectives and drivers of exercise and dietary behaviors in people living with HIV. *Applied Nursing Research* 2017;37:13-18.

31. Nguyen AL, Lake JE, Reid MC, et al. Attitudes towards exercise among substance using older adults living with HIV and chronic pain. *AIDS care* 2017;29(9):1149-52. doi: 10.1080/09540121.2017.1325437

32. Roos R, Myezwa H, van Aswegen H. “Not easy at all but I am trying”: barriers and facilitators to physical activity in a South African cohort of people living with HIV participating in a home-based pedometer walking programme. *AIDS care* 2015;27(2):235-39.

33. Montoya JL, Wing D, Knight A, et al. Development of an mHealth Intervention (iSTEP) to promote physical activity among people living with HIV. *Journal of the International Association of Providers of AIDS Care (JIAPAC)* 2015;14(6):471-75.

For peer review only

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

34. Neff HA, Kellar-Guenther Y, Jankowski CM, et al. Turning disability into ability: barriers and facilitators to initiating and maintaining exercise among older men living with HIV. *AIDS care* 2018:1-5.

35. Justice AC. HIV and aging: time for a new paradigm. *Current HIV/AIDS Reports* 2010;7(2):69-76.

36. Brown D, Claffey A, Harding R. Evaluation of a physiotherapy-led group rehabilitation intervention for adults living with HIV: referrals, adherence and outcomes. *AIDS care* 2016;28(12):1495-505. doi: 10.1080/09540121.2016.1191611

37. Nosrat S, Whitworth JW, Ciccolo JT. Exercise and mental health of people living with HIV: A systematic review. *Chronic illness* 2017;13(4):299-319.

38. Vancampfort D, Mugisha J, Richards J, et al. Physical activity correlates in people living with HIV/AIDS: a systematic review of 45 studies. *Disability and Rehabilitation* 2018;40(14):1618-29. doi: 10.1080/09638288.2017.1306587

39. Petróczi A, Hawkins K, Jones G, et al. HIV Patient Characteristics that Affect Adherence to Exercise Programmes: An Observational Study. *The open AIDS journal* 2010;4:148-55. doi: 10.2174/1874613601004010148

40. McAuley E, Szabo A, Gothe N, et al. Self-efficacy: implications for physical activity, function, and functional limitations in older adults. *American journal of lifestyle medicine* 2011;5(4):361-69.

41. Koeneman MA, Verheijden MW, Chinapaw MJM, et al. Determinants of physical activity and exercise in healthy older adults: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity* 2011;8(1):142. doi: 10.1186/1479-5868-8-142

42. Gray L, Chalabaev A, Durant J, et al. Exercise stereotypes and fatigue in people living with HIV: does self-efficacy play a mediating or a moderating role? *Archives of Public Health* 2018;76(1):23.

For peer review only

43. Schrimshaw EW, Siegel K. Perceived barriers to social support from family and friends among older adults with HIV/AIDS. *Journal of Health Psychology* 2003;8(6):738-52.

44. Smith GL, Banting L, Eime R, et al. The association between social support and physical activity in older adults: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity* 2017;14(1):56.

45. Prince SA, Reed JL, McFetridge C, et al. Correlates of sedentary behaviour in adults: a systematic review. *Obesity reviews : an official journal of the International Association for the Study of Obesity* 2017;18(8):915-35. doi: 10.1111/obr.12529 [published Online First: 2017/05/20]

46. Thornton CM, Kerr J, Conway TL, et al. Physical Activity in Older Adults: an Ecological Approach. *Annals of Behavioral Medicine* 2017;51(2):159-69. doi: 10.1007/s12160-016-9837-1

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Table 1. Participant Characteristics

	Exercising Men (n=11)	Non-exercising Men (n=14)	Women (Non-exercisers and Exercisers, n=4)
Age[a]	57 (53, 61)	58 (53, 65)	56 (53,61)
Race[b]			
White	10 (91)	8 (57)	2 (50)
Black	1(9)	3 (21)	1 (25)
Other	0 (0)	3 (21)	1 (25)
Ethnicity[b]			
Hispanic or Latino	1 (9)	2 (14)	1 (25)
Not Hispanic / Unknown	10 (91)	12 (86)	3 (75)
Education[b]			
Some high school	0 (0)	0 (0)	1 (25)
High school or equivalent	4 (36)	2 (14)	0 (0)
Some college	3 (27)	5 (36)	3 (75)
College degree	3 (27)	2 (14)	0 (0)
Post-graduate work	1 (9)	5 (36)	0 (0)
Employment[b]			
On disability	6 (55)	4 (29)	0 (0)
Unemployed	0 (0)	5 (36)	3 (75)
Retired	3 (27)	4 (29)	0 (0)
Full-time	2 (18)	2 (14)	0 (0)
Part-time	0 (0)	0 (0)	1 (25)
Years since HIV diagnosis[a]	20 (14, 27)	20 (11, 27)	15 (4,27)
Sexual Preference[b]			
Men	8 (73)	13 (93)	4 (100)
Women	2 (18)	1 (7)	0 (0)
Other	1 (9)	0 (0)	0 (0)
Self-Reported Co-morbidities[b,c]			
Hypertension	4 (29)	4 (29)	2 (50)
Hyperlipidemia	4 (29)	2 (14)	0 (0)
Diabetes	0 (0)	2 (14)	0 (0)
Depression / anxiety[b]	7 (64)	9 (64)	3 (75)
Osteoporosis[b]	0 (0)	1 (7)	0 (0)

Presented as a) median with interquartile range (IQR) or b) frequency (%).
c. language used on the survey instrument for self-reported co-morbidities was as follows: Have you ever been told by a doctor that you have any of the following medical problems? High blood pressure, high cholesterol, diabetes, depression or anxiety, osteoporosis.

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Table 2. Themes, sub-themes, and frequency of times mentioned across focus groups.

			Count of Times Discussed in Each Group		
Main Theme	Sub-theme	Example	Exercising Men N=11	Non-exercising Men N=14	Women (Exercisers and Non-exercisers) N=4
Motivators and benefits to exercise					
Intrapersonal	Sense of accomplishment	"For me, yeah. It's a badge of something. It is an achievement" "and I was so proud of myself cause that was the first time that I'd danced in so long" "And I'll set, for instance on my stationary bike how far I'm going to go. And try to achieve that. And I really feel good when I achieve that goal. And probably move it up a little bit the next time"	10	5	0
	Health-related motivators	"But I guess one of my goals is that I am self-sufficient and able to live in my own home. We own our own home. I want to be able to stay in my own home. That's important to me" "So it is like yeah, I've got to exercise. Keep eating, but keep exercising so I don't blow up like a balloon. Because if I do, I'm not going to walk again" "If you want to live longer, you have to get a trainer and join a gym. He said lean muscle mass and organ tissue is the key."	23	6	12
	Positive mood change	"For me it is a lot of a reliever of stress. It gives you that freedom in your head. You feel much better, you know?" "And my partner many years ago suggested and encouraged me to find some kind of exercise that I enjoyed. And it was that encouragement that I discovered the pool. And I went over there and to this day, I believe that for some reason, just simply being in the water is like a safe zone for depression."	22	11	3
	Increased energy	"And by exercising, I find I get a lot more energy than if I'm just sitting around like a couch potato, not doing anything. So...I try to make it a regular part of my life" "I just have lived through a variety of things I could do to improve my vitality and I've found that exercise is the most energizing."	13	3	4
	Thinking is clearer	"[when asked to describe how he feels when exercising] Focused and present. Mindful and serene."	9	15	2

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Interpersonal	Social activities outside of exercise	"I've found that if you have a lot of people who are more active, you tend to be more active." "I think the community part of it connects me. So I want to go [to the gym] at the same time cause I know the same people are going to be there. It gets me on that schedule." "And for many years, what got me over to the pool was knowing I would see people that I enjoyed being with. And then I would spend the first hour socializing and you know, we had a routine where we'd visit for quite a while"	12	18	7
Barriers to exercise					
Intrapersonal	Physical health (medication side effects, fatigue, disability, other health responsibilities)	"Well, it's funny that you mention the chemo and stuff, because after I got done with the Interferon for the Hep C treatment, I noticed my energy level was zapped. And even to this day, I'm not back to where I was 7 1/2 years ago, prior to starting that, you know?" "And then I got really sick and I had a lot of problems with my legs and I wasn't really able to walk. And then I had to battle that, even though it was a missed diagnosis. I had a PIC line for 6 months, so I didn't work out for that period either. And so there were medical reasons and drug reasons why I didn't work out." "Well, you know…I'm not very active. I have a spinal thing going on. And…they are probably going to have to operate on. So I've been kind of out of the exercise program…I was in the hospital for about 9 months."	20	36	20
	Lack of motivation or self-efficacy	"I mean…trying to get motivated at an older age is difficult cause you do have to be motivated and you do have to be focused. But…it is just not there really…" "So I could go back into something that I feel like I'm comfortable in. But the motivation to believe in myself and to have the ability to know that I can do it again, would probably be the hardest part for me."	3	21	8
	Age-related barriers	"I think one of the biggest problems with gyms today, they are activities. And there are a lot of them that are …their focus is younger people. They don't have age related…they don't cater to, you know, the broader demographics of society" "That's why I don't play any hockey because it would take me a week to recuperate. When you are younger, it takes a couple hours and you are good to go."	3	17	9

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Interpersonal	Social factors (caregiver burden, lack of social group, lack of support from family and friends)	"But I'm finding myself more and more and more just staying in the apartment for a number of reasons. Number one, I don't have anybody to do anything with." "Yeah. I have a problem with accountability. Doing it by myself is hard to do."	9	3	10
Environmental	Comfort at the gym	"I don't want to get naked at the gym anymore and I like getting naked to use the facility. I mean you know, you take a shower and you take a steam. But I just don't want to do it anymore." "But I got so embarrassed because there were probably mostly women. Elderly. And they would hand the pin at #10 to be able to do each machine. And I couldn't do 10. So I would …So I would sit down and watch the women. And they would see…I got so embarrassed…so I would deliberately put it back to 10 and I was done."	2	10	5
	Gym culture	"I always assume I am going to be sold. Like there is going to be a sales person there at the gym of some sort, that is going to sell me on some package or something… They aren't really concerned about my needs but what they can get out of me."	3	23	1
Ideal gym / next steps					
Facility level factors	Cost	"Back when I used to go to the gym, to the public gym, the charges were like 5.00 a year or something…but man, it is hundreds of dollars now." "Again, feel the same. I look at exercise…going to a gym. I wouldn't mind going to a gym…if I could afford it."	11	14	5
	Amenities (age appropriate and varied activities, instructions, good facilities)	"So maybe have like the ones that cater to the 20 to 30, maybe 30 to 40 and someone that caters to the 40 to 40 plus year olds?" "I'd much rather not ask questions about something. Like if the machine had a basic sign that it is used for this. And best to be used after this…kind of a 5 point user's manual." "I like a clean gym where things are working, you know? Where parking is easy."	3	11	2
Social factors	Who is at the gym	"I just want to be by myself at the gym…I mean if they had a gym for HIV, I still wouldn't go because why advertise it? "…having people around you that are of a similar age…you don't feel…I don't know if it's threatened or whatever, but you just feel more at ease. You know?" "I need a place where I can talk about HIV"	12	21	3

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	Interpersonal interactions	“Yeah. Yeah. Again, the gym is not going to miss you, if you don't show up. But if you've got a buddy, he might give you a call and go where the hell are you?” “And I think that there is a social aspect to it. I don’t like competition with other people. But I like being around other people and sharing the same kind of things that they do.” “Yeah. A little check in with people. How are you doing? How's your work out? And just whatever conversation it is. I like that.”	40	25	11

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Reporting checklist for qualitative study.

Based on the SRQR guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the SRQR reporting guidelines, and cite them as:

O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. Standards for reporting qualitative research: a synthesis of recommendations. Acad Med. 2014;89(9):1245-1251.

		Reporting Item	Page Number
	#1	Concise description of the nature and topic of the study identifying the study as qualitative or indicating the approach (e.g. ethnography, grounded theory) or data collection methods (e.g. interview, focus group) is recommended	5-7
	#2	Summary of the key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results and conclusions	3-4
Problem formulation	#3	Description and signifcance of the problem / phenomenon studied: review of relevant theory and empirical work; problem statement	5-6
Purpose or research question	#4	Purpose of the study and specific objectives or questions	6
Qualitative approach and research paradigm	#5	Qualitative approach (e.g. ethnography, grounded theory, case study, phenomenolgy, narrative research) and	7

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		guiding theory if appropriate; identifying the research paradigm (e.g. postpositivist, constructivist / interpretivist) is also recommended; rationale. The rationale should briefly discuss the justification for choosing that theory, approach, method or technique rather than other options available; the assumptions and limitations implicit in those choices and how those choices influence study conclusions and transferability. As appropriate the rationale for several items might be discussed together.	
Researcher characteristics and reflexivity	#6	Researchers' characteristics that may influence the research, including personal attributes, qualifications / experience, relationship with participants, assumptions and / or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results and / or transferability	6
Context	#7	Setting / site and salient contextual factors; rationale	
Sampling strategy	#8	How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g. sampling saturation); rationale	6
Ethical issues pertaining to human subjects	#9	Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	6
Data collection methods	#10	Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources / methods, and modification of procedures in response to evolving study findings; rationale	6
Data collection instruments and technologies	#11	Description of instruments (e.g. interview guides, questionnaires) and devices (e.g. audio recorders) used for data collection; if / how the instruments(s) changed over the course of the study	6-7
Units of study	#12	Number and relevant characteristics of participants, documents, or events included in the study; level of	8, table 1

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		participation (could be reported in results)	
Data processing	#13	Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymisation / deidentification of excerpts	6-7
Data analysis	#14	Process by which inferences, themes, etc. were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale	6-7
Techniques to enhance trustworthiness	#15	Techniques to enhance trustworthiness and credibility of data analysis (e.g. member checking, audit trail, triangulation); rationale	7
Syntheses and interpretation	#16	Main findings (e.g. interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	8-12
Links to empirical data	#17	Evidence (e.g. quotes, field notes, text excerpts, photographs) to substantiate analytic findings	8-12
Intergration with prior work, implications, transferability and contribution(s) to the field	#18	Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application / generalizability; identification of unique contributions(s) to scholarship in a discipline or field	13
Limitations	#19	Trustworthiness and limitations of findings	16
Conflicts of interest	#20	Potential sources of influence of perceived influence on study conduct and conclusions; how these were managed	7
Funding	#21	Sources of funding and other support; role of funders in data collection, interpretation and reporting	17

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