Article

Clinical Nursing Research
1–11

DOI: 10.1177/10547738241231626
journals.sagepub.com/home/cnr
Sage

Exploring the Interrelationships Between Physical Function, Functional Exercise Capacity, and Exercise Self-Efficacy in Persons Living with HIV

Kathleen M. Nokes, PhD, RN, FAAN[1],
Dudu G. Sokhela, RN, RM, D Nursing[2],
Penelope M. Orton, RN, RM, PhD, FANSA[3],
William Ellery Samuels, PhD[4],
J. Craig Phillips, LLM, PhD, RN, ACRN, FAAN, FCAN[5],
Kimberly Adams Tufts, ND, WHNP-BC, FAAN[6],
Joseph D. Perazzo, PhD, RN, ACRN[7],
Puangtip Chaiphibalsarisdi, PhD, RN[8],
Carmen Portillo, PhD, RN, FAAN[9],
Rebecca Schnall, PhD, MPH, RN-BC, FAAN, FACMI[10],
Mary Jane Hamilton, PhD, RN[11],
Carol Dawson-Rose, RN, PhD, FAAN[12],
and Allison R. Webel, PhD, RN, FAAN[13]

Abstract

While physical activity can mitigate the metabolic effects of HIV disease and HIV medications, many HIV-infected persons report low levels of physical activity. *Purpose*: To determine if there were differences between the subjective and objective assessments of physical activity while controlling for sociodemographic, anthropometric, and clinical characteristics. *Setting/sample*: A total of 810 participants across eight sites located in three countries. *Measures*: Subjective instruments were the two subscales of Self-efficacy for Exercise Behaviors Scale: Making Time for Exercise and Resisting Relapse and Patient-Reported Outcomes Measurement Information System, which measured physical function. The objective measure of functional exercise capacity was the 6-minute Walk Test. *Analysis*: Both univariate and multivariant analyses were used. *Results*: Physical function was significantly associated with Making Time for Exercise ($\beta = 1.76$, $p = .039$) but not with Resisting Relapse ($\beta = 1.16$, $p = .168$). Age ($\beta = -1.88$, $p = .001$), being employed ($\beta = 16.19$, $p < .001$) and race ($\beta s = 13.84–31.98$, $p < .001$), hip–waist ratio ($\beta = -2.18$, $p < .001$), and comorbidities ($\beta = 7.31$, $p < .001$) were significant predictors of physical functioning. The model predicting physical function accounted for a large amount of variance (adjusted $R^2 = .938$). The patterns of results predicting functional exercise capacity were similar. Making Time for Exercise self-efficacy scores significantly predicted functional exercise capacity ($\beta = 0.14$, $p = .029$), and Resisting Relapse scores again did not ($\beta = -0.10$, $p = .120$). Among the covariates, age ($\beta = -0.16$, $p < .001$), gender ($\beta = -0.43$, $p < .001$), education ($\beta = 0.08$, $p = .026$), and hip–waist ratio ($\beta = 0.09$, $p = .034$) were significant. This model did not account for much of the overall variance in the data (adjusted $R^2 = .081$). We found a modest significant relationship between physical function and functional exercise capacity ($r = 0.27$). *Conclusions*: Making Time for Exercise Self-efficacy was more significant than Resisting Relapse for both physical function and functional exercise capacity. Interventions to promote achievement of physical activity need to use multiple measurement strategies.

Keywords

exercise, nursing interventions, clinical research areas, functional exercise capacity, physical function, syndromes, HIV/AIDS, diseases exercise self-efficacy

The global burden of HIV disease was approximately 38.4 million in 2021 and, as of August 2022, 75% of the people living with HIV (PLWH) were taking antiretroviral treatment (ART) to treat the infection (HIV.gov, 2022). Many PLWH are living longer but with a concomitant increase in cardio-metabolic disorders associated with the disease process, medications used to suppress the virus, and advancing age (Nguyen et al., 2021). Compared to uninfected people, PLWH often develop cardiovascular disease (CVD) at a younger median age (Ramos et al., 2021). The etiology of the increased prevalence of CVD results from complex interactions among HIV-specific factors (i.e., chronic infection, immune activation, and chronic inflammation), traditional CVD risk factors (i.e., tobacco or illicit drug use, obesity and dyslipidemia, diabetes mellitus, and hypertension), treatment with ART, and disparities in access to healthcare (Henning & Greene, 2023). The Canadian HIV and Aging Cohort Study found that cardiovascular pathology included increased carotid artery wall stiffness, epicardial fat deposition, and noncalcified coronary atherosclerotic plaques in HIV infected compared to negative persons. Eight times more PLWH reported a personal history of CVD at baseline compared to HIV-negative counterparts. Frailty includes slow walking speed and limited physical activity and PLWH were more likely to be prefrail (41.0% vs. 28.6%) or frail (6.0% vs. 2.9%) compared to those without HIV (Giguère et al., 2023). Regular physical activity decreases mortality from all causes by increasing cardiorespiratory and musculoskeletal fitness, flexibility, balance, and speed (World Health Organization [WHO], 2022).

Physical activity refers to bodily movements produced by skeletal muscles that require energy expenditure and includes movement during leisure time, for transport to get to and from places, or as part of a person's work (WHO, 2022). Exercise, as one form of physical activity, is a self-management strategy that can address disability and improve or sustain health (O'Brien et al., 2017). Physical function refers to the performance, or the capacity, to perform a variety of physical activities that are normal for people in good health (Stewart & Kamberg, 1992). Perception of the capacity to organize and execute courses of action required to attain designated types of performance is referred to as exercise self-efficacy (Bandura, 1986, p. 391). Exercise self-efficacy has been associated with physical function but both are measured through self-report, which might introduce a social desirability bias. In comparison, functional exercise capacity is measured by recording the distance that a person walks during a timed period.

Although Jankowski et al. (2023) found differences in the DNA methylation profiles in the skeletal muscle of older adults with HIV and uninfected controls of similar chronologic age, the pilot research did not identify the specific mechanism of how exercise affects HIV cellular changes. While physical activity is one strategy that may overcome negative effects of HIV disease, comorbidities, and adverse effects of treatment modalities, PLWH often do not reach the levels recommended by the WHO's physical activity guidelines (Voigt et al., 2018). According to these guidelines (2022), people living with chronic conditions including HIV should complete at least 150 to 300 minutes of moderate-intensity aerobic physical activity or at least 75 to 150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week and muscle-strengthening activities at moderate or greater intensity that involve all major muscle groups on two or more days a week.

Bullard et al. (2019) conducted a systematic review of adherence rates to the WHO aerobic physical activity guidelines among people with different chronic conditions and identified a possible 1,616 randomized control trials conducted between 2000 and 2018. Participants in the clinical trials achieved a less than desirable average adherence rate of 77%. Substantial heterogeneity in adherence rates across studies was found, and they suggested new approaches for increasing continued exercise engagement among chronically ill individuals who may have particular difficulty achieving the weekly exercise target identified in the WHO guidelines. The only demographic factor that Bullard et al. (2019) examined was age. In

[1]International Nursing Network for HIV Research, Durban University of Technology, South Africa
[2]Department of Nursing, Durban University of Technology, South Africa
[3]Durban University of Technology, South Africa
[4]Hunter College, CUNY, Hunter-Bellevue School of Nursing, New York, NY, USA
[5]Faculty of Health Sciences, School of Nursing, University of Ottawa, ON, Canada
[6]School of Nursing, Old Dominion University, Norfolk, VA, USA
[7]University of Cincinnati College of Nursing, OH, USA
[8]Metharath University, Bangkok, Thailand
[9]Yale School of Nursing, Orange, CT, USA
[10]Columbia University School of Nursing, New York, NY, USA
[11]College of Nursing and Health Sciences, Texas A&M University-Corpus Christi, USA
[12]UCSF School of Nursing, San Francisco, CA, USA
[13]Department of Child, Family and Population Health Nursing, University of Washington, Seattle, USA

Corresponding Author:
Kathleen M. Nokes, International Nursing Network for HIV Research, Durban University of Technology, P.O. Box 1334, Durban 4000, South Africa.
Email: kathynokes@aol.com

order to develop new approaches for sustained exercise engagement, measurement tools need to be valid. The aim of this research was to assess the relationship between subjective assessment of physical activity as reported on the exercise self-efficacy and physical function scales and the objective measure of physical activity as measured on the 6-minute walk test (6MWT). We also explored for relationships between the study variables and different sociodemographic, anthropometric, and HIV-related clinical characteristics since exercise engagement may need to be adjusted based on those variables.

Review of the Literature

Physical activity is one modality that PLWH can use to mitigate the metabolic effects of HIV disease, aging, and ART, but PLWH report low levels of physical activity (Webel et al., 2019). Lower levels of physical activity have been observed in older adults and women (Hallal et al., 2012). Although the effect of age and gender on physical activity interventions is mixed, significant differences have been found. Males and females have different motives and considerations to be physically active, and gender has been found to have moderate intervention effect. Although women were more influenced by planning, men were more affected by attitude and self-efficacy was a determinant for women over the long term (Tummers et al., 2022). Van Uffelen et al. (2017) investigated whether the social aspects of physical activity were considered more important by women compared to men, with older women preferring activities with other women who were of the same age, supervised activity, and at fixed times. Men tended to prefer physical activity that was competitive, vigorous, and that involved skill, practice, and conducted outside. Finally, Van Uffelen et al. found that *feeling good* and *preventing health problems* were helpful stimuli to use in developing intrinsic motivation in older adults.

A logistic regression conducted by Zou et al. (2022) showed that gender, CD4+T-cell level, and self-efficacy were independently associated factors for physical activity in Chinese patients living with HIV. A systematic review conducted by Vancampfort et al. (2018) found that older age was consistently associated with lower physical activity; higher educational level with higher physical activity levels; mixed results about physical activity levels in the non-white population; and lower number of CD4+ T cells and less physical activity. Vancampfort et al. (2018) suggest that immunological parameters, such as a lower number of CD4+ T cells, were associated with less physical activity due to the impact of HIV infection on CD4+ T cells counts, which are measures of HIV disease severity.

Exercise self-efficacy may be a mediator variable and, by developing interventions that target it, physical activity may increase (Bateman et al., 2022; Luszczynska, 2011). Townsend (2023) found that self-efficacy was a facilitator of physical activity for both Black and White women. While self-efficacy may be associated with physical function, both are measured through self-report. Individuals might inflate their ability to regularly exercise, while use of an objective measure may provide a more realistic description of the ability to meet those exercise guidelines. In order to develop effective, sustainable interventions that assist more PLWH regularly achieve the exercise guidelines (WHO, 2022), the relationships between exercise self-efficacy, physical function, and functional exercise capacity need to be elucidated and sociodemographic variables including age (Webel et al., 2019; Hallal et al., 2012; Van Uffelen et al., 2017), gender (Townsend, 2023; Tummers et al., 2022), race (Vancampfort et al., 2018), employment status, and education (Vancampfort et al., 2018); illness-related factors such as CD4+ T cell counts (Zou et al., 2022), viral load, and comorbidities; and anthropometric variables including hip–waist ratio (Webel et al., 2019) need to be considered.

The purpose of the current study was to determine if there were differences between the subjective assessment of physical activity as reported by the exercise self-efficacy and physical function scales and the objective measure of physical activity as measured on the 6MWT while controlling for known sociodemographic, anthropometric, and clinical characteristics. Precise measurement of physical activity may lead to more effective and sustainable interventions that integrate regular exercise into activities of daily living.

Methods

Researchers from the International Nursing Network for HIV Research (Holzemer, 2017) conducted the primary multisite cross-sectional descriptive study. Webel et al. (2019) described physical activity and cardiorespiratory fitness by sex and age and examined the association between physical activity and cardiorespiratory fitness in PLWH. This research is using data from that study, along with additional data collected in South Africa. Consistent with the International Nursing Network for HIV Research's procedural framework, the coordinating site finalized the study protocol, developed the standardized training modules, and obtained the primary Institutional Review Board (IRB) approval from University Hospitals Cleveland Medical Center. All site principal investigators provided input to enhance the final study design, were trained and certified in all study procedures, and obtained local IRB approval before data collection.

Sample/Setting

The International Nursing Network for HIV Research has, through six international protocols, operated to recruit samples of at least 100 participants per site in areas with high HIV prevalence. Given the large number of sites that participate in each protocol, the total sample size has provided power to detect clinically and statistically meaningful relationships for our single group, cross sectional designs. To be eligible to participate, adults had to have a confirmed positive HIV laboratory test. Those with a medical contraindication for exercise as determined by the American

Heart Association (Fletcher et al., 2001) were not able to be physically active without an assistive device (i.e., cane, walker, and wheelchair) or were not able to communicate in either English or Spanish were excluded. Participants were drawn from eight sites located in three countries. The sites in the United States were located in Cleveland, Ohio; Newark, New Jersey; New York City, New York; Norfolk, Virginia; Corpus Christi, Texas; and San Francisco, California; Bangkok was the site in Thailand, and Durban was the site in South Africa. Since the medical record data were accessed for CD4 counts, viral loads, and comorbidities, all participants were receiving HIV-related primary care in ambulatory care settings. The informed consent procedures ensured that potential participants were aware that their medical chart would be reviewed.

Procedures

Study team members met with eligible participants and reviewed an informed consent document that described the study's purpose, procedures, risks, and potential benefits. After confirming understanding, written informed consent was obtained and the team member was available if participants needed help to complete the measures. All data were entered in a central Research Electronic Data Capture (REDCap) database housed at the coordinating site, where it was cleaned and checked for quality regularly. REDCap is a secure web application for building and managing online surveys and databases that is specifically geared to support data capture for research studies and operations (Harris et al., 2019). Upon completion of the procedures, participants received an incentive amount consistent with local standards (USD $5–$50). All study procedures for this analysis occurred between January 2016 and November 2019 in sites in the United States, Thailand, and South Africa.

Measures

Exercise Self-Efficacy

The Self-Efficacy for Exercise Behaviors Scale (Sallis et al., 1988) measures confidence in the ability to engage in physical exercise (self-efficacy) despite barriers such as family obligations, work, and fatigue. Self-efficacy influences the types of activities engaged in, the amount of effort expended, and the length of persistence in the face of obstacles. The scale consists of 12 items with two subscales: *making time for exercise* (7 items) items and *resisting relapse* (*5 items*). Sallis et al. designed the instrument so that the two subscales are meant to be computed separately; total scores are not considered valid measures of self-efficacy. Instructions asked participants *to rate how confident they were to really motivate themself to do things like these consistently, for at least 6 months.* Participants answered each item on a five-point Likert-style scale ranging from *I know I cannot (1)*, through *maybe I can (3)* to *I know I can (5);* higher scores indicate greater confidence to make time for exercise and resist relapse.

In a systematic review of measures of physical activity self-efficacy, this instrument was rated high in internal consistency and dimensionality evidence (Bateman et al., 2022). In the original instrument development study, this scale demonstrated a Cronbach's alpha of .83 or greater and test–retest reliability of 0.68 (Sallis et al., 1988); in a sample of persons with Opioid Use Disorder, the Cronbach's alpha was .93 (Simonton et al., 2022). In this sample, both the *making time* subscale and the *resisting relapse* subscale showed good inter-item reliability (Cronbach's $\alpha = .86$ and .91, respectively).

Physical Function

The United States National Institutes of Health (NIH) sponsored Patient-Reported Outcomes Measurement Information System (PROMIS) supports measures of physical, mental, and social health (Rose et al., 2008). Raw scores on the PROMIS are converted into common T-scores with a mean of 50 and a standard deviation of 10, which, in most cases, equals the mean in the U.S. general population (Rose et al., 2014). The physical function scale consists of four items measuring the ability to do chores, go up and down stairs, walk for at least 15 minutes, and run errands and shop. Each item is measured on a five-point scale ranging from *without any difficulty* (5) through to *unable to do* (1); a higher T-score reflects better physical function. Schnall et al. (2017) reported that the PROMIS-29 was reliable in various populations with a diversity of disease conditions; this included the reliability of the physical function subscale used here among PLWH (Cronbach $\alpha = .90$).

Functional Exercise Capacity

Functional exercise capacity is measured by a field walking test, specifically, the widely used and validated self-paced measure, the 6MWT. This objective measure provides valuable information in clinical practice and can be used when resources are limited (Ross et al., 2016). A member of the research team accompanied the study participant throughout the walk. Standardized instructions and encouragement (Singh et al., 2014) were given. While the 6MWT should be performed indoors, along a long, flat, straight, enclosed corridor with a hard surface that is seldom traveled, it can also be performed outdoors if the weather is comfortable. The walking course must be 30 m in length. Participants were asked to walk as far as possible over a 6-minute observed period and the measure was total distance walked in 6 minutes.

Demographic, Anthropometric, and Clinical Factors

Participants completed items about demographic and social characteristics; anthropometric data such as height, weight, and hip-to-waist ratio were collected by the research staff who also collected HIV-related and comorbidity data through medical chart abstraction. The anthropometric measure used here was hip-to-waist ratio given the recommendations by the American Medical Association (AMA) to move away from body mass index as a measure of adiposity (AMA Council on Science and Public Health, 2023).

Data Analysis. All data were entered into a central REDCap database, which was retained at the coordinating site, where it was cleaned and regularly checked for quality. After all data were entered and cleaned, the distributional assumptions for both of our physical function outcome variables were computed using Stata (version 13.0) (StataCorp, 2023). Data were summarizing using frequencies, percentages, and the appropriate measure of dispersion. To examine the relationship between exercise self-efficacy, physical function, and functional exercise capacity, two multiple linear regression models were built. The first model (Table 3) investigated which variables significantly predicted a participant's physical functioning as measured by self-reported PROMIS physical function T-scores. The second model (Table 4) investigated the same predictors, this time investigating their relationships with functional exercise capacity as measured by the 6MWT. The predictors in both models included both subscales on the exercise self-efficacy scale as the independent variables along with covariates known to influence physical function: age, gender, race, employment status, education, hip–waist ratio, CD4+ T cell count, comorbidities, and HIV viral load. Type 1 error rate (α) was set to .05; p-values less than this were considered significant.

We estimated a priori the number of participants required to detect effects that Cohen (1988) suggested as a "medium" size. To do this, we set $\alpha = .05$, power $(1-\beta) = .8$, and effect size (here $\eta^2) = .06$ in a general linear regression model with 13 predictors. We thus estimated requiring at least 309 participants. Sample size estimation was computed using G*Power version 3.1.9.7 (Faul et al., 2007).

It is important to distinguish between criteria for significance within Frequentist statistics and what may be considered clinically significant (Hojat & Xu, 2004). One could interpret statistical significance as a measure of whether there are enough data to be reasonably sure that a given effect is different than no effect, the null hypothesis used here; more data often mean a larger sample, and with a large enough sample, even the smallest (real and unreal) effects will be significant. Clinical significance may be interpreted from primary, quantitative research as the size of a given effect, regardless of its statistical significance. This is the standard we employ here: Cohen's (1988) suggestions for what one may consider to a "small," "medium," or "large" effects, where effect sizes are "the *degree* to which the phenomenon is present in the population" (p. 9) and thus of more likely interest to those working with general populations.

Table 1. Sample Characteristics.

Race (n=689)		
Black	323	46.99
Asian	207	30.00
White	159	23.08
Self-identified sexuality (n=791)		
Gay or lesbian (homosexual)	225	28.44
Bi (bisexual)	59	7.45
Straight (heterosexual)	507	64.09
Country (n=810)		
United States	609	75.34
South Africa	100	12.14
Thailand	101	12.52
Currently working (n=809)		
Yes	242	29.91
No	567	70.09
Schooling level (n=806)		
Below high school	193	23.94
High school or GED	243	30.15
Technical training or some college	281	34.86
College degree or higher	89	11.04
Comorbidities (n=766)		
Yes	447	58.36
No	319	41.64
Viral load (n=641)		
Undetectable (50 and under)	500	78.00
Over 50	141	22.00

GED = General Educational Diploma.
Total n varies due to missing data/declinations to respond.

Results

A total of 810 participants across 8 sites located in 3 countries were enrolled in the primary study. On average, the participants were 49 years of age (SD=11.7), male, Black, not Hispanic, and heterosexual. In addition, the average participant was not working and had completed high school or less education. Most (n=609) resided in the United States. Participants had been living with HIV for approximately 17.5 years, 75% (n=606) had an undetectable HIV viral load, and the average CD4+ T cell count was 630 (SD=369, n=739). Eighty nine percent (n=724) were taking ART, and 84% (n=683) were engaged in healthcare over the prior 6 months. The majority reported at least one comorbidity (Table 1).

The average participant reported an exercise self-efficacy, *making time for exercise* score of 10.5 (SD=4.2) and *resisting relapse* score of 21.4 (SD=9.0). On average, participants reported a PROMIS physical function T-score of 49.5 (SD=8.5) and achieved approximately 68.6% of their age and sex predicted distance on the 6MWT that measured functional exercise capacity. As presented in Table 2, there was what Cohen (1988) would suggest is a "strong" ($r > .5$) correlation between the two exercise self-efficacy subscales ($r = .833$, $p < .001$). The

Table 2. Correlations for Study, Sociodemographic, and Anthropometric Variables.

Variable	1	2	3	4	5	6	7a	7b	7c	8	9	10	11	12	13	14
1. Exercise self-efficacy, making time	—					−.06	−.02	.02	.03	−.04	.11*	.02	.04	−.08*	.02	−.06
2. Exercise self-efficacy, resisting relapse	.83*	—				−.05	−.01	.03	.01	−.05	.10*	−.02	.06	−.06	−.01	−.02
3. Physical function	.27*	.27*	—	.13*	−.20*	−.17*	.04	.05	−.01	−.15*	<.01	−.05	−.02	−.12*	−.03	<.01
4. Functional exercise capacity	.12	.06	.13**	—	−.06*	−.25*	.07*	−.02	.04	−.10*	12*	−.07*	.06	<.01	−.05	−.02
5. Age	−.06	−.11*	−.20*	−.08*	—											
6. Gender	−.06	−.05	−.17*	−.25*	−.01	—										
7. Race																
7a Asian	−.02	−.01	04	.07*												
7b Black	.02	.03	.05	−.02												
7c White	.03	.01	−.01	.04*												
8. Working	−.04	−.05	−15*	−10*												
9. Education	.11*	.10*	<.01	,12*												
10. Weight	.02	.02	−.15*	−.23*												
11. Hip–waist ratio	.04	.06	−.02	.06												
12. Has comorbidities	−.08*	−.06	−.12*	<.01												
13. CD4+ T cell count	−.02	−.01	−.03	−.04												
14. Viral Load	−.06	−.02	<.01	−.02												

*$p < .05$.

correlation between making time for exercise and resisting relapse and physical function was almost what Cohen would suggest is "medium" ($r = .3$) sized ($r = .271$, $p < .001$ and $r = .273$, $p < .001$, respectively). The correlation between functional exercise capacity and making time was slightly above the $r = .1$ criterion Cohen suggested for a "small" effect ($r = .117$, $p < .001$).

There was a "small," significant correlation between physical function and functional exercise capacity ($r = .131$, $p < .001$). Sociodemographic variables associated with better physical functioning were younger age ($r = -.195$, $p < .001$), and having a male birth sex ($r = -.165$, $p < .001$) while not working ($r = -.145$, $p < .001$) was associated with less physical function; the clinical variable that was significantly associated with physical function was having fewer comorbidities ($r = -.123$, $p < .001$). That all of these correlations were between Cohen's (1988) recommendations for "small" to "medium" effects suggests that they have some relevance to clinical practice.

Sociodemographic variables associated with greater functional exercise capacity were younger age ($r = -.082$, $p = .020$), male birth sex ($r = -.254$, $p < .001$) being Asian ($r = .-71$, $p = .032$), not working ($r = -.094$, $p = .007$), and having more years of education ($r = .119$, $p < .001$); the anthropometric variable associated with functional exercise capacity was less body weight ($r = -.074$, $p < .001$). Most of these correlations are "small," but gender and being Asian displayed "medium" and "large" effects, respectively. (The p-values for age and identifying as Asian were roughly the same ($ps = .020$ and .032, respectively), while the sizes of the correlations were very different ($rs = -.082$ and $-.710$, respectively); this pattern of results demonstrates the greater variability in the associations of the latter compared to the former.)

Tables 3 and 4 present the results of a linear regression predicting PROMIS physical function and functional exercise capacity, respectively. All variables were set to the same scales in these models (either by standardizing the scores or using dummy coding as appropriate), so the estimates allow us to compare the relative contributions of each predictor on the given outcome, discern the "clinical significance" of the respective terms, and to generally compare the weights between the models.

In Table 3, we can see that PROMIS physical function was significantly associated with Making Time for Exercise ($\beta = 1.76$, $p = .039$) but not with Resisting Relapse ($\beta = 1.16$, $p = .168$). Among the covariates, age ($\beta = -1.88$, $p = .001$) and especially being employed ($\beta = 16.19$, $p < .001$) and race ($\beta s = 13.84$–31.98, $p < .001$) were significant predictors of physical functioning. Hip–waist ratio ($\beta = -2.18$, $p < .001$) and having comorbidities ($\beta = 7.31$, $p < .001$) were also both "large" and significant, but CD4+ T cell count and viral load were not ($\beta s \leq -2.15$, $ps \geq .082$). This model predicting PROMIS scores accounted for a "large" amount of the variance in our data (adjusted $R^2 = .938$).

The patterns of results predicting functional exercise capacity were similar. Making Time for Exercise self-efficacy scores significantly predicted 6MWTs ($\beta = 0.14$, $p = .029$), Resisting Relapse scores again did not ($\beta = -0.10$, $p = .120$). Among the covariates, age ($\beta = -0.16$, $p < .001$) and gender

Table 3. One Self-Efficacy Scale is Positively Associated with Better Physical Functioning (PROMIS-29).

Effect	Standardized estimate	95% CI LL	95% CI UL	*P*
Making time to exercise self-efficacy	1.76	1.70	1.82	.039*
Sticking to exercise self-efficacy	1.16	1.10	1.23	.168
Age (years)	−1.88	−1.92	−1.84	.001*
Gender	−1.89	−1.96	−1.81	.067
Black race	14.57	14.47	14.67	<.001*
Asian race	31.98	31.87	32.09	<.001*
White race	13.84	13.72	13.95	<.001*
Working now	16.19	16.14	16.24	<.001*
Education level	0.15	0.11	0.18	.766
Waist hip ratio	−2.18	−2.22	−2.14	<.001*
Has comorbidities	7.31	7.22	7.40	<.001*
CD4 T cell count	0.86	0.83	0.90	.082
Viral load	−2.15	−2.24	−2.05	.090

PROMIS = patient-reported outcomes measurement information system; LL = lower limit; UL = upper limit.
*p < .05.

Table 4. One Self-Efficacy Scale is Associated with Functional Exercise Capacity (6MWT).

Effect	Standardized estimate	95% CI LL	95% CI UL	*p*
Making time to exercise self-efficacy	0.14	0.01	0.27	.029*
Sticking to exercise self-efficacy	−0.10	−0.23	0.03	.120
Age (years)	−0.16	−0.24	−0.08	<.001*
Gender	−0.43	−0.58	−0.27	<.001*
Black race	0.14	−0.07	0.35	.199
Asian race	0.09	−0.13	0.32	.419
White race	0.10	−0.13	0.33	.379
Working now	−0.01	−0.11	0.10	.914
Education level	0.08	0.01	0.16	.026*
Waist hip ratio	0.09	0.01	0.17	.034*
Has comorbidities	0.04	−0.15	0.23	.678
CD4 T cell count	0.02	−0.06	0.09	.628
Viral load	0.14	−0.05	0.33	.150

6MWT = 6-minute walk test; LL = lower limit; UL = upper limit.
*p < .05.

($\beta = -0.43$, $p < .001$) was to be significant while race was not. Education also significantly predicted functional exercise capacity ($\beta = 0.08$, $p = .026$). Hip–waist ratio was also significantly associated with functional exercise capacity ($\beta = 0.09$, $p = .034$), even though it had here a "small" effect. However, this model predicting functional exercise capacity did not account from much of the overall variance in the data (adjusted $R^2 = .081$), suggesting that there is much to learn.

Discussion

Adopting regular exercise into daily living requires behavior changes for many people. Intermediary variables are important to identify in the causal process between an intervention and the desired behavior change (Rhodes et al., 2021). Self-efficacy has been found to be a predictor of physical activity in different adult subpopulations (Bateman et al., 2022). The making time for exercise self-efficacy scale was significantly related to both physical function and functional exercise capacity in our international sample of diverse PLWH (Table 2). There was no relationship between the resisting relapse exercise self-efficacy scale and either physical function or functional exercise capacity.

Covariates including age, being employed, race, hip–waist ratio, and comorbidities explained a large amount of the variance in the model predicting physical function

(R^2 = .938) but only age, gender, education, and hip–waist ratio were associated with functional exercise capacity explaining a small amount of the total variance (R^2 = .081). While physical function and functional exercise capacity were correlated (r = .27), this relationship is modest, and although statistically significant, it may not be clinically significant. By using both subjective and objective measures of physical activity, more nuanced intervention programs can be suggested, which may assist in achieving the goal of increasing movement.

Subjective and objective tools are contingent on the concepts of validity, reliability, and bias which is how accurate/inaccurate the measurement is to reality (Mobbs, 2021). Whether a measure is subjective such as exercise self-efficacy and physical function or objective such as functional exercise capacity is an important characteristic of variables measuring health states (Cleary, 1997). While psychometric instruments measuring constructs similar to physical function have strong internal and external validity, many respondents may have a typical response style and others might underestimate or overestimate their confidence in their abilities, skills, and knowledge (Tempelaar et al., 2020). Self-efficacy on quantitative measures may be inflated but when asked individually, participants may acknowledge a greater lack of self-efficacy toward physical activity (Simonton et al., 2022).

O'Brien et al. (2017) conducted a systematic review of the effectiveness of aerobic exercise for PLWH using the Cochrane Collaboration protocol and searched databases for publications up until April, 2013. In those 24 reports of randomized clinical trials, they found an overall ~24% withdrawal rate (303/1242 participants at baseline) which they referred to as attrition bias. Understanding barriers to physical activity specific to, or more pronounced among, PLWH is essential to developing effective, patient-centered physical activity recommendations (Montoya et al., 2019). When plans are developed based on self-report, they may be overly ambitious resulting in lower motivation to achieve unrealistic goals. But working with clients to make time for exercise is an important predictor of both physical function and functional exercise capacity. Although healthcare providers need to assess and promote physical activity in the routine healthcare of all PLWH, our findings indicate that developing client-specific plans that address making time for exercise is more important than focusing on encouraging the client to stick to the exercise program.

This study had several limitations that should be considered when contextualizing our results. While the exact mechanism of how exercise affects the underlying pathology of HIV disease has not been elucidated, there is global acceptance of the value of physical activity on overall health status. This study was limited by its cross-sectional design, which precludes assessing temporal relationships. Additionally, subjects were recruited from multiple sites in the United States, Thailand, and South Africa, which may have resulted in a wider range of outcomes. However, the sample size overwhelmingly draws from the United States' sites, which makes cross-country comparisons difficult. The strengths of this study include a large sample size and protocol fidelity managed by a central site, which also oversaw data entry. All the principal investigators developed the protocol and attended two-day meetings twice a year to address issues and identify solutions throughout the study period, and many had participated in prior research conducted by the International Nursing Network for HIV Research. All the site investigators completed a standardizing protocol training session prior to launching the study procedures. Despite the limitations, we believe that our findings can be hypothesis generating and lead to more effective interventions that engage PLWH in physical activity.

Conclusion

Achievement of the WHO guidelines requires significant daily motivation over a lifetime. The differences between research that supports the positive effects of exercise and people's difficulty in adopting and maintaining exercise routines may be explained by Cook et al.'s (2022) Two Minds Theory, which is a novel approach to understanding and changing health behaviors based on the idea of intention-behavior gaps. To better understand the physical activity of PLWH (N = 55), they used a FITBIT to measure total steps per day, and high-intensity physical activity was based on the number of active minutes when the participant had an elevated heart rate during exercise. They found that physical activity varied dramatically both between and within individuals. Daily psychological experiences, including self-efficacy, coping, and HIV-related stigma, also predicted physical activity, as did everyday self-care barriers such as alcohol use and ART side effects (Cook et al., 2022).

Sustained adoption of the WHO physical activity guidelines into self-care routines is a challenging goal requiring socioecological support. Individual motivation needs to be enhanced by environmental facilitators such as safe streets and sidewalks. The body of research supporting the beneficial effects of regular physical activity is noteworthy along with the persistent finding that most adults do not achieve those benefits since they do not spend a considerable amount of time each week engaged in physical activity. In measuring outcomes after spinal fusion, Mobbs (2021) recommended an amalgamate of data streams into a composite score of health and suggested that the future of outcomes assessment will favor objective measures that can be obtained by smart/wearable devices. Our findings explore measurement issues, and we recommend that objective measures are used not only in the baseline assessment of physical activity but also in promoting sustained adherence to weekly physical activity guidelines in community settings.

Authors' Note

All authors meet the four criteria for authorship identified by the International Committee of Medical Journal Editors.

Acknowledgments

The authors wish to acknowledge the International Nursing Network for HIV Research.

Author Contributions

All authors have participated in drafting and revising the manuscript, reviewed the final version before submission, and agree to be accountable for all aspects of the work. The specific contributions of the authors were: Conceptualization: K. Nokes, D. Sokhela, P. Orton, A. Webel. Methodology: K. Nokes, D.Sokhela, P. Orton, J.C. Phillips, J. Perazzo, P. Chaiphibalsrisdi, K. Tufts, C. Portillo, R. Schnall, M.J. Hamilton, C. Dawson-Rose, W. Samuels, and A.R.Webel. Data Curation and Formal Analysis K. Nokes, D.Sokhela, P. Orton, J.C. Phillips, J. Perazzo, P., Chaiphibalsrisdi, K. Tufts, C. Portillo, R. Schnall, M.J. Hamilton, C. Dawson-Rose, W. Samuels, and A.R. Webel. Investigation: K. Nokes, D. Sokhela, P. Orton, J.C. Phillips, J. Perazzo, P., Chaiphibalsrisdi, K. Tufts, C. Portillo, R. Schnall, M.J. Hamilton, C. Dawson-Rose, W. Samuels, and A.R. Webel. Manuscript Writing and Revision: K. Nokes, D. Sokhela, P. Orton, J.C. Phillips, J. Perazzo, P., Chaiphibalsrisdi, K. Tufts, C. Portillo, R. Schnall, M. J. Hamilton, C. Dawson-Rose, W. Samuels, and A.R. Webel.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Research reported in this publication was supported by the National Institute of Nursing Research of the NIH under award numbers T32 NR007081, Dawson-Rose; R01NR015737, Schnall. The contents of this manuscript are solely the responsibility of the authors and do not necessarily represent the official views of the NIH or any other funders.

ORCID iD

Kathleen M. Nokes https://orcid.org/0000-0001-9026-4189

References

American Medical Association Council on Science and Public Health (2023). *Report of the council on science and public health* (CSAPH Report 07-A-23). The American Medical Association. https://www.ama-assn.org/system/files/a23-csaph07.pdf

Bandura, A. (Ed.) (1986). Chapter 9: Self-efficacy. In *Social foundations of thought and action: A social cognitive theory* (pp. 390–453). Prentice-Hall, Inc.

Bateman, A, Myers, N. D., Chen, S., & Lee, S. (2022). Measurement of physical activity self-efficacy in physical activity-promoting interventions in adults: A systematic review. *Measurement in Physical Education and Exercise Science*, *26*(2), 141–154. https://doi.org/10.1080/1091367X.2021.19623

Bullard, T., Ji, M., An, R., Trinh, L., Mackenzie, M., & Mullen, S. P. (2019). A systematic review and meta-analysis of adherence to physical activity interventions among three chronic conditions: cancer, cardiovascular disease, and diabetes. *BMC Public Health*, *19*(1), 636. https://doi.org/10.1186/s12889-019-6877-z

Cleary, P. (1997). Subjective and objective measures of health: Which is better when? *Journal of Health Services Research & Policy*, *2*(1), 3–4.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.

Cook, P., Jankowski, C., Erlandson, K. M., Reeder, B., Starr, W., & Flynn Makic, M. B. (2022). Low- and high-intensity physical activity among people with HIV: Multilevel modeling analysis using sensor- and survey-based predictors. *JMIR Mhealth Uhealth*, *10*(4), e33938, https://doi.org/10.2196/33938

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

Fletcher, G. F., Balady, G. J., Amsterdam, E. A., Chaitman, B., Eckel, R., Fleg, J., Froelicher, V. F., Leon, A. S., Piña, I. L., Rodney, R., Simons-Morton, D. A., Williams, M. A., & Bazzarre, T. (2001). Exercise standards for testing and training: A statement for healthcare professionals from the American Heart Association. *Circulation*, *104*(14), 1694–1740.

Hallal, P. C, Andersen, L. B., Bull, F. C., Guthold, R., Haskell, W., Ekelund, U., & Lancet Physical Activity Series Working Group. (2012). Global physical activity levels: Surveillance progress, pitfalls, and prospects. *Lancet*, *380*(9838), 247–257.

Giguère, K., Chartrand-Lefebvre, C., Baril, J. G., Conway, B., El-Far, M., Falutz, J., Harris, M., Jenabian, M. A., Leipsic, J., Loutfy, M., Mansour, S., MacPherson, P., Margolese, S., McMillan, J. M., Monteith, K., Murray, M. C. M., Pick, N., Thomas, R., Trottier, B., . . . Canadian HIV and Aging Cohort Study Group. (2023). Baseline characteristics of a prospective cohort study of aging and cardiovascular diseases among people living with HIV. *HIV Medicine*, *24*(12), 1210–1221. https://doi.org/10.1111/hiv.13550

Harris, P. A., Taylor, R., Minor, B. L., Elliott, V., Fernandez, M., O'Neal, L., McLeod, L., Delacqua, G., Delacqua, F., Kirby, J., Duda, S. N., & REDCap Consortium (2019). The REDCap consortium: Building an international community of software platform partners. *Journal of Biomedical Informatics*, *95*, 103208. https://doi.org/10.1016/j.jbi.2019.103208

HIV.gov (2022). The global HIV/AIDs epidemic. Retrieved March 17, 2023, from Global Statistics | HIV.gov

Henning, R. J., & Greene, J. N. (2023). The epidemiology, mechanisms, diagnosis and treatment of cardiovascular disease in adult patients with HIV. *American Journal of Cardiovascular Disease*, *13*(2), 101–121.

Hojat, M., & Xu, G. (2004). A visitor's guide to effect sizes: Statistical significance versus practical (clinical) importance of research findings. *Advances in Health Sciences Education: Theory and Practice*, *9*(3), 241–249. https://doi.org/10.1023/B:AHSE.0000038173.00909.f6

Holzemer, W. L. (2007). University of California, San Francisco International Nursing Network for HIV/AIDS research.

International Nursing Review, *54*(3), 234–242. https://doi.org/10.1111/j.1466-7657.2007.00571.x

Luszczynska, A., Schwarzer, R., Lippke, S., & Mazurkiewicz, M. (2011). Self-efficacy as a moderator of the planning-behaviour relationship in interventions designed to promote physical activity. *Psychology and Health*, *26*(2), 151–166.

Jankowski, C. M., Konigsberg, I. R., Wilson, M. P., Sun, J., Brown, T. T., Julian, C. G., & Erlandson, K. M. (2023). Skeletal muscle DNA methylation: Effects of exercise and HIV. *Aging Cell*, *23*(1), e14025. https://doi.org/10.1111/acel.14025

Mobbs, R. J. (2021). From the subjective to the objective era of outcomes analysis: How the tools we use to measure outcomes must change to be reflective of the pathologies we treat in spinal surgery. *Journal of Spine Surgery (Hong Kong)*, *7*(3), 456–457. https://doi.org/10.21037/jss-2021-2

Montoya, J. L., Jankowski, C. M., O'Brien, K. K., Webel, A. R., Oursler, K. K., Henry, B. L., Moore, D. J., & Erlandson, K. M. (2019). Evidence-informed practical recommendations for increasing physical activity among persons living with HIV. *AIDS*, *33*(6), 931–939.

Nguyen, K. A., Peer, N., & Kengne, A. P. (2021). Associations of gamma-glutamyl transferase with cardio-metabolic diseases in people living with HIV infection in South Africa. *PLoS One*, *16*(2), e0246131. https://doi.org/10.1371/journal.pone.0246131

O'Brien, K. K., Tynan, A.-M., Nixon, S. A., & Glazier, R. H. (2017). Effectiveness of aerobic exercise for adults living with HIV: Systematic review and meta-analysis using the Cochrane Collaboration protocol. *BMC Infectious Diseases*, *16*, 182. https://doi.org/10.1186/s12879-016-1478-2

Ramos, S. R., O'Hare, O. M., Hernandez Colon, A., Kaplan Jacobs, S., Campbell, B., Kershaw, T., Vorderstrasse, A., & Reynolds, H. R. (2021). Purely behavioral: A scoping review of nonpharmacological behavioral and lifestyle interventions to prevent cardiovascular disease in persons living with HIV. *The Journal of the Association of Nurses in AIDS Care*, *32*(5), 536–547. https://doi.org/10.1097/JNC.0000000000000230

Rhodes, R., Boudreau, P., Josefsson, K. W., & Ivarsson, A. (2021) Mediators of physical activity behavior change interventions among adults: A systematic review and meta-analysis, *Health Psychology Review*, *15*(2), 272–286, https://doi.org/10.1080/17437199.2019.1706614

Rose, M., Bjorner, J. B., Becker, J., Fries, J. F., & Ware, J. E. (2008). Evaluation of a preliminary physical function item bank supports the expected advantages of the Patient-Reported Outcomes Measurement Information System (PROMIS). *Journal of Clinical Epidemiology*, *61*, 17–33.

Rose, M., Bjorner, J. B., Gandek, B., Bruce, B., Fries, J. F., & Ware, J. E. (2014). The PROMIS physical function item bank was calibrated to a standardized metric and shown to improve measurement efficiency. *Journal of Clinical Epidemiology*, *67*(5), 516–526.

Ross, R., Blair, S., Arena, R., Church, T., Després, J.-P, Franklin, B., Haskell, W. L., Kaminsky, L. A., Levine, B. D., Lavie, C. J., Myers, J., Niebauer, J., Sallis, R., Sawada, S. S., Sui, X., & Wisløff, U., American Heart Association Physical Activity Committee of the Council on Lifestyle and Cardiometabolic Health, Council on Clinical Cardiology, Council on Epidemiology and Prevention; Council on Cardiovascular and Stroke Nursing, Council on Functional Genomics and Translational Biology, & Stroke Council. (2016). Importance of assessing cardiorespiratory fitness in clinical practice: A case for fitness as a clinical vital sign: A scientific statement from the American Heart Association. *Circulation*, *134*, e653–e699. https://doi.org/10.1161/CIR.0000000000000461

Sallis, J. F., Pinski, R. B., Grossman, R. M., Patterson, T. L., & Nader, P. R. (1988). The development of self-efficacy scales for health-related diet and exercise behaviours. *Health Education Research Theory and Practice*, *3*(3), 283–292.

Schnall, R., Liu, J., Cho, H., Hirshfield, S., Siegel, K., & Olender, S. (2017). A health-related quality-of-life measure for use in patients with HIV: A validation study. *AIDS Patient Care STDS*, *31*(2), 43–48. https://doi.org/10.1089/apc.2016.0252

Simonton, A., Young, C., García, A., Bartholomew, J., & Brown, R. (2022). A cross-sectional study of physical activity attitudes and preferences of individuals with opioid use disorder. *Mental Health and Physical Activity*, *22*, 100444. https://doi.org/10.1016/j.mhpa.2022.100444

Singh, S., Puhan, M., Andrianopoulos, V., Hernandes, N., Mitchell, K., Hill, C., Lee, A. L., Camillo, C. A., Troosters, T., Spruit, M. A., Carlin, B. W., Wanger, J., Pepin, V., Saey, D., Pitta, F., Kaminsky, D. A., McCormack, M. C., MacIntyre, N., Culver, B. H., . . .Holland, A. E. (2014). An official systematic review of the European respiratory society/American thoracic society: Measurement properties of field walking tests in chronic respiratory disease, *European Respiratory Journal*, *44*(6), 1447–1478. https://doi.org/10.1183/09031936.00150414

StataCorp. (2023). *Stata Statistical Software: Release 18*. StataCorp LLC.

Stewart, A., & Kamberg, C. (1992). Chapter 6: Physical functioning measures. In J. E. Ware (Ed.), *Measuring functioning and well-being: The medical outcomes study approach* (pp. 86–101). Duke University Press.

Tempelaar, D., Rienties, B., & Nguyen, Q. (2020). Subjective data, objective data and the role of bias in predictive modelling: Lessons from a dispositional learning analytics application. *PLoS One*, *15*(6), e0233977. https://doi.org/10.1371/journal.pone.0233977

Tummers, S. C. M. W., Hommersom, A., Lechner, L., Bemelmans, R., & Bolman, C. A. W. (2022). Determinants of physical activity behaviour change in (online) interventions, and gender-specific differences: A Bayesian network model. *International Journal of Behavioural Nutrition and Physical Activity*, *19*, 155. https://doi.org/10.1186/s12966-022-01381-2

Townsend, S. (2023). *Race, gender, physical activity, and cancer: A quantitative investigation* [ProQuest Dissertations & Theses Global]. http://ezproxy.gc.cuny.edu/login?url=https://www-proquest-com.ezproxy.gc.cuny.edu/dissertations-theses/race-gender-physical-activity-cancer-quantitative/docview/2778851220/se-2

Van Uffelen, J. G. Z., Khan, A., & Burton, N. W. (2017). Gender differences in physical activity motivators and context preferences: A population-based study in people in their sixties. *BMC Public Health*, *17*, 624. https://doi.org/10.1186/s12889-017-4540-0

Vancampfort, D., Mugisha, J., Richards, J., De Hert, M., Probst, M., & Stubbs, B. (2018). Physical activity correlates in people living with HIV/AIDS: A systematic review of 45 studies.

Disability and Rehabilitation, *40*(14), 1618–1629. https://doi.org/10.1080/09638288.2017.1306587

Voigt, N., Cho, H., & Schnall, R. (2018). Supervised physical activity and improved functional capacity among adults living with HIV: A systematic review. *Journal of the Association of Nurses in AIDS Care*, *29*(5), 667–680. https://doi.org/10.1016/j.jana.2018.05.001

Webel, A. R., Perazzo, J., Philips, J. C., Nokes, K. M., Rentrope, C., Schnall, R., Musanti, R., Adams Tufts, K., Sefcik, E., Hamilton, M. J., Portillo, C., Chaiphibalsarisdi, P., Orton, P., Davis, L., & Dawson Rose, C. (2019). The relationship between physical activity and cardiorespiratory fitness among people living with Human Immunodeficiency Virus throughout the life span. *Journal of Cardiovascular Nursing*, *34*(5), 364–371.

World Health Organization. (2022). *WHO guidelines on physical activity and sedentary behaviour. Fact Sheet on Physical Activity*. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/physical-activity

Zou, Y., Sun, P., Zhang, Y., & Li, Y. (2022) Physical activities and associated factors among HIV/AIDS patients: A questionnaire survey. *Patient Preference and Adherence*, *16*, 1703–1712. https://doi.org/10.2147/PPA.S360517

Author Biographies

Kathleen M. Nokes, PhD,RN,FAAN is a Honorary Research Professor Durban University of Technology and Adjunct Professor, School of Professional Studies, City University of New York (CUNY).

Dudu G. Sokhela, RN, RM, D Tech is Senior Lecturer, Department of Nursing at the Durban University of Technology.

Penelope M. Orton, RN, RM, PhD, FANSA is an Honorary Research Fellow at the Durban University of Technology.

William Ellery Samuels, PhD, is an Assistant Professor at Hunter College, Hunter-Bellevue School of Nursing whose expertise includes traditional psychometric & item response theory analyses and multilevel & structural equation modeling.

J. Craig Phillips, PhD, LLM, RN, ACRN, FAAN is a Professor; Vice Dean Governance and Secretary Faculty of Health Sciences at the School of Nursing, University of Ottawa.

Kimberly Adams Tufts, ND, WHNP-BC, FAAN is Professor Emerita at the School of Nursing at Old Dominion University.

Joseph D. Perazzo, PhD, RN, ACRN was an Assistant Professor at the University of Cincinnati College of Nursing.

Puangtip Chaiphibalsarisdi, PhD,RN, is an Associate Professor, Faculty of Nursing, Metharath University, Bangkok, Thailand.

Carmen Portillo, PhD, RN, FAAN is the Executive Deputy Dean & Professor of Nursing at Yale School of Nursing.

Rebecca Schnall PhD, MPH, RN-BC, FAAN, FACMI is the Mary Dickey Lindsay Professor of Disease Prevention and Health Promotion (Nursing) and Associate Dean of Faculty Development (Nursing) and Professor of Population and Family Health (Public Health) at Columbia University.

Mary Jane Hamilton Ph.D., RN is Dean Emeritus, College of Nursing & Health Sciences at Texas A&M University-Corpus Christi.

Carol Dawson-Rose, RN, PhD, FAAN is the Professor and Chair, University of California, San Francisco School of Nursing.

Allison R. Webel, PhD, RN, FAAN is the Aljoya Endowed Professor in Aging and Associate Dean for Research, Department of Child, Family and Population Health Nursing and |Interim Robert G. and Jean A. Reid Executive Dean, University of Washington.