Author(s): Sutin, Angelina R.; Cajuste, Sabrina; Stephan, Yannick; Luchetti, Martina; Kekäläinen, Tiia; Terracciano, Antonio

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Purpose in life and slow walking speed: Cross-sectional and longitudinal associations

Angelina R. Sutin, PhD[1], Sabrina Cajuste, MS[1], Yannick Stephan, PhD[2], Martina Luchetti, PhD[1], Tiia Kekäläinen, PhD[3], and Antonio Terracciano, PhD[1]
[1]Florida State University College of Medicine, Tallahassee, FL USA
[2]Euromov, University of Montpellier, Montpellier, FRANCE
[3]University of Jyväskylä, Faculty of Sport and Health Sciences, Jyväskylä FINLAND

Address correspondence to:
Angelina R. Sutin, Ph.D.
Florida State University College of Medicine
1115 W. Call Street
Tallahassee, FL 32306
Phone: (850) 645-0438
Fax: (850) 644-1773
angelina.sutin@med.fsu.edu

Abstract

The present research examines the association between purpose in life – a component of well-being defined as the feeling that one's life is goal-oriented and has direction – and slow walking speed and risk of developing slow walking speed over time. Participants (*N*=18,825) were from three established longitudinal studies of older adults. At baseline, participants reported on their purpose in life, and interviewers measured their usual walking speed. Walking speed was measured at annual or biannual follow-up waves up to 16 years later. Random-effects meta-analysis was used to summarize the estimates from the individual studies. Every standard deviation higher in purpose in life (as a continuous measure) was associated with a lower likelihood of cross-sectional slow walking speed at baseline (meta-analytic OR=.80, 95% CI=.77-.83). Among participants who did not have slow walking speed at baseline (*n*=8,448), every standard deviation higher purpose in life was associated with a lower likelihood of developing slow walking speed over the up to 16 years of follow-up (meta-analytic HR=.93, 95% CI=.89-.96). Physical activity and disease burden accounted for 25% and 14% of the cross-sectional and longitudinal associations, respectively. The associations were independent of age, sex, race, ethnicity, and education and not moderated by these factors. Higher purpose in life is associated with lower risk of slow walking speed and lower risk of developing slow walking speed over time. Purpose in life is a psychological resource that may help to support aspects of physical function, such as walking speed, and may help support better function with age.

Keywords: Purpose; Meaning; Gait Speed; Walking; Prospective; Meta-analysis

Walking speed is a critical marker of health in older adulthood [1]. Individuals who walk slower, for example, are at greater risk of incident cardiovascular disease and fatal and non-fatal cardiovascular events [2]. Slow walking speed is likewise associated with increased risk of developing functional limitations over time [3] and greater risk of falls [4]. In the cognitive domain, it is associated with worse cognitive function, particularly episodic memory [5], greater risk of converting from mild cognitive impairment to dementia [6], and, among cognitively healthy individuals, higher risk of developing dementia [7]. Slow walking speed also increases financial cost of care, particularly due to the greater need for long-term nursing home care associated with it [8]. Ultimately, it is associated with increased risk of premature mortality [9].

As such, there is great interest in identifying factors that contribute to slow walking speed to improve primary prevention and preserve function. Most of this work has focused on clinical and behavioral factors associated with more rapid declines in speed. Individuals who carry a greater disease burden, for example, are more likely to walk slower and decline more in speed over time [10]. Individuals who are sedentary likewise face greater risk of declines in walking speed [11], whereas engagement in physical activity helps to sustain a faster walking speed [12], and interventions to increase physical activity decrease risk of walking speed decline [13,14].

Beyond clinical and behavioral factors, psychological factors may also contribute to walking speed and changes in speed over time. There is replicated evidence, for example, that personality traits are associated with the speed someone walks: Older adults higher in neuroticism and lower in extraversion, openness, and conscientiousness tend to walk slower [15]. There is likewise replicated evidence that a younger subjective age – the feeling that one is younger than their chronological age – is associated with faster walking speed and less decline in speed over time [16]. Further, individuals with greater psychological well-being (broadly defined) tend to have slower decline in physical function, including maintaining walking speed over 12 years, although this association may not hold for men [17].

There are specific components of psychological well-being that may be associated with walking speed. In particular, purpose in life is an aspect of eudaimonic well-being that reflects the feeling that one's life is goal-oriented and has direction [18]. It has been associated consistently with better health across adulthood [19], including better physical function [20]. Purpose in life, for example, is associated with stronger grip strength [21] and fewer limitations in activities of daily living [22]. To our knowledge, there has been one previous study on purpose in life and walking speed that used four years of longitudinal data from the Health and Retirement Study (HRS) and found that individuals with more purpose had a decreased risk of developing slow walking speed over this follow-up [21].

These better physical function outcomes associated with purpose, including walking speed, may be due, in part, to healthier behavioral and clinical profiles associated with purpose. Purpose in life, for example, is associated consistently with being physically active: individuals with more purpose tend to engage in more physical activity, measured with either self-report or accelerometry [23], are less sedentary [24], and have healthier patterns of physical activity in older adulthood [25]. Purpose in life is likewise associated with healthier clinical profiles, particularly a lower burden of chronic diseases [26]. The engagement in physical activity and better health associated with purpose may contribute to the association between purpose and walking speed.

The present research examines the association between purpose in life and walking speed in three longitudinal cohort studies. We build on the one previous study that found that purpose was associated with lower risk of incident slow walking speed over four years in the HRS [21]. In addition to examining the baseline association between purpose and slow walking speed, the present research seeks to replicate and extend the previous longitudinal finding in four ways. First, we use all available longitudinal data on walking speed in HRS to extend the follow-up from four to 14 years in this sample. Second, we seek to establish replicability by examining this association in two other longitudinal cohort studies: the National Health and Aging Trends Study (NHATS) and the English Longitudinal Study of Ageing (ELSA). Further, the meta-analytic synthesis of results provides more robust estimates of effect sizes. Third, we evaluate to what extent physical activity and disease burden accounted for the association between purpose and walking speed. Fourth, we evaluate generalizability by examining whether this association is moderated by age, sex, race, ethnicity, or education. We hypothesize that higher purpose in life will be associated with lower likelihood of slow walking speed at baseline and lower risk of developing slow walking speed over time, associations that will remain significant controlling for physical activity and disease burden. We also hypothesize that these associations to be replicable and generalizable across the populations included in these samples.

Method

Participants and Procedure

Participants were from three longitudinal studies: HRS (https://hrs.isr.umich.edu), NHATS (https://www.nhats.org), and ELSA (https://www.elsa-project.ac.uk/).

HRS is a study of adults 50 years and older living in the United States and their spouses [27]. Purpose in life and walking speed were first measured on a random half of the HRS sample in 2006; the other half of the sample completed these measures in 2008. The 2006 and 2008 assessments were combined as baseline. Walking speed was measured every four years in HRS up to the most recent available wave in 2020.

NHATS is a study of Medicare beneficiaries aged 65 and older [28]. Purpose in life and walking speed were first measured at the baseline assessment in 2011. Walking speed was measured at every annual assessment (except wave 10) through the most recently available wave in 2021.

ELSA is a study of adults 50 years and older living in England and their spouses [29]. Purpose in life and walking speed were first measured at the baseline assessment in 2002. Walking speed was measured at every biannual assessment through the most recently available assessment in 2018-2019.

The walking speed task was only administered to participants aged 65 and older in HRS and participants aged 60 and older in ELSA; there was no age restriction in NHATS (all NHATS participants were aged 65 and older).

Measures

Purpose in life. A 7-item (e.g., "I have a sense of direction and purpose in my life") version of the Purpose in Life subscale from the Ryff Scales of Psychological Well-Being was used in HRS [18]. Items were rated from 1 (*strongly disagree*) to 6 (*strongly agree*) and the mean taken across items. The item, "My life has meaning and purpose" rated from 1 (*agree a lot*) to 3 (*agree not at all*) was used in NHATS and "I feel that my life has meaning" rated from 1 (*often*) to 4 (*never*) was used in ELSA. In each sample, items were re-coded when necessary, in the direction of greater purpose. For example, responses to the item in NHATS were recoded to 1=3, 2=2, 3=1 so that 1 was agree not at all and 3 was agree a lot, and thus higher scores indicated more purpose. Purpose was then standardized to a mean of zero and standard deviation of one within each sample so that estimates could be interpreted as the association for each standard deviation difference in purpose in life. This measure was entered as a continuous variable in all analyses.

Walking speed. In each sample, participants walked a specified distance at their normal pace. The distance was 2.5 meters in HRS, 3 meters in NHATS, and 2.43 meters in ELSA. Participants walked the course twice; the fastest time of the two trials was used to calculate walking speed. Walking speed was calculated as distance in meters divided by time in seconds (m/s). Following previous research [21,30], slow walking speed was defined as a pace of <.80 meters/second. Walking speed at each assessment was classified as slow walking speed (=1) versus not slow walking speed (=0).

Covariates. Sociodemographic covariates were age in years, sex (0=male, 1=female), race, ethnicity, and education. In HRS and NHATS, race was dummy-coded into two variables that compared Black (=1) and Otherwise identified (=1) to White (=0), and ethnicity was coded to compare Hispanic/Latino (=1) to not Hispanic/Latino (=0). In ELSA, race/ethnicity was coded to compare people of color (=1) to White (=0); ELSA does not release more specific information on race/ethnicity. Education was reported in years in HRS and on a scale from 1 (*no schooling*) to 9 (*graduate degree*) in NHATS and from 1 (*no qualification*) to 7 (*nvq4/nvq5/degree or equivalent*) in ELSA.

Disease burden and physical activity were included as additional covariates. Disease burden was the sum of seven reported physician-diagnosed chronic diseases: hypertension, diabetes, cancer, lung disease, heart disease, stroke, and arthritis. Physical activity in HRS and ELSA was measured with two items on how often the participant engaged in moderate and vigorous physical activity; the mean was taken across the two items in the direction of greater physical activity. Physical activity in NHATS was measured with an item that asked whether the participant had engaged in any vigorous physical activity in the last month (0=no, 1=yes).

Analytic Strategy

All continuous variables were standardized so that coefficients indicated the association for one standard deviation difference in the predictor. Logistic regression was used to examine the cross-sectional association between purpose in life and slow walking speed. Model 1 controlled for the sociodemographic covariates. Model 2 controlled for disease burden and physical activity, in addition to the sociodemographic covariates. This analysis was run in each cohort, and the results were summarized with a random effects meta-analysis. Moderation was tested with an interaction between purpose and each sociodemographic characteristic controlling for the main effects. As with the main effect, interaction terms were tested in each sample and then summarized with a random effects meta-analysis.

Cox regression was used to examine the longitudinal association between purpose in life and risk of developing slow walking speed over follow-up. Participants were selected for this analysis if they did not have slow walking speed at baseline and had at least one follow-up assessment of walking speed over the study period. Time to incidence was calculated as the number of years between the baseline assessment and the first instance of slow walking speed.

Time was censored at the last assessment available for participants who did not develop slow walking speed. Similar to the cross-sectional analysis, the association between purpose and incident slow walking speed was tested in each cohort, controlling for the sociodemographic covariates (Model 1) and then disease burden and physical activity (Model 2), and summarized with a random effects meta-analysis. Also similar to the cross-sectional analysis, moderation was tested with an interaction with each sociodemographic characteristic controlling for the main effects and summarized with a random effects meta-analysis.

Results

Descriptive statistics for each cohort are in Table 1. Across the three samples, 37-51% of participants had slow walking speed at the baseline assessment and 57-63% of participants developed slow walking speed over the 10-16 years of follow-up across the three cohorts.

Table 2 shows the cross-sectional association between purpose in life and slow walking speed. For each standard deviation higher purpose in life, there was a 25% decreased likelihood of having concurrent slow walking speed at baseline (meta-analytic OR=.80, 95% CI=.77-.83, p<.001). This association was apparent in every cohort; heterogeneity across samples was not significant (Q=2.42, p=.300, I^2=17.36). The association between purpose and slow walking speed remained significant controlling for disease burden and physical activity (meta-analytic OR=0.85, 95% CI=0.83, 0.89, p<.001; Q=.12, p=.939, I^2=0) but was attenuated by 25% ([(HR_{model1} – HR_{model2})/(HR_{model1} - 1)] x 100) [31]. The interaction terms for purpose and each sociodemographic factor on concurrent slow walking speed are in Supplemental Table S1. There was one significant interaction between purpose and age in HRS. This interaction did not replicate in NHATS or ELSA, and it was not significant when the interaction terms from the three studies were summarized in the meta-analysis. None of the other interactions was significant. The null interactions indicated that the association between purpose in life and lower likelihood of concurrent slow walking speed was similar across age, sex, race, ethnicity, and education.

Table 3 shows the results of the survival analysis predicting incident slow walking speed. Among participants who did not walk slow at baseline, every standard deviation higher purpose in life was associated with an 8% lower risk of developing slow walking speed over the up to 16-year follow-up (meta-analytic HR=.93, 95% CI=.89-.96, p<.001). This association was apparent in HRS and ELSA and in the meta-analysis but was not statistically significant in NHATS. Heterogeneity across samples was not significant (Q=4.36, p=.113, I^2=54.11). The association remained significant controlling for disease burden and physical activity (meta-analytic HR=.94, 95% CI=.91-.97, p<.001; Q=2.70, p=.259, I^2=26.01) but was attenuated by 14%. The interaction terms for purpose and the sociodemographic factors on incident slow walking speed are in Supplemental Table S2. There was one significant interaction between purpose and age in NHATS. This interaction did not replicate in HRS or ELSA, and it was not significant when the interaction terms from the three studies were summarized in the meta-analysis. The null interactions indicated that the association between purpose in life and lower likelihood of developing slow walking speed over time was similar across the sociodemographic factors tested.

Discussion

Meta-analyses of three independent samples of older adults found that purpose in life was associated with lower likelihood of concurrent slow walking speed at baseline and with lower risk of developing slow walking speed over up to 16 years of follow-up. These associations were similar across age, sex, race, ethnicity, and education and were partly accounted for by physical activity or disease burden. This evidence builds on the one previous study [21] on purpose and walking speed in the HRS: It extends the follow-up by a decade, provides replication, and demonstrates generalizability across sociodemographic groups. This work thus suggests that purpose in life is associated with maintaining walking speed longer across older adulthood.

Purpose in life is an aspect of eudaimonic well-being and a component of a meaningful life, which is considered one where the individual feels that their life is purposeful, coherent, and significant [32]. Of these three components, purpose has been highlighted for its theoretical and empirical connections to health across adulthood [33]. Purpose, for example, provides a future-oriented mindset and acts as a motivational resource to pursue long-term goals and overcome obstacles that may otherwise deter goal pursuit. These processes, in turn, help maintain and protect health with age. And, indeed, purpose in life is associated empirically with multiple aspects of health across adulthood: Individuals higher in purpose have better cardiovascular health [34], better brain health, including lower risk of stroke [35] and Alzheimer’s disease [36], lower risk of depression [37], and, ultimately, tend to live longer than individuals with less purpose [38].

The present research provides an additional piece of information that contributes to a more comprehensive model of the mechanisms that link purpose in life to better health. Walking speed helps to maintain better health across older adulthood, including cardiovascular [2], brain [6], and mental [39] health that is also associated with purpose. Maintenance of faster walking speed may be one reason that purpose helps support better health with age. The present research also sheds light on factors that may contribute, in part, to the association between purpose and walking speed. Specifically, individuals with more purpose tend to engage in more physical activity [23], are less sedentary [24], and carry a lower burden of disease [26]. This physically active lifestyle and fewer diseases then help support maintaining walking speed with age and reduce risk of developing slow walking speed [10,12]. There could be reciprocal factors that feed a virtuous cycle: Maintaining walking speed may reciprocally contribute to physical activity and disease burden such that maintaining physical function supports continued engagement in physical activity and reduces risk of developing chronic diseases.

In addition to physical activity and disease burden, there may be other mechanisms that contribute to the association between purpose and walking speed. Greater engagement in activity is inherent in the definition of purpose in life: To engage in purposeful behaviors requires some amount of activity [23]. Many such activities encompass more than physical activity. Individuals with more purpose, for example, tend to be more socially integrated [40], and social activity usually involves movement that may keep an individual active. Other forms of engagement, including working and volunteering, likewise involve movement that may be protective against decline and are also associated with purpose [41]. Individuals who report more purpose in life are also more likely to have psychological profiles, including lower neuroticism and higher conscientiousness [42] and fewer depressive symptoms [43] that are associated with maintaining walking speed [12,15]. Purpose has also been associated with other aspects of physical function (e.g., grip strength [21]) that may protect against the development of slow walking speed [44]. Given the complexity of the determinants of walking speed, there are likely to be multiple pathways through which purpose is associated with walking faster.

Purpose in life may be a useful target of intervention to support healthier walking speed. Purpose, for example, may be used to identify individuals at risk for declines in walking speed who are not detected through other common risk factors (e.g., age, disease burden). In addition, purpose itself may be increased through intervention [45]. As such, intervention development could target purpose, either as the focus of the intervention or as a component added to other promising interventions to maintain walking speed and better health.

A previous study on well-being (broadly defined and not specifically on purpose) and maintenance of physical function (a composite of walking speed, balance, and chair stands) over time found that this association held for females but not males [17]. This difference suggests that the protective association between well-being and physical function may be specific to females. The present study, however, did not replicate this sex difference. In all three samples in the current study, the interaction between purpose and sex was not significant, which indicated that the association between purpose and walking speed (both concurrent and incident) was similar for males and females. The only interactions that were significant did not replicate across samples, and none of the interactions was significant in the meta-analysis. This evidence indicates that the association between purpose and walking speed generalizes across age, sex, race, ethnicity, and education.

The present study had several strengths, including three longitudinal samples, the objective measurement of usual walking speed, and more than 10 years of follow-up data on walking speed. There are also some limitations. First, the three samples assessed purpose in life with different measures. Although also a strength because it demonstrates that the association is not dependent on a specific measure, some differences across the samples may have been due to the different measures and/or response scales. Second, the three longitudinal studies were observational and so no conclusions about causality can be drawn from the data. Finally, although the associations were similar across sociodemographic groups, the samples had limited representation of races other than Black and White, and all three samples were from high-income countries. Future research will need to evaluate whether these associations generalize more broadly. Despite these limitations, the present research provides evidence that purpose in life is associated with faster walking speed and maintenance of walking speed in older adulthood.

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References

1. Middleton A, Fritz SL, Lusardi M. Walking speed: the functional vital sign. *J Aging Phys Act*. 2015;23(2):314-22. doi:10.1123/japa.2013-0236

2. Welsh CE, Celis-Morales CA, Ho FK, et al. Grip strength and walking pace and cardiovascular disease risk prediction in 406,834 UK Biobank participants. *Mayo Clin Proc*. 2020;95(5):879-888. doi:10.1016/j.mayocp.2019.12.032

3. Perera S, Patel KV, Rosano C, et al. Gait speed predicts incident disability: A pooled analysis. *J Gerontol A Biol Sci Med Sci*. 2016;71(1):63-71. doi:10.1093/gerona/glv126

4. Menant JC, Schoene D, Sarofim M, Lord SR. Single and dual task tests of gait speed are equivalent in the prediction of falls in older people: a systematic review and meta-analysis. *Ageing Res Rev*. 2014;16:83-104. doi:10.1016/j.arr.2014.06.001

5. Zuo M, Gan C, Liu T, Tang J, Dai J, Hu X. Physical predictors of cognitive function in individuals with hypertension: Evidence from the CHARLS baseline Survey. *West J Nurs Res*. 2019;41(4):592-614. doi:10.1177/0193945918770794

6. Hoogendijk EO, Rijnhart JJM, Skoog J, et al. Gait speed as predictor of transition into cognitive impairment: Findings from three longitudinal studies on aging. *Exp Gerontol*. 2020;129:110783. doi:10.1016/j.exger.2019.110783

7. Hackett RA, Davies-Kershaw H, Cadar D, Orrell M, Steptoe A. Walking speed, cognitive function, and dementia risk in the English Longitudinal Study of Ageing. *J Am Geriatr Soc*. 2018;66(9):1670-1675. doi:10.1111/jgs.15312

8. Lyons JG, Ensrud KE, Schousboe JT, et al. Slow gait speed and risk of long-term nursing home residence in older women, adjusting for competing risk of mortality: Results from the

study of osteoporotic fractures. *J Am Geriatr Soc*. 2016;64(12):2522-2527. doi:10.1111/jgs.14346

9. Veronese N, Stubbs B, Volpato S, et al. Association between gait speed with mortality, cardiovascular disease and cancer: A systematic review and meta-analysis of prospective cohort studies. *J Am Med Dir Assoc*. 2018;19(11):981-988.e7. doi:10.1016/j.jamda.2018.06.007

10. Heiland EG, Qiu C, Wang R, et al. Cardiovascular risk burden and future risk of walking speed limitation in older adults. *J Am Geriatr Soc*. 2017;65(11):2418-2424. doi:10.1111/jgs.15158

11. Semanik PA, Lee J, Song J, et al. Accelerometer-monitored sedentary behavior and observed physical function loss. *Am J Public Health*. 2015;105(3):560-6. doi:10.2105/AJPH.2014.302270

12. Figgins E, Pieruccini-Faria F, Speechley M, Montero-Odasso M. Potentially modifiable risk factors for slow gait in community-dwelling older adults: A systematic review. *Ageing Res Rev*. 2021;66:101253. doi:10.1016/j.arr.2020.101253

13. Lopopolo RB, Greco M, Sullivan D, Craik RL, Mangione KK. Effect of therapeutic exercise on gait speed in community-dwelling elderly people: a meta-analysis. *Phys Ther*. 2006;86(4):520-40.

14. Custodero C, Agosti P, Anton SD, et al. Effect of physical activity intervention on gait speed by frailty condition: A randomized clinical trial. *J Am Med Dir Assoc*. 2023;24(4):489-496. doi:10.1016/j.jamda.2023.01.023

15. Stephan Y, Sutin AR, Bovier-Lapierre G, Terracciano A. Personality and walking speed across a dulthood: Prospective evidence from five samples. *Soc Psychol Pers Sci*. 2018;9(7):773-780. doi:10.1177/1948550617725152

16. Stephan Y, Sutin AR, Terracciano A. "Feeling younger, walking faster": subjective age and walking speed in older adults. *Age*. 2015;37(5):86. doi:10.1007/s11357-015-9830-9

17. Saadeh M, Welmer AK, Dekhtyar S, Fratiglioni L, Calderón-Larrañaga A. The role of psychological and social well-being on physical function trajectories in older adults. *J Gerontol A Biol Sci Med Sci*. 2020;75(8):1579-1585. doi:10.1093/gerona/glaa114

18. Ryff CD. Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *J Pers Soc Psychol*. 1989;57:1069-1081.

19. Kim ES, Chen Y, Nakamura JS, Ryff CD, VanderWeele TJ. Sense of purpose in life and subsequent physical, behavioral, and psychosocial health: An outcome-wide approach. *Am J Health Promot*. 2022;36(1):137-147. doi:10.1177/08901171211038545

20. Fischer IC, Feldman DB, Tsai J, et al. Purpose in life and physical health in older U.S. military veterans: Cross-sectional results from the National Health and Resilience in Veterans Study. *Prev Med*. 2023;170:107495. doi:10.1016/j.ypmed.2023.107495

21. Kim ES, Kawachi I, Chen Y, Kubzansky LD. Association between purpose in life and objective measures of physical function in older adults. *JAMA Psychiatry*. 2017;74(10):1039-1045. doi:10.1001/jamapsychiatry.2017.2145

22. Boyle PA, Buchman AS, Bennett DA. Purpose in life is associated with a reduced risk of incident disability among community-dwelling older persons. *Am J Geriatr Psychiatry*. 2010;18(12):1093-102. doi:10.1097/JGP.0b013e3181d6c259

23. Hooker SA, Masters KS. Purpose in life is associated with physical activity measured by accelerometer. *J Health Psychol*. 2016;21(6):962-71. doi:10.1177/1359105314542822

24. Sutin AR, Luchetti M, Stephan Y, Terracciano A. Sense of purpose in life and motivation, barriers, and engagement in physical activity and sedentary behavior: Test of a mediational model. *J Health Psychol*. 2022;27:2068–2078. doi:10.1177/13591053211021661

25. Sutin AR, Stephan Y, Kekäläinen T, Luchetti M, Terracciano A. Purpose in life and accelerometer-measured physical activity among older adults. *Psychol Health*. 2023:1-15. doi:10.1080/08870446.2023.2200414

26. Musich S, Wang SS, Kraemer S, Hawkins K, Wicker E. Purpose in life and positive health outcomes among older adults. *Popul Health Manag*. 2018;21(2):139-147. doi:10.1089/pop.2017.0063

27. Sonnega A, Faul JD, Ofstedal MB, Langa KM, Phillips JW, Weir DR. Cohort profile: the Health and Retirement Study (HRS). *Int J Epidemiol*. 2014;43(2):576-85. doi:10.1093/ije/dyu067

28. Freedman VA, Kasper JD. Cohort Profile: The National Health and Aging Trends Study (NHATS). *Int J Epidemiol*. 2019;48(4):1044-1045g. doi:10.1093/ije/dyz109

29. Steptoe A, Breeze E, Banks J, Nazroo J. Cohort profile: the English longitudinal study of ageing. *Int J Epidemiol*. 2013;42(6):1640-8. doi:10.1093/ije/dys168

30. Studenski S, Perera S, Patel K, et al. Gait speed and survival in older adults. *JAMA*. 2011;305(1):50-8. doi:10.1001/jama.2010.1923

31. Elovainio M, Hakulinen C, Pulkki-Råback L, et al. Contribution of risk factors to excess mortality in isolated and lonely individuals: an analysis of data from the UK Biobank cohort study. *Lancet Public Health*. 2017;2(6):e260-e266. doi:10.1016/S2468-2667(17)30075-0

32. Martela F, Steger MF. The three meanings of meaning in life: Distinguishing coherence, purpose, and significance. *J Pos Psychol* 2016;11:531-545. doi:10.1080/17439760.2015.1137623

33. McKnight PE, Kashdan TB. Purpose in life as a system that creates and sustains health and well-being: An integrative, testable theory. *Rev Gen Psychol*. 2009;13:242-251. doi:10.1037/a0017152

34. Kim ES, Delaney SW, Kubansky LD. Sense of purpose in life and cardiovascular disease: Underlying mechanisms and future directions. *Current Cardiology Reports*. 2019;21:135.

35. Kim ES, Sun JK, Park N, Peterson C. Purpose in life and reduced incidence of stroke in older adults: 'The Health and Retirement Study'. *J Psychosom Res*. 2013;74(5):427-32. doi:10.1016/j.jpsychores.2013.01.013

36. Sutin AR, Luchetti M, Aschwanden D, Stephan Y, Sesker AA, Terracciano A. Sense of meaning and purpose in life and risk of incident dementia: New data and meta-analysis. *Arch Gerontol Geriatr*. 2023;105:104847. doi:10.1016/j.archger.2022.104847

37. Wood AM, Joseph S. The absence of positive psychological (eudemonic) well-being as a risk factor for depression: a ten year cohort study. *J Affect Disord*. 2010;122(3):213-7. doi:10.1016/j.jad.2009.06.032

38. Cohen R, Bavishi C, Rozanski A. Purpose in life and its relationship to all-cause mortality and cardiovascular events: A meta-analysis. *Psychosom Med*. 2016;78(2):122-33. doi:10.1097/PSY.0000000000000274

39. Lavie I, Schnaider Beeri M, Schwartz Y, et al. Decrease in gait speed over time is associated with increase in number of depression symptoms in older adults with type 2 diabetes. *J Gerontol A Biol Sci Med Sci*. 2023;78(8):1504-1512. doi:10.1093/gerona/glad008

40. Sutin AR, Luchetti M, Aschwanden D, et al. Sense of purpose in life and concurrent loneliness and risk of incident loneliness: An individual-participant meta-analysis of 135,227 individuals from 36 samples. *J Aff Dis*. 2022;309:211-220.

41. Sutin AR, Luchetti M, Stephan Y, Terracciano A. Purpose in life and cognitive performance and informant ratings of cognitive decline, affect, and activities. *J Int Neuropsychol Soc*. 2023:1-9. doi:10.1017/S1355617723000516

42. Anglim J, Horwood S, Smillie LD, Marrero RJ, Wood JK. Predicting psychological and subjective well-being from personality: A meta-analysis. *Psychol Bull*. 2020;146(4):279-323. doi:10.1037/bul0000226

43. Boreham ID, Schutte NS. The relationship between purpose in life and depression and anxiety: A meta-analysis. *J Clin Psychol*. 2023;doi:10.1002/jclp.23576

44. Verghese J, Wang C, Allali G, Holtzer R, Ayers E. Modifiable risk factors for new-onset slow gait in older adults. *J Am Med Dir Assoc*. 2016;17(5):421-5. doi:10.1016/j.jamda.2016.01.017

45. Park CL, Pustejovsky JE, Trevino K, et al. Effects of psychosocial interventions on meaning and purpose in adults with cancer: A systematic review and meta-analysis. *Cancer*. 2019;125(14):2383-2393. doi:10.1002/cncr.32078

Table 1

Descriptive statistics for all study variables

Variable	Study		
	HRS	NHATS	ELSA
Age (years)	74.18 (6.78)	76.83 (7.54)	70.58 (7.51)
Sex (female)	57.3% (4177)	57.3% (3408)	53.8% (3006)
Race (Black)	10.2% (740)	19.7% (1172)	--
Race (Otherwise identified)	2.8% (204)	8.0% (473)	.70% (40)
Ethnicity (Hispanic/Latinx)	6.8% (492)	5.5% (326)	--
Education	12.45 (3.07)	5.17 (2.20)	2.83 (2.15)
Purpose in life	4.56 (.91)	2.82 (.42)	3.58 (.72)
Disease burden	2.23 (1.27)	2.12 (1.31)	1.31 (1.10)
Physical activity	2.48 (1.01)	38.5% (2291)	2.44 (.95)
Baseline slow gait (yes)	48.8% (3559)	51.7% (3076)	37.3% (2083)
Incident slow gait (yes)[a]	57.4% (1756)	59.6% (1402)	63.9% (1939)
Follow-up time (years)	6.72 (2.82)	3.40 (3.36)	7.11 (4.93)
Follow-up time range (years)	4-12	1-10	2-16
N baseline/longitudinal	7286/3060	5949/2353	5590/3035

Note. HRS=Health and Retirement Study. NHATS=National Health and Aging Trends Study. ELSA=English Longitudinal Study of Ageing. Values are means (standard deviations) or percentages (sample size). [a] The percentage of incident slow walking speed is calculated from participants with longitudinal data and who did not have slow walking speed at baseline in each study.

Table 2

Logistic regression predicting likelihood of slow walking speed at baseline

Predictor	HRS		NHATS		ELSA	
	HR (95% CI)	*p*	HR (95% CI)	*p*	HR (95% CI)	*p*
			Model 1			
Age	1.88 (1.78-1.98)	<.001	2.12 (2.00-2.26)	<.001	1.90 (1.79-2.02)	<.001
Sex (female)	1.54 (1.39-1.70)	<.001	1.53 (1.37-1.72)	<.001	1.28 (1.14-1.44)	<.001
Race (Black)	3.42 (2.86-4.09)	<.001	3.03 (2.60-3.52)	<.001	--	--
Race (Otherwise)	1.57 (1.14-2.16)	.006	1.75 (1.22-3.51)	.002	4.12 (2.10-8.09)	<.001
Ethnicity (Hispanic)	1.59 (1.27-1.99)	<.001	1.10 (.71-1.69)	.672	--	--
Education	.73 (.69-.77)	<.001	.71 (.67-.75)	<.001	.66 (.62-.70)	<.001
Purpose in life	.78 (.74-.82)	<.001	.83 (.78-.88)	<.001	.80 (.76-.85)	<.001
			Model 2			
Age	1.79 (1.69-1.89)	<.001	2.07 (1.94-2.20)	<.001	1.68 (1.58-1.79)	<.001
Sex (female)	1.45 (1.30-1.61)	<.001	1.40 (1.25-1.58)	<.001	1.17 (1.03-1.32)	.015
Race (Black)	3.20 (2.67-3.85)	<.001	2.84 (2.44-3.32)	<.001	--	--
Race (Otherwise)	1.67 (1.21-2.32)	.002	1.67 (1.16-2.42)	.006	3.00 (1.47-6.10)	.002
Ethnicity (Hispanic)	1.72 (1.37-2.17)	<.001	1.20 (.77-1.88)	.412	--	--
Education	.76 (.72-.81)	<.001	.76 (.71-.81)	<.001	.71 (.66-.76)	<.001
Disease burden	1.31 (1.24-1.38)	<.001	1.48 (1.39-1.57)	<.01	1.43 (1.34-1.52)	<.001
Physical activity	.71 (.67-.90)	<.001	.52 (.56-.58)	<.001	.57 (.53-.61)	<.001
Purpose in life	.85 (.81-.90)	<.001	.87 (.82-.92)	<.001	.86 (.81-.91)	<.001

Note. HRS=Health and Retirement Study. NHATS=National Health and Aging Trends Study. ELSA=English Longitudinal Study of Ageing. HR=hazard ratio. CI=confidence interval. All continuous variables are standardized and thus can be interpreted as per one standard deviation difference. Sex compares females to male, race (Black) compares Black to White participants, race (otherwise) compares participants with a race identified as other than Black or White to White participants, and ethnicity compares Hispanic with non-Hispanic participants.

Table 3

Cox regression predicting risk of incident slow walking speed over follow-up

Predictor	HRS		NHATS		ELSA	
	HR (95% CI)	*p*	HR (95% CI)	*p*	HR (95% CI)	*p*
			Model 1			
Age	1.30 (1.24-1.36)	<.001	1.45 (1.38-1.52)	<.001	1.51 (1.44-1.58)	<.001
Sex (female)	1.22 (1.11-1.34)	<.001	1.14 (1.02-1.26)	.020	1.16 (1.06-1.27)	.002
Race (Black)	1.74 (1.45-2.08)	<.001	1.59 (1.37-1.85)	<.001	--	--
Race (Otherwise)	1.07 (.78-1.47)	.676	1.61 (1.14-2.26)	.007	1.03 (.49-2.18)	.930
Ethnicity (Hispanic)	1.02 (.82-1.27)	.858	.81 (.52-1.25)	.341	--	--
Education	.85 (.81-.89)	<.001	.78 (.74-.82)	<.001	.86 (.82-.90)	<.001
Purpose in life	.90 (.86-.94)	<.001	.96 (.92-1.01)	.155	.93 (.89-.97)	<.001
			Model 2			
Age	1.28 (1.22-1.34)	<.001	1.43 (1.36-1.51)	<.001	1.46 (1.39-1.52)	<.001
Sex (female)	1.19 (1.08-1.31)	<.001	1.12 (1.01-1.25)	.035	1.33 (1.03-1.24)	.008
Race (Black)	1.67 (1.39-1.99)	<.001	1.52 (1.30-1.77)	<.001	--	--
Race (Otherwise)	1.09 (.79-1.51)	.584	1.63 (1.16-2.29)	.005	.96 (.46-2.03)	.924
Ethnicity (Hispanic)	1.02 (.82-1.28)	.843	.83 (.54-1.28)	.393	--	--
Education	.86 (.82-.91)	<.001	.80 (.76-.85)	<.001	.88 (.84-.92)	<.001
Disease burden	1.12 (1.07-1.17)	<.001	1.12 (1.07-1.18)	<.001	1.12 (1.07-1.17)	<.001
Physical activity	.89 (.85-.94)	<.001	.81 (.72-.90)	<.001	.85 (.81-.89)	<.001
Purpose in life	.92 (.88-.96)	<.001	.97 (.93-1.02)	.304	.94 (.90-.98)	.006

Note. HRS=Health and Retirement Study. NHATS=National Health and Aging Trends Study. ELSA=English Longitudinal Study of Ageing. HR=hazard ratio. CI=confidence interval. All continuous variables are standardized and thus can be interpreted as per one standard deviation difference. Sex compares females to male, race (Black) compares Black to White participants, race (otherwise) compares participants with a race identified as other than Black or White to White participants, and ethnicity compares Hispanic with non-Hispanic participants.

Supplemental Table S1

Interaction between purpose in life and sociodemographic factors on likelihood of concurrent slow walking speed at baseline

Interaction terms	HR (95% CI)	P
Purpose x Age		
HRS	1.06 (1.01-1.12)	.026
NHATS	1.02 (.96-1.09)	.436
ELSA	1.00 (.94-1.06)	.980
Meta-analytic association	1.03 (.99-1.07)	.085
Purpose x Sex		
HRS	.96 (.87-1.07)	.469
NHATS	.90 (.80-1.01)	.082
ELSA	.99 (.88-1.11)	.902
Meta-analytic association	.95 (.89-1.02)	.142
Purpose x Race		
HRS (Black)	1.08 (.90-1.29)	.432
HRS (Otherwise identified)	.99 (.72-1.36)	.956
NHATS (Black)	1.11 (.94-1.32)	.228
NHATS (Otherwise identified)	1.09 (.89-1.33)	.399
ELSA (Otherwise identified)	1.32 (.79-2.22)	.293
Meta-analytic association	1.09 (.99-1.20)	.085
Purpose x Ethnicity		
HRS	1.07 (.87-1.31)	.522
NHATS	.92 (.70-1.20)	.515
Meta-analytic association	1.01 (.86-1.18)	.908
Purpose x Education		
HRS	1.00 (.94-1.06)	.936
NHATS	1.02 (.95-1.08)	.628
ELSA	1.01 (.94-1.08)	.781
Meta-analytic association	1.01 (.97-1.04)	.707

Note. HRS=Health and Retirement Study. NHATS=National Health and Aging Trends Study. ELSA=English Longitudinal Study of Ageing. HR=hazard ratio. CI=confidence interval.

Supplemental Table S2

Interaction between purpose in life and sociodemographic factors on risk of incident slow walking speed over follow-up

Interaction terms	HR (95% CI)	p
Purpose x Age		
HRS	1.01 (.96-1.05)	.797
NHATS	1.05 (1.00-1.10)	.039
ELSA	1.00 (.96-1.04)	.928
Meta-analytic association	1.02 (.98-1.05)	.302
Purpose x Sex		
HRS	1.06 (.96-1.16)	.258
NHATS	1.00 (.90-1.10)	.924
ELSA	.99 (.91-1.08)	.808
Meta-analytic association	1.01 (.96-1.07)	.661
Purpose x Race		
HRS (Black)	1.15 (.95-1.38)	.147
HRS (Otherwise identified)	.88 (.64-1.20)	.412
NHATS (Black)	.98 (.83-1.16)	.811
NHATS (Otherwise identified)	.97 (.80-1.18)	.761
ELSA (Otherwise identified)	1.61 (.81-3.22)	.174
Meta-analytic association	1.02 (.92-1.14)	.707
Purpose x Ethnicity		
HRS	.90 (.75-1.09)	.528
NHATS	1.10 (.80-1.52)	.565
Meta-analytic association	.95 (.80-1.12)	.558
Purpose x Education		
HRS	1.01 (.97-1.05)	.969
NHATS	1.01 (.96-1.06)	.715
ELSA	1.00 (.96-1.04)	.942
Meta-analytic association	1.01 (.98-1.03)	.655

Note. HRS=Health and Retirement Study. NHATS=National Health and Aging Trends Study. ELSA=English Longitudinal Study of Ageing. HR=hazard ratio. CI=confidence interval.