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Felt Age Discrepancy Differs by HIV Serostatus: A Secondary Analysis.

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Abstract

We examined how the discrepancy between felt age (FA) and chronological age (CA) differed by HIV serostatus across three age cohorts and related to health-related quality of life (HRQoL). Participants included 119 people living with HIV (PLWH) and 98 uninfected adults, ages 36–65 years. FA was assessed by asking, “How old/young do you feel?” HRQoL was measured using the Medical Outcome Study Short Form Health Survey. Linear regressions examined the interaction between HIV serostatus and HRQoL on FA discrepancy scores (FADS; i.e., difference between CA and FA). 72.3% of PLWH felt younger than their CA, which was lower than the uninfected group (92.9%; $p < .001$). PLWH had lower FADS than the uninfected group ($p = .050$), particularly in the 46- to 55-year-old cohort ($p = .015$). The positive association between physical

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HRQoL and FADS was stronger among PLWH (β = 0.14, p = .024). A high proportion of PLWH reported feeling younger than their CA, and this perception was related to higher physical HRQoL.

Keywords

age identity; cross-sectional analyses; healthy aging; human immunodeficiency virus; subjective health; quality of life

As the proportion of aging individuals continues to increase in the United States, it is crucial to understand the consequences of advancing chronological age (Vincent & Velkoff, 2010). Extant literature suggests that older chronological age is associated with declines in overall health, physical capabilities, activities of daily living, and cognition (Zeng et al., 2017); however, emerging evidence indicates that older age is not necessarily the sole indicator of ill health and that there is substantial variability in health outcomes in normal aging (Depp & Jeste, 2006). Thus, chronological age alone may have limited pertinence in understanding variability of health outcomes. As an alternative, research has explored the subjective dimension of age, that is, the conceptualization of the way people experience their own age (Westerhof & Wurm, 2015). Felt age signifies the age an individual feels, which is an individual expression of each person's perception of aging (Kastenbaum et al., 1972; Westerhof & Wurm, 2015). For example, if an individual's chronological age is 80, they may report feeling 60 if they perceive themselves as fitting the stereotypical 60-year-old profile more strongly than that of an 80-year-old person (Ward, 2013).

Cross-sectional and longitudinal examinations of the association between felt age and chronological age have shown a significant bias towards perceptions of youthfulness, such that the majority of middle-age and older adults report feeling younger than their chronological age (Shinan-Altman & Werner, 2019; Stephan et al., 2018). For example, one study found that middle age (ages 44–64) persons felt 9.8 years younger than their chronological age and older adults (ages 65 and older) felt 13.5 years younger than their chronological age (Shinan-Altman & Werner, 2019). These findings support the notion that feeling younger than one's chronological age is normative in mid-to-later adulthood.

Health-related quality of life (HRQoL) is considered a general indicator of healthy functioning across physical, emotional, and social domains (Wilson & Cleary, 1995). Better perception of HRQoL has been previously associated with feeling younger among healthy older adults (Hubley & Russell, 2009). Within the context of chronic and disabling disorders (i.e., prostate cancer, chronic obstructive pulmonary disease, fibromyalgia, hyperlipidemia, and HIV), individuals who felt younger than, or equal to, their chronological age also reported better HRQoL compared to those who felt subjectively older than their chronological age (Boehmer, 2006). Thus, maintaining higher HRQoL may be supportive of positive perceptions of age, even in the midst of chronic conditions or health adversities.

Given emerging literature that supports felt age as an alternative marker of aging, and the association of felt age with overall health and quality of life, it is imperative to further understand the associates of felt age within populations that are preferentially vulnerable to negative health outcomes (Westerhof & Wurm, 2015). Persons living with HIV (PLWH)

experience heightened health related burden and are at a higher susceptibility for disease-related impairments as well as comorbid medical conditions (Negredo et al., 2017). Given this burden, PLWH tend to report lower HRQoL compared to uninfected populations (Engelhard et al., 2018; Rooney et al., 2019). There has been an absence of studies investigating felt age or the potential association between HRQoL and felt age among PLWH. It is possible that among PLWH, higher HRQoL may be more positively internalized, reflective in a youthful felt age.

Our study explores how the association between HRQoL and the discrepancy between chronological and felt age (felt age discrepancy score; FADS) varies by HIV serostatus. The specific purpose of this study was to (a) compare FADS by HIV serostatus, (b) assess differences in FADS across chronological age cohorts (i.e., ages 36–45, 46–55, and 56–65 years) between persons living with and without HIV, and (c) investigate the moderating effect of HIV serostatus on the association between HRQoL indices (i.e., physical and mental HRQoL) and FADS. We hypothesized that PLWH would feel older than their uninfected counterparts. We anticipated that this difference by HIV serostatus would be consistent across age cohorts. We additionally hypothesized the relationship between HRQoL and FADS would vary as a function of HIV serostatus, such that PLWH would have stronger associations between their perceptions of HRQoL and their perceptions of youthfulness given they faced greater health related burden.

METHODS

Participants

Participants (217 adults; 119 PLWH and 98 persons without HIV), were convenience sampled from the parent study (Multi-Dimensional Successful Aging Among HIV-Infected Adults study) that was conducted at the University of California, San Diego (UCSD). Among the 119 PLWH, about 85% self-reported sex as male and 15% female, which is consistent with the national prevalence by sex according to the Centers for Disease Control and Prevention census of new HIV diagnoses in 2017 (81% male and 19% female; Centers for Disease Control and Prevention, 2012). We did not consistently query about gender; although our goal is to have adequate representation of both sex and gender in our studies (i.e., participants are not excluded based on sex or gender). Participants were recruited for the parent study via flyers and advertisements placed at a variety of sources (e.g., local pharmacies, local hospital psychiatry services, waiting/treatment rooms at clinics and community-based organizations). Additionally, recruitment staff conducted outreach and presentations to potential participants at community-based meetings primarily in San Diego County. We have previously published several papers using other aspects of these data including everyday functioning outcomes, grit and ambition, and positive psychological factors (Moore et al., 2018a; Moore et al., 2018b; R.C. Moore et al., 2017; Watson et al., 2019). This is the first paper on felt age in this sample.

As a part of the multicohort longitudinal study design, participants were recruited in defined age cohorts (i.e., younger: ages 36–45; middle age: ages 46–55; and older: ages 56–65) with balanced recruitment resulting in approximately 40 PLWH and 33 uninfected participants per age cohort. The resulting cohorts included: (a) younger (ages 36–45): 37 PLWH and 29

uninfected; (b) middle age (ages 46–55): 43 PLWH and 36 uninfected; (c) older (ages 56–65): 39 PLWH and 33 uninfected. Participants were not matched based on any demographic factor other than chronological age, although we tried to ensure demographic comparability. Exclusion criteria were minimal to extend generalizability of findings. Participants were excluded for diagnosis of a psychotic disorder (e.g., schizophrenia), presence of a known neurologic/neurodegenerative disorder that could negatively impact neurocognitive functioning (e.g., Parkinson's Disease), or a lack of English fluency. The UCSD Institutional Review Board approved this study (IRB #120244), and all participants provided written informed consent to participate. The current study represents a secondary analysis of baseline data that were collected for other studies between 2013 and 2016. Considering those studies had a priori power analyses conducted before data collection, no further power analyses were done. The HIV Neurobehavioral Research Program (HNRP) staff were trained, certified, and supervised to administer self-report, neuromedical, neuropsychological, and functional assessments. Measures pertinent to the current investigation are described below.

Measures

Felt age and felt age discrepancy.—Ratings of felt age were obtained from a single self-report question from a battery of successful aging questions, commonly used to assess felt age (Kleinspehn-Ammerlahn et al., 2008): *How old/young do you feel (please write a specific age, e.g., 75)?*

In order to calculate a FADS, participants' felt age, as reported in years, was subtracted from their chronological age (i.e., FADS = chronological age – felt age), a previously used method (Kleinspehn-Ammerlahn et al., 2008; Stephan et al., 2014). A positive FADS indicated the participant felt younger than their chronological age, while a negative FADS indicated the participant felt older relative to their chronological age. For example, a score of +15 implies the participant felt 15 years younger than their chronological age.

HRQoL measures.—Physical and mental health were assessed using the Medical Outcome Study Short-Form Health Survey (MOS SF-36); a self-report measure commonly used to reliably evaluate HRQoL among persons without HIV (Clayson et al., 2006; Ware, 1994). The MOS SF-36 covers eight health domains, which are aggregated into two summary measures (i.e., physical and mental health component scores). The MOS SF-36 has been shown to be a reliable measure with high internal consistency ($\alpha > 0.70$ across 8 domains) among PLWH (Hsiung et al., 2005). Component scores for physical and mental health were used as predictor variables in analyses.

HIV disease characteristics.—Clinicians (e.g., nurses/physicians) were trained and certified to conduct a comprehensive neuromedical evaluation. Participants completed a blood draw, self-report assessments, and answered questions from the clinician assessing HIV disease characteristics, including (a) plasma HIV viral load (via reverse transcriptase-polymerase chain reaction (RT-PCR; Amplicor, Roche Diagnostics, Indianapolis, IN); undetectable < 50 copies/mL), (b) history of AIDS, (c) current CD^{4+} T-cell count, (d) nadir

CD^{4+} T-cell count, (e) antiviral medication status (i.e., prescribed/not prescribed), and (f) estimated years of living with HIV disease.

Other medical comorbidities.—Current and lifetime major depressive disorder (MDD), and lifetime substance use disorder (SUD) were identified via The Composite International Diagnostic Interview (CIDI, v2.1; World Health Organization, 1997). The CIDI is a fully-structured, computer-based diagnostic interview for gathering DSM diagnoses that allows administration by lay interviewers and scoring by computer. The CIDI has been shown to have moderate to substantial test-retest reliability with kappa values ranging from 0.45–0.72 across diagnostic sections (Landis and Koch, 1977; Wittchen et al., 1998;). To align with current DSM-5 criteria, lifetime diagnosis of SUD was assigned if DSM-IV criteria for abuse or dependence were met for any of the following substances: alcohol, cocaine, methamphetamine, heroin, hallucinogen, opioid, PCP, or sedative.

Number of diseases.—The HIV Neurobehavioral Research Program (HNRP) neuromedical evaluation assesses comorbid conditions from a standardized medical history interview. Co-morbid medical diagnoses were self-reported by participants or inferred from self-reported medication history and recorded by International Classification of Diseases, Ninth Revision diagnostic code. Diagnosis of conditions via self-report include: cerebrovascular accident, myocardial infarction, congestive heart failure, peripheral vascular disease, malignancy, metastatic solid tumor, mild liver disease, moderate to severe liver disease, chronic pulmonary disease, rheumatologic disease, peptic ulcer disease, renal disease, hemiplegia/paraplegia, and head injury. Diagnosis of conditions based on self-reported medication history include: diabetes, hyperlipidemia, hypertension, and HCV. These co-morbid conditions were summed to create the variable capturing the number of diseases for each participant (possible range: 0–18).

Premorbid estimate of intellectual functioning.—The Wide Range Achievement Test 4^{th} Edition Reading (WRAT4 Reading) subtest was administered by HNRP staff to all participants to provide an estimate of premorbid cognitive reserve. The WRAT4 Reading subtests have been previously used as measures of premorbid intellectual functioning among PLWH. Longitudinally, the WRAT4 Reading subtests have demonstrated strong test-retest reliability with no significant practice effects ($\rho = .85$, $p < .001$) among PLWH (Casaletto et al., 2014; Wilkinson, 1993). Age-corrected normative standard scores ($M = 100$, $SD = 15$) were calculated from raw scores where higher scores indicated better functioning (Casaletto et al., 2014).

Global cognitive impairment.—The HNRP core neuropsychological battery assesses seven cognitive domains commonly affected by HIV and was administered to all participants by HNRP staff (Heaton et al., 2004b). This battery has published norms that correct for demographic characteristics (age, education, sex, and, where possible, race/ethnicity; (Antinori et al., 2007; Heaton et al., 2010). Cognitive domains assessed included: verbal fluency, working memory, speed of information processing, learning, delayed recall, executive function, and complex motor function (Heaton et al., 2010). Raw scores from the neuropsychological tests were converted to demographically-adjusted T-scores ($M = 50$, SD

= 10 in healthy subjects; (Heaton et al., 2003; Heaton et al., 2004b). Global deficit scores (GDS) were derived by converting T-scores for each domain into an averaged deficit score, ranging from 0 (no impairment) to 5 (severe impairment). Participants with a GDS greater than or equal to 0.5 were considered neurocognitively impaired, and those with a GDS less than 0.5 were deemed cognitively normal (Blackstone et al., 2012). We used this dichotomized global impairment variable in our comparisons of cognition by HIV serostatus.

Functional dependence.—Participants completed a modified version of the Lawton and Brody Activities of Daily Living scale which is a self-report measure used to assess functional dependence versus independence in instrumental activities of daily living (IADLs). The modified form of the Lawton and Brody scale has been previously used among PLWH as an index of daily functioning abilities (Heaton et al., 2004a; Lawton and Brody, 1969). This is a self-report measure that asks participants the extent to which they currently require assistance completing everyday tasks (i.e., managing finances, using the telephone, cooking, buying groceries, working, transportation, understanding of written and viewed material, social activities, and childcare) compared to their highest level of functioning. If there has been a decline in functioning in at least two domains compared to their highest level of functioning, participants were deemed IADL dependent (Obermeit et al., 2017). The modified version of this scale has been shown as moderately (76%) concordant with performance-based measures of functional dependence (Blackstone et al., 2012).

Statistical Analysis

Comparisons between PLWH and uninfected participants on demographic characteristics, comorbid diseases, neurocognitive impairment, and HRQoL were carried out using independent t-tests or Wilcoxon Rank-Sum tests for continuous characteristics; and Chi-square statistics or Fisher's exact tests were used for categorical characteristics.

To evaluate the first aim, independent t-tests were used to compare FADS between PLWH and uninfected participants. For the second aim, independent t-tests compared differences in FADS by HIV serostatus and across chronological age cohorts that were characterized as younger (ages 36–45), middle age (ages 46–55), and older (ages 56–65). To investigate the third aim, separate multivariable linear regressions examined the interaction between HIV serostatus and HRQoL indices (i.e., physical and mental HRQoL) on FADS. Model covariates selection was done by first examining the univariate associations between FADS and demographic factors (e.g., sex, age, race/ethnicity, years of education), comorbidities (e.g., lifetime MDD, number of diseases, lifetime SUD), and neurocognitive function (i.e., WRAT4 Reading, GDS impairment) via a series of Pearson correlation coefficients, or independent t-tests, as appropriate. Covariates that significantly differed by HIV-serostatus at $p < .05$ and were associated with FADS at $p < .05$ in univariable analyses were entered into backward stepwise regression models using Akaike information criterion (AIC). Backward stepwise regression model selections were conducted to determine the most appropriate set of covariates for physical HRQoL and, separately, for mental HRQoL. HIV-serostatus was included in both models. The final model examining physical HRQoL and FADS included

the term of primary interest (i.e., HIV × physical HRQoL), HIV-serostatus, physical HRQoL, and chosen covariates. The final model examining mental HRQoL and FADS included the term of primary interest (i.e., HIV × mental HRQoL), HIV-serostatus, mental HRQoL, and selected covariates.

A follow-up analysis was conducted for any model that did not reveal a significant interaction term between HRQoL and HIV serostatus ($p > .05$). The interaction term was removed to examine the independent associations between HRQoL, HIV serostatus, and FADS, covarying for the same demographic variables as in the above analyses.

An exploratory analysis was conducted using independent samples Jonckheere-Terpstra Tests (Siegel & Castellan Jr, 1988) for ordered alternatives to investigate the differences in FADS across age cohorts within each HIV serostatus group. We anticipated a stair-step pattern in which the youngest cohort would have the lowest FADS, followed by the middle age cohort, and finally, the older cohort would have the highest FADS among both PLWH and the uninfected group.

All analyses were performed using JMP Pro version 14.0.0 (JMP®, Version *<14.0.0>*. SAS Institute Inc., Cary, NC, 1989–2007). All data were screened for outliers, resulting in the identification of one individual with an improbable response for felt age (FADS = +87) that lay significantly outside of the interquartile range of the variable (Barbato et al., 2011). That one participant was excluded from analyses.

RESULTS

Participant Characteristics

Participant characteristics by HIV serostatus are presented in Table 1. The PLWH group had significantly fewer years of education, a higher proportion of males, higher rates of lifetime and current MDD, more comorbid diseases, higher rates of a lifetime history of SUD, lower (worse) WRAT4 Reading scores, and a higher rate of neurocognitive impairment ($ps < .10$). PLWH and uninfected participants additionally differed on race/ethnicity ($p < .10$). PLWH and uninfected individuals were comparable with respect to chronological and felt age; however, PLWH had significantly lower (worse) physical and mental HRQoL scores compared to uninfected individuals ($ps < .001$).

Felt Age Discrepancy across HIV-Age Groups

On average, regardless of serostatus, participants reported feeling 9.9 ($SD = 10.7$) years younger than their chronological age. Nearly three quarters (72.3%) of PLWH felt younger than their chronological age; however, this proportion was significantly lower than that among the uninfected group (92.9%; $\chi^2(1 = 15.15, p < .001)$. The distributions of FADS by HIV serostatus and stratified across age cohorts are displayed in Figure 1. FADS differed by HIV serostatus such that PLWH had significantly lower FADS than uninfected individuals ($M = 8.6$, $SD = 13.1$ vs. $M = 11.3$, $SD = 6.6$, respectively; $t(182) = -2.0$, $p = .050$), indicating feeling subjectively less youthful in relation to one's chronological age. Follow-up analyses of FADS within each age cohort by HIV serostatus indicated that within the middle-age cohort (ages 46–55) PLWH ($M = 6.3$, $SD = 12.7$) had significantly lower FADS

than their uninfected counterparts (M = 12.1, SD = 7.8; $t(71) = 2.5$, $p = .015$). The difference in FADS in the younger cohort (ages 36–45) by HIV serostatus approached statistical significance, such that PLWH (M = 5.0, SD = 13.0) had lower FADS than the uninfected group (M = 9.2, SD = 5.7; $t(51) = 1.8$, $p = .08$). There were no significant differences in FADS in the older age cohort (ages 56–65) by HIV serostatus; although, the older PLWH showed higher FADS compared to the uninfected group; whereas among the younger and middle-age groups, PLWH reported lower FADS compared to the uninfected groups. In the exploratory analysis, results of the independent samples Jonckheere-Terpstra tests stratified by HIV serostatus were suggestive of significant differences in FADS between age cohorts only among PLWH ($T_{JT} = 1876.0$, $z = 1.8$, $p < .001$). Follow-up pairwise comparisons indicated significant differences between the younger cohort (36–45; *Mdn* FADS = 8) and older cohort (56–65; *Mdn* FADS = 18; $T_{JT} = 1065.0$, $z = 3.6$, $p = .001$), and the middle cohort (46–55; *Mdn* FADS = 9) and older cohort ($T_{JT} = 1165.5$, $z = 3.0$, $p = .004$).

Multivariate Findings

Results of multivariable linear regression analyses are presented in Table 2. Chosen covariates from backward stepwise regressions for the model examining physical HRQoL and FADS were age, lifetime MDD, WRAT4 Reading, and race/ethnicity. Multivariable linear regression analyses revealed a significant interaction effect between physical HRQoL and HIV serostatus on FADS ($\beta = 0.14$, $p = .024$). Specifically, there was a significant effect of physical HRQoL on FADS among PLWH ($\beta = 0.23$, $p < .001$), and no significant effect among the uninfected group ($\beta = 0.09$, $p = .083$; Figure 2). There was a significant main effect of chronological age ($\beta = 0.47$, $p < .001$), such that older chronological age was associated with higher FADS.

Age was the selected covariate included in the model examining mental HRQoL and FADS. Results of multivariable linear regressions examining the interaction effect between mental HRQoL and HIV serostatus on FADS revealed no significant interaction (Figure 3). There was a significant main effect of mental HRQoL on FADS ($\beta = 0.16$, $p = .023$), such that better mental HRQoL was associated with higher FADS. Additionally, there was a significant effect of chronological age ($\beta = 0.39$, $p < .001$), such that older chronological age was associated with higher FADS. A follow-up linear regression model without interaction examined independent effects of mental HRQoL and HIV serostatus on FADS, covarying for chronological age. In this adjusted model, FADS was significantly associated with mental HRQoL ($p < .001$) and chronological age ($p < .001$). There was no detected effect of HIV serostatus on FADS in this model.

DISCUSSION

Our results show that the majority of PLWH reported feeling younger than their chronological age, although this proportion was significantly lower among PLWH than among the uninfected group. As hypothesized, PLWH reported closer correspondence between their chronologic and felt ages, indicating lower perceived youthfulness than their uninfected counterparts. This finding was particularly notable among persons between the ages of 46–55 years, such that PLWH reported lower FADS compared to the 46- to 55-year-

old uninfected group. These results partially supported our hypothesis that PLWH across age cohorts would have similar felt ages, as felt age ratings within younger and older cohorts were comparable by HIV serostatus. The exact psychosocial (e.g., mood, social support, stress) and/or HIV specific (e.g., duration of HIV-infection, perceptions of HIV) mechanisms underlying the significant discrepancy between chronological and felt age among our middle age cohort (ages 46–55) by HIV serostatus remains to be elucidated (Fumaz et al., 2015; R.C. Moore et al., 2013; Sun-Suslow et al., 2020).

Notably, the oldest cohort of PLWH indicated feeling younger than those of the uninfected group, although this difference was not statistically significant. Furthermore, among PLWH, the oldest cohort showed the highest FADS compared to the younger and middle-age cohorts. This finding could be suggestive of a potential chronological age association with FADS among PLWH. Considering life expectancies have significantly increased among PLWH, research has focused on positive factors associated with survivorship among older PLWH and suggests that individuals who live longer could be more physically and psychologically resilient, showing a positive survivorship effect (Vance et al., 2019). It is possible that longevity associated with pharmaceutical advances in suppressing viral replication of HIV is associated with more positive assessments of age (e.g., feeling younger). Contrastingly, FADS across the three age cohorts were not statistically different in the uninfected group. These findings are consistent with the existing literature that suggests individuals typically feel younger than their chronological age from their mid to late twenties, and this discrepancy remains stable as chronological age increases (Kotter-Grühn et al., 2016; Shinan-Altman & Werner, 2019). Taken together, upon older chronological age, PLWH may have substantially more positive perceptions of aging and age, comparable to their uninfected counterparts. Future research is warranted to examine the potential positive factors associated with survivorship, specifically among PLWH and their associations with felt age.

Additionally, our results indicate that perceptions of youthfulness are more strongly associated with better HRQoL among PLWH, such that better physical health is associated with feeling younger. Notably, results indicate a significant main effect of mental HRQoL on FADS and no significant interactive effect of mental HRQoL and HIV serostatus on FADS. These results could suggest that variability in mental health may not differentially affect perceptions of age by HIV serostatus. Thus, physical HRQoL may have a greater influence on perceptions of youthfulness among PLWH; and perhaps regular assessment of it may yield insights into how PLWH conceptualize aging.

A growing body of research investigating the predictors and correlates of felt age suggests attitudes toward aging (ATOA) is significantly associated with felt age (Bodner et al., 2017; Kotter-Gruhn et al., 2015). ATOA have been previously associated with felt age such that an individual with positive ATOA is more likely to have a younger felt age (Bodner et al., 2017). Considering poor HRQoL negatively impacts perceptions of youthfulness, interventions targeted at improving physical HRQoL may subsequently influence positive attitudes toward aging (ATOA) in this psychosocially vulnerable population (Bodner et al., 2017; Mock & Eibach, 2011). Furthermore, evidence suggests that felt age has state-like qualities and can fluctuate based on daily changes in health, stressors, and negative affect

(Kotter-Gruhn et al., 2015, Shao et al., 2020); thus, felt age is amenable to improvement by intervention. Interventions aimed to promote positive attitude toward aging could have beneficial effects on older adults, considering older adults with positive ATOA have been shown to live longer compared to those with negative outlooks toward their aging (Levy & Bavishi, 2018). In 2015, 47% of PLWH in the United States were older than the age of 50 (i.e., > 50 years of age; (Centers for Disease Control and Prevention, 2018); therefore, targeting improving physical HRQoL in an effort to promote positive ATOA and youthful felt age may positively impact longevity and overall wellbeing. Future research may investigate whether interventions aimed to improve physical HRQoL, thereby promoting a youthful felt age, contribute to positive ATOA and longer life spans within the context of HIV.

Our study is not without limitations. Although felt age is an established construct, it has been operationalized in different ways in the aging literature (Gendron et al., 2018). Therefore, there is a lack of research examining the psychometric properties of felt age measures. Given our single self-report question assessing felt age is commonly used in the literature, we consider the assessment of felt age adequate. Within our sample, HIV disease was relatively well controlled and not demographically representative of the national population of PLWH, which limits the generalizability of this study to other subgroups of aging PLWH. Furthermore, our sample of “younger” persons were of middle ages and our cohort of “older” persons was relatively “young,” with a mean age across the entire sample of 50.9 years (SD_{age} = 7.9). Expanding the age range to include younger adults, below the age of 35 years, and older adults, above the age of 65 years, could enhance our understanding of the chronological age-related differences in subjective aging. Furthermore, with increasing chronological age, there is a greater range of possible FADS. For example, those in the youngest age cohort (upper limit = 45) have a range of felt ages associated with feeling younger of 0 to 45 years, whereas those in the oldest age cohort (upper limit = 65) have a possible range of 0 to 65 years. Although our results indicate stability in FADS across age cohorts in the uninfected group, future investigations of felt age and FADS could consider using an adjustment, such as a proportional score (e.g., felt age – chronological age/chronological age), to control for this variability.

Another limitation is that our cross-sectional study design did not allow for examination of the causal nature or directionality of influence among our variables of interest. It is possible that having a younger felt age precedes, rather than predicts, better HRQoL as indicative of better physical and mental health functioning. It makes sense that perceived poorer HRQoL may translate to feeling older; however, it is also possible that the age one feels may influence one’s approach and perception of physical and mental HRQoL. It is also plausible, given that our HRQoL predictor and felt age outcome are self-report measures, the significant associations resulting from these variables may be related to a tendency to report more positively on such measures. Furthermore, our study examined only one aspect of perceptions of aging (i.e. HRQoL) and its relationship with perceived or felt age. Future research will want to consider other indicators of health and successful aging and their associations with felt age. Finally, it would be beneficial to examine fluctuations in felt age over the course of a lifespan to expose the causal influence between felt age and everyday functioning.

In conclusion, we found that the discrepancy between chronological and felt age significantly differs by HIV serostatus, such that the proportion of PLWH who feel younger than their chronological age is lower than the proportion of the uninfected group. Our study is among the first to suggest that better physical HRQoL, particularly among PLWH, may be associated with younger felt ages and potentially positive perceptions of age. Our findings linking higher HRQoL to better felt age (i.e., youthfulness) are an important step toward understanding the factors influencing positive attitudes toward age among PLWH.

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KEY CONSIDERATIONS

- Emerging evidence suggests significant variability in health outcomes related to normal chronological aging and has identified the discrepancy between felt and chronological age as a meaningful and reliable alterative marker of aging.
- People living with HIV (PLWH) reported feeling significantly less youthful in relation to their chronological age compared to uninfected persons; particularly, adults between the ages of 46 and 55.
- PLWH among the oldest age cohort (ages 56–65) reported feeling subjectively youngest compared to the younger and middle aged cohorts, suggesting there may be positive lifestyle, environmental, HIV-specific, and/or psychosocial factors in later life that are associated with more positive attitudes towards aging. PLWH may have comparable or more positive perceptions of age and aging.
- PLWH with higher reports of physical health related quality of life (HRQoL) may have stronger perceptions of youthfulness; therefore, regular assessment of HRQoL may yield insights into attitudes towards aging.
- Given poor HRQoL is associated with poorer perceptions of youthfulness, interventions targeted at improving physical HRQoL among PLWH may subsequently positively influence attitudes toward aging in this psychosocially vulnerable population.

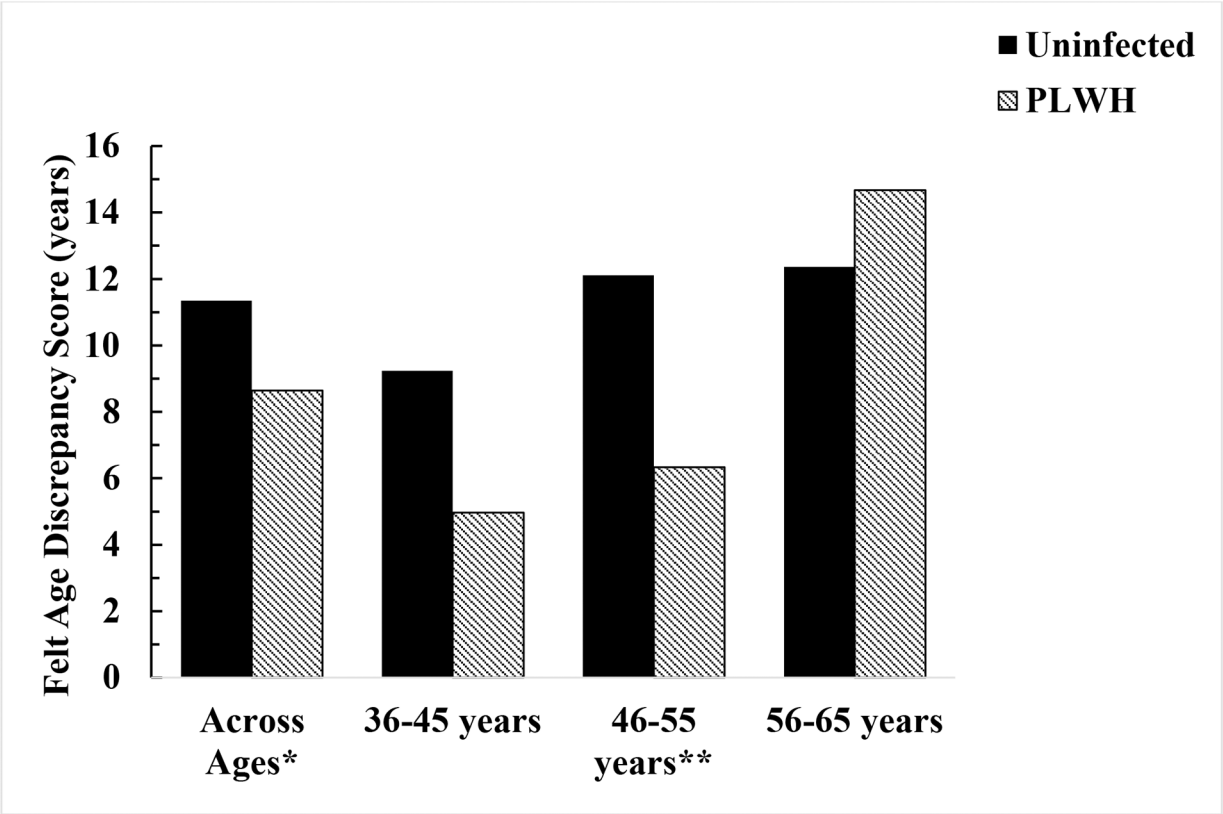

Figure 1.

Mean felt age discrepancy scores (FADS) by HIV serostatus and stratified by age group

Note. Values are presented as *M* (*SD*). A higher FADS indicates feeling younger than one's chronological age. Pairwise comparisons of FADS by HIV serostatus and across age cohorts were made using independent *t*-tests. **p* = .050; ***p* = .015

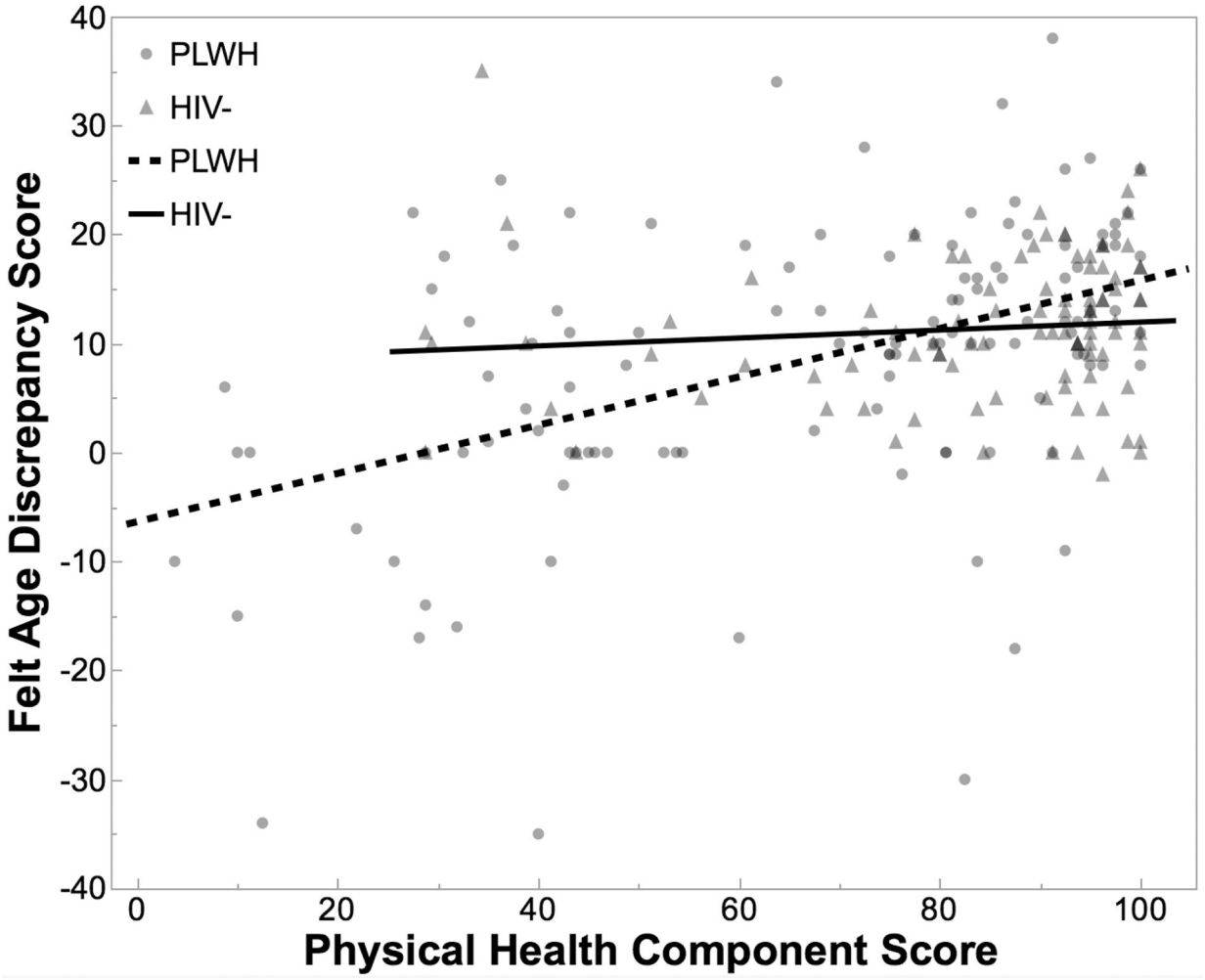

Figure 2.
Physical health related quality of life and felt age discrepancy score by HIV serostatus

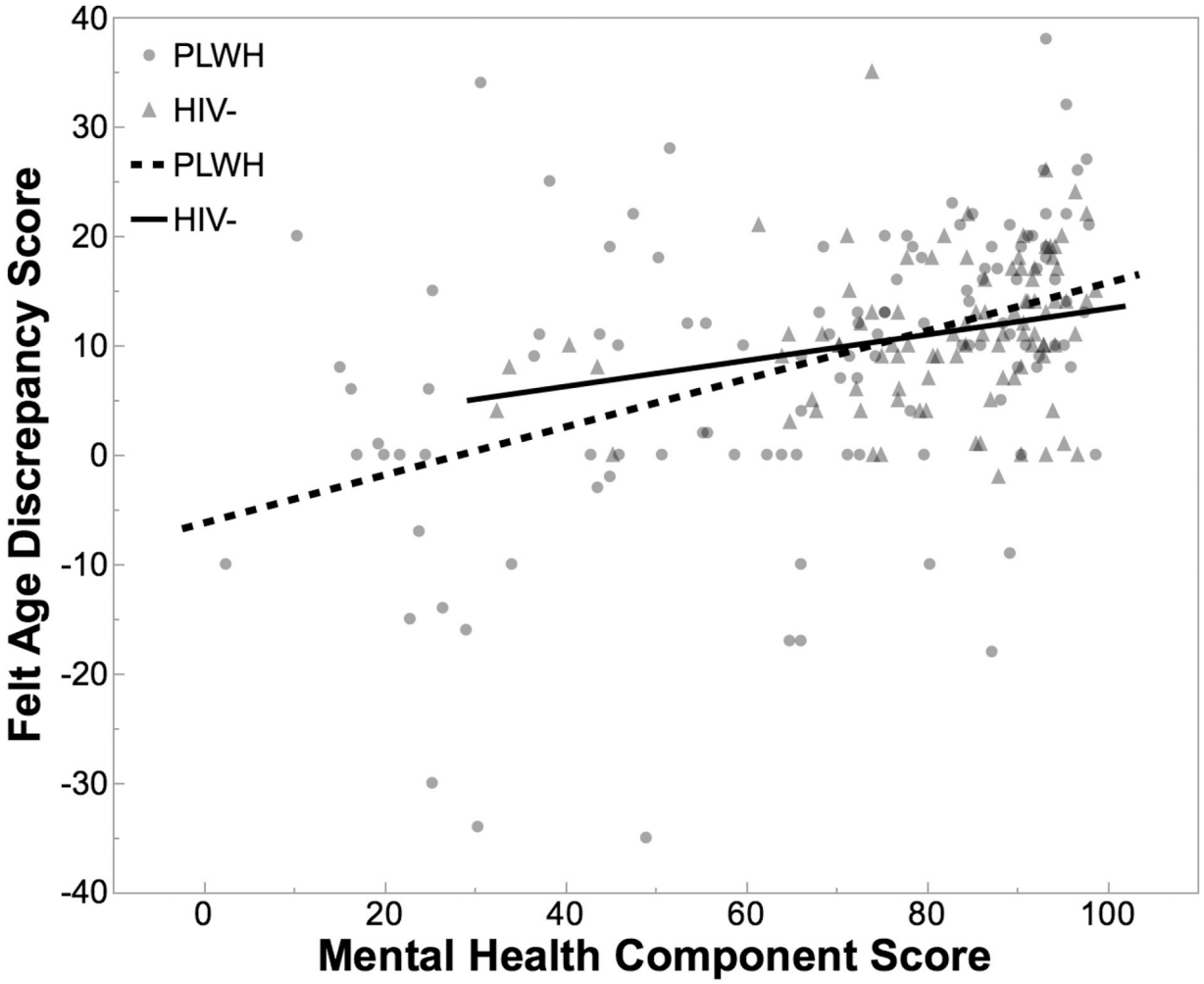

Figure 3.
Mental health related quality of life and felt age discrepancy score by HIV serostatus

Table 1.

Descriptive statistics for demographic and clinical variables by HIV serostatus ($N = 217$)

Variable	PLWH ($n = 119$)	HIV uninfected ($n = 98$)	t, z or χ^2	df	p[a]
Demographics					
Age (years)	50.8 (8.3)	51.1 (7.6)	0.29	215	.769
Felt age (years)	42.1 (12.9)	39.76 (9.1)	−1.60	210	.112
Felt age status				2	**<.001**
Felt younger	86 (72.3%)	91 (92.9%)			
Felt at the same age	16 (13.5%)	6 (6.1%)			
Felt older	17 (14.3%)	1 (1.0%)			
Education (years)	14.2 (2.4)	15.0 (2.3)	2.64	215	**.009**
Sex (male)	101 (84.9%)	67 (68.4%)	8.38	1	**.004**
Race/ethnicity (non-Hispanic White)	65 (54.6%)	67 (68.4%)	4.3	1	**.038**
IADL (dependent)	38 (32.5%)	8 (8.3%)	19.99	1	**<.001**
Comorbidities					
Lifetime MDD	60 (53.1%)	19 (19.4%)	25.44	1	**<.001**
Current MDD	12 (10.2%)	0 (0.0%)			**<.001**
Number of diseases	1.87 (1.3)	0.54 (0.8)	−7.92		**<.001**
Lifetime history of SUD	76 (67.3%)	37 (37.8%)	18.61	1	**<.001**
HIV Characteristics					
History of AIDS	72 (61.5%)	–			–
Detectable plasma viral copies/mL	296.7 (2289.1)	–			–
CD4+ T cell count (cells/mm3)	638 [437–854]	–			–
Nadir CD4 count	180 [49–332]	–			–
Estimated years of infection	18.4 [9.8–25.3]	–			–
ARV Status (on cART)	109 (92.4%)	–			–
Neurocognitive Function					
WRAT4 reading	102.9 (13.5)	106.5 (13.4)	1.95	210	**.052**
GDS (impaired)	47 (39.5%)	24 (24.5%)	5.58	1	**.018**
Health Related Quality of Life					
Physical health component score	66.7 (26.5)	84.1 (18.5)	5.36		**<.001**
Mental health component score	66.9 (25.7)	82.3 (13.8)	4.25		**<.001**

Note. Bolded values indicate $p < .10$. Values are presented as M (SD), MDN [IQR], or N (%). IADL = Instrumental Activities of Daily Living; MDD = Major Depressive Disorder; SUD = Substance Use Disorder; ARV = Antiretrovirals; cART = combination Antiretroviral Therapy; WRAT4 = Wide-Range Achievement Test 4 Reading subtest; GDS = Global Deficit Score.

[a] p-values were calculated using independent t-tests, Wilcoxon Rank-Sum tests, Chi-square statistics, and Fisher's exact tests as appropriate.

Table 2.

Results of multivariable linear regression analyses of the interaction effects between HIV serostatus and physical HRQoL, and HIV serostatus and mental HRQoL, on felt age discrepancy scores

HIV serostatus × physical HRQoL			
	Regression Estimate (SE)	***t* Ratio**	***p***
HIV Status[a]	−1.01 (1.85)	−0.69	.493
Physical HRQoL component score	0.09 (0.05)	1.74	.083
Physical HRQoL × HIV status	0.14 (0.06)	2.27	**.024**
Age	0.47 (0.08)	5.63	**<.001**
Lifetime MDD[b]	1.75 (1.45)	1.21	.228
Race/ethnicity[c]	2.61 (1.37)	1.90	.059
HIV serostatus × mental HRQoL			
	Regression Estimate (SE)	***t* Ratio**	***p***
HIV Status[a]	0.18 (1.45)	0.12	.904
Mental HRQoL component score	0.16 (0.07)	2.29	**.023**
Mental HRQoL × HIV status	0.05 (0.08)	0.65	.516
Age	0.39 (0.08)	4.81	**<.001**

Note. HRQoL = health-related quality of life; MDD = Major Depressive Disorder; Wide-Range Achievement Test 4 reading subtest. Bolded values indicate $p < .05$

[a] People living with HIV compared to uninfected

[b] Lifetime history of MDD compared to no lifetime MDD

[c] Non-Hispanic White compared to White