**Perceived discrimination: Associations with physical and cognitive function in older adults**

Aparna Shankar1,2 & Petra Hinds2

1Population Health Research Institute, St. George’s, University of London

2Department of Epidemiology & Public Health, UCL

Address correspondence to:

Aparna Shankar, PhD

Population Health Research Institute

St. George’s, University of London

Cranmer Terrace

London SW17 0RE

Phone: 00-44-(0)208 7252771

Email: [ashankar@sgul.ac.uk](mailto:ashankar@sgul.ac.uk)

**© 2017, American Psychological Association. This paper is not the copy of record and may not exactly replicate the final, authoritative version of the article. Please do not copy or cite without authors permission. The final article will be available, upon publication, via its DOI: 10.1037/hea0000522**

**Abstract**

**Objectives:** Perceived discrimination has been associated with poor physical and psychological health. There is limited research examining perceived discrimination in older adults, and its effects on health in later life. The aim of this study is to extend research in this area by examining longitudinal associations between reported everyday discrimination and physical and cognitive function in older adults.

**Methods:** The present study uses a national sample of 4,886 community-dwelling individuals aged 60 years and older from the English Longitudinal Study of Ageing. Perceived discrimination was assessed at baseline by asking participants about the frequency with which they experienced five everyday discriminatory situations. Cognitive functioning, comprising of tests of recall and a test of verbal fluency, and physical functioning, comprising of a timed walk test, were measured identically at baseline and follow-up. Multiple regression analyses were carried out, adjusting for socio-demographic and health status variables.

**Results:** At baseline, 39.3% of participants reported being discriminated against at least a few times a year. After adjusting for demographic variables, health status and depression, baseline discrimination was associated with poorer recall (B = -0.26, 95%CI: -0.44 to – 0.08) and slower gait speed (B = -0.02, 95%CI: -0.03 to -0.004) at follow-up. Discrimination was not associated with changes in verbal fluency (B = -0.12, 95%CI: -0.45 to 0.22).

**Conclusions:** The experience of discrimination is common among older adults, and is associated with declines in physical and cognitive functioning. Addressing issues around discrimination in older adults may contribute to maintaining functioning in later life.

**Keywords:** perceived discrimination; aging; cognitive function; physical function; English Longitudinal Study of Ageing

**Introduction**

Declines in physical and cognitive function are common in older age. As individuals age, the risk of developing conditions such as dementia increases, with estimates suggesting that dementia risk doubles for every 5-6 year increase in age after the age of 60 years (Prince et al., 2013). Similarly, sarcopenia (characterized by decreased muscle strength and function) and mobility limitations are more common in older adults (Brown & Flood, 2013; Cruz-Jentoft et al., 2010). With a rapid increase in the ageing population worldwide, these issues are of major public health significance, and understanding factors other than natural ageing that have an effect on older adults’ physical and cognitive function is of primary social and economic significance.

Discrimination refers to unfair or unjust treatment based on personal characteristics such as gender, race, age or sexual orientation (K. H. Banks, Kohn-Wood, & Spencer, 2006; Pascoe & Richman, 2009). Perceived discrimination is a common social phenomenon. More than 60% of U.S. adults report having experienced some type of everyday discrimination in their lives, and over 30% report having experienced major lifetime discrimination (Kessler, Mickelson, & Williams, 1999). The experience of discrimination is believed to act as a chronic stressor leading to physiological and psychological dysregulation, and ultimately poor physical and mental health outcomes (Pascoe & Richman, 2009; Williams & Mohammed, 2009). Perceived discrimination has been found to be significantly associated with depression, anxiety, and reduced well-being (Schmitt, Branscombe, Postmes, & Garcia, 2014), risky health behaviors (Sims et al., 2015), hypertension (Dolezsar, McGrath, Herzig, & Miller, 2014), inflammation (Goosby, Malone, Richardson, Cheadle, & Williams, 2015; Lewis, Aiello, Leurgans, Kelly, & Barnes, 2010; Sutin, Stephan, Luchetti, & Terracciano, 2014), poor self-care (Dawson, Walker, Campbell, & Egede, 2014), and adverse health outcomes including cardiovascular events (Everson-Rose et al., 2015) and mortality (Barnes et al., 2008).

There is limited research examining the effects of perceived discrimination on physical and cognitive function. The findings with regard to physical function have been equivocal. Harris and colleagues examined the experience of racism among individuals aged 15 years and over in New Zealand, and found in their cross-sectional analysis that experience of unfair treatment was associated with poorer physical functioning (defined as the lowest quartile of the SF-36 scale) (Harris et al., 2006) while a cross-sectional study of Chinese Americans aged 18 – 65 years examining both institutional and individual-level discrimination found no association between either measure of discrimination and scores on the SF-36 (Gee, 2002). A longitudinal study of women aged 47 – 62 years in the US found that experience of discrimination in the workplace was associated with greater functional limitations such as difficulties in standing, lifting heavy objects, etc. at a 7-year follow-up (Pavalko, Mossakowski, & Hamilton, 2003), while an analysis of data from the Health and Retirement Study, with participants aged 53 years and over, found that neither everyday discrimination nor major lifetime discrimination was associated with change in the number of difficulties with activities such as walking up a flight of stairs, moving a chair, etc. over a 2-year period (Luo, Xu, Granberg, & Wentworth, 2012).

The findings with regard to cognitive function have been more consistent. In a cross-sectional study of older African-Americans (mean age of 72.9 years), perceived discrimination was found to be associated with poor episodic memory and perceptual speed (Barnes et al., 2012). A study of older Americans aged 65 years and over found that perceived racial discrimination moderated the association between diabetes and cognitive decline among African-Americans over a 4-year period, such that diabetes was significantly predictive of decline only among participants who reported discrimination (Crowe et al., 2010). Sutin and colleagues, using data from the Health and Retirement Study (HRS), found that discrimination based on physical disability was associated with a decrease in recall over a 4-year period (Sutin, Stephan, Carretta, & Terracciano, 2015). No other type of discrimination (race, ancestry, sex, age, weight, appearance and sexual orientation) was associated with a change in memory.

It is clear from the above that the majority of previous work on discrimination and health has focused on specific types of discrimination, usually racial discrimination. Such an approach is unable to account for exposure to multiple forms of discrimination. Individuals are commonly exposed to more than a single type of discrimination (Everson-Rose et al., 2015; Grollman, 2012; Luo et al., 2012) and it has been shown that non-race/ethnicity-based forms of discrimination are also harmful to health (Alvarez-Galvez, 2015; Everson-Rose et al., 2015). Further, little is known about older people’s exposure to discrimination or the associations between health outcomes and perceived discrimination for this age group, as research has mostly concentrated on young and middle-aged adults (Sutin et al., 2015).

Typically studies examining health effects of perceived discrimination have focused on mental health and physical health outcomes separately. However, these effects may not be completely independent (Forsyth, Schoenthaler, Chaplin, Ogedegbe, & Ravenell, 2014; Schunck, Reiss, & Razum, 2015). There is considerable evidence linking perceived discrimination to increased depression (Britt-Spells, Slebodnik, Sands, & Rollock, 2016; Schmitt et al., 2014). Depression has been associated with poorer physical functioning, disability and frailty (Demakakos et al., 2013; Rozzini et al., 1997; Vaughan, Corbin, & Goveas, 2015) as well as with cognitive impairment and dementia (Byers & Yaffe, 2011; da Silva, Gonçalves-Pereira, Xavier, & Mukaetova-Ladinska, 2013; Wang & Blazer, 2015). In fact, in the Barnes et al. (2012) study quoted above, perceived discrimination was no longer significantly associated with cognitive function once depression was included in the model, suggesting that depression may represent a pathway through which perceived discrimination affects cognitive function.

The present analysis aimed to extend work in this area by examining associations between reported everyday discrimination and physical and cognitive function in older adults. Cognitive function was assessed using tests of recall and verbal fluency, which have been shown to be associated with outcomes important to this population, including health literacy (Bostock & Steptoe, 2012), investment decisions (J. Banks & Oldfield, 2007), and survival (Batty, Deary, & Zaninotto, 2016). Physical function was assessed using the walking speed test, an important predictor of wellbeing, disability and mortality (Abellan Van Kan et al., 2010; Cooper et al., 2011; Cooper et al., 2014; Studenski et al., 2011). To overcome limitations of previous research in this area, changes in functioning over a period of 4 years were examined, adjusting for a range of demographic and health factors. Most studies in the area of perceived discrimination and physical/cognitive function do not control for other co-morbidities, which may be particularly important in older populations. Finally, the analyses were adjusted for depression to examine if effects are independent of depression. It was hypothesized that participants who reported experiencing discrimination would show greater declines in physical and cognitive function over a 4-year period.

**Method**

**Participants**

Data were obtained from waves 5 (2010/11) and 7 (2014/15) of the English Longitudinal Study of Ageing (ELSA). ELSA is a nationally representative panel study of individuals aged 50 years and over. Wave 1 of ELSA was carried out in 2002/3 and participants are followed-up every two years. Further details regarding the sample, design and measures are available elsewhere (Steptoe, Breeze, Banks, & Nazroo, 2013). Ethical approval was obtained from the London Multicentre Research Ethics Committee.

Wave 5 (2010/11) was chosen as the baseline for this analysis as this is the first wave in which questions on perceived discrimination were included. Outcomes were assessed 4 years later (wave 7; 2014/15), as this is the latest wave available. At baseline, 9090 participants completed the main interview in person. As the measure of physical function (timed walk test) was administered only to participants aged 60 years and over (N = 7122), we restricted the analysis to participants in this age group who had a valid value on the timed walk test and on at least one cognitive function measure at baseline (N = 6129). Of these participants, 4886 took part in the follow-up interview 4 years later and this forms the analytical sample. At follow-up, participants were included in the analysis as long as they had an interview.

Individuals excluded due to invalid outcome data at baseline (N = 993) were older, more disadvantaged and in poorer health compared with those with outcome data at baseline. When compared with the 1243 participants who did not take part in the follow-up, participants included in the analysis were younger (mean age 69.6 years vs 73.0 years, p < 0.001) and more likely to be women (55.6% vs 51.4%, p = 0.010). While there were no significant differences in ethnicity between the two groups (Non-White 2.2% vs 1.9%, p = 0.446), the current analytical sample was more likely to be married/cohabiting (68.7% vs 62.2%, p < 0.001), better educated (having no formal qualifications 25.6% vs 38.3%, p < 0.001) and wealthier (in the lowest wealth group 14.8% vs 19.9%, p < 0.0001). Health status was generally better among participants when compared with dropouts, as they were less likely to have cardiovascular disease (31.9% vs 39.9%, p < 0.001), lung disease (6.6% vs 10.6%, p < 0.001), osteoporosis (9.2% vs 11.6%, p = 0.011), Alzheimer’s disease (0.1% vs 0.8%, p < 0.001), and depressive symptoms (mean depressive symptoms 1.3 vs 1.6, p < 0.001). However, there were no significant differences between the groups in the proportion of individuals with asthma (13.4% vs 12.6%, p = 0.453), arthritis (42.2% vs 41.6%, p = 0.699) or dementia (0.8% vs 1.2%, p = 0.174). There were also no significant differences between the groups in proportion of participants who had experienced discrimination (36.3 vs 34.9%, p = 0.42). At baseline participants in the study had faster gait speed (0.91 m/s vs 0.79 m/s, p < 0.001), better recall (mean words recalled 10.5 vs 8.8, p < 0.001) and better verbal fluency (mean 20.8 vs 18.5, p < 0.001) than those who dropped out.

**Measures**

Perceived discrimination was measured using a scale adapted from the short form of the Everyday Discrimination Scale (Sternthal, Slopen, & Williams, 2011). Participants were asked *“In your day-to-day life, how often have any of the following things happened to you?”* followed by 5 scenarios, *‘You receive poorer service than other people at restaurants or stores’*, ‘*You are treated with less courtesy or respect than other people’, ‘People act as if they think you are not clever’,* *‘You are threatened or harassed’* and ‘*You receive poorer service or treatment than other people from doctors or hospitals’*. Response options included *almost every day, at least once a week, a few times a month, a few time a year, less than once a year* and *never.*  Participants who reported being discriminated against a few times a year or more on any of the above were classified as ‘discriminated’ while those who reported experiencing discrimination less than once a once a year or never were classified as ‘not discriminated’ (Rippon, Kneale, de Oliveira, Demakakos, & Steptoe, 2014). Perceived discrimination was measured at baseline.

Physical and cognitive function was measured identically at baseline and at follow-up.

Cognitive function was measured using two memory tasks (*immediate and delayed recall*) and one test of executive function (*verbal fluency*). For the memory tests, a list of 10 words was read out by the computer at a steady rate. Following this participants were asked to recall as many words as they could (*immediate recall).* After a short interval during which participants performed other cognitive tasks, they were asked to recall these 10 words again *(delayed recall).* The sum of the number of words correctly recalled in each test (immediate recall + delayed recall; range 0-20) was taken as a measure of memory. The measure forms part of the adapted Telephone Interview for Cognitive Status (Brandt, Spencer, & Folstein, 1988) used in the Health and Retirement Survey (Ofstedal, Fisher, & Herzog, 2005). For the *verbal fluency* task participants were asked to name as many animals as they could in 1 minute. The total number of animals named was used an indicator of executive function. The verbal fluency test was initially developed by Thurstone as a written task; oral versions including animal naming form part of various tests including the Western Aphasia Battery and the Boston Diagnostic Aphasia examination (Tombaugh, Kozak, & Rees, 1999).

Physical functionwas assessed using the timed walk test (*gait speed)*. Participants were asked to walk a distance of 8 feet (2.44 meters) twice and timed as they did so. Participants were required to start with both feet at the start line and instructed to walk as normal and not race. Timing commenced when the participant’s foot was placed over the start line. If the participant normally used a walking stick or a Zimmer frame, s/he was allowed to use this for the test. The walking test was not administered if the participant needed help from another person, if the interviewer judged it unsafe or if there was no suitable space for the test. The mean speed of the two walks (m/s) was taken as the measure of physical function. If only a single walk was completed without any problems, the speed for this walk was used.

Sociodemographic and health status covariates, measured at baseline, were included in the analysis. *Age* and *gender* were assessed in the main interview. Total (non-pension) *wealth* divided into quintiles for the entire baseline sample and *educational level* classified as having no formal qualifications versus at least O-levels (equivalent to high school in the US) or higher, were used measures of socioeconomic status. As the final analytical sample included only part of the baseline sample there are unequal numbers in each of the five wealth groups. *Marital status/cohabitation* was classified as married or cohabiting versus not. As the ELSA population is predominantly White, ethnicity was classified as *White* or *Non-White*. Analyses of cognitive function were adjusted for the following health status variables: *cardiovascular disease* (CVD; including arrhythmia, myocardial infarction, congestive heart failure, angina, heart murmur, diabetes, and stroke), and *Alzheimer’s disease* or *other* *dementia*. The analysis of gait speed was adjusted for *cardiovascular disease* as above, *lung disease, asthma, osteoporosis* and *arthritis*. All health status variables were self-reports of doctor-diagnosed conditions. *Depressive symptoms* were assessed using the 8-item Centre for Epidemiologic Studies Depression scale (CES-D). Participants were required to respond yes or no to 8 statements. Responses were summed, and scores ranged from 0 to 8 such that higher scores indicate more depressive symptoms. Validity and reliability of the scale has been established elsewhere (Steffick, 2000).

**Statistical analysis**

Missing data on covariates and outcomes were imputed using the multiple imputation procedure in SPSS (for items imputed, mean percentage missing = 2.5%, median = 0.4%, maximum = 11.8%). As results for the analyses using the imputed data do not differ substantively from results for the complete case analyses (N = 4412 for recall, N = 4413 for verbal fluency, N = 4019 for gait speed), we report results from the pooled analyses for the imputed dataset.

Descriptive statistics (means and standard deviation for continuous variables, and percentage for categorical variables) were examined for the entire sample and also by discrimination status. T-tests (for continuous variables) and χ2 tests for categorical variables were used to assess differences between the groups. Following recommendations by Pascoe & Richman (2009) in their meta-analysis, we initially report results for follow-up physical or cognitive function regressed onto baseline perceived discrimination, adjusted for baseline physical or cognitive function, age and gender. Step 2 further adjusts for educational level, wealth group, marital status/cohabitation and ethnicity, Step 3 additionally adjusts for health status, and the final Step 4 also adjusts for depression. As participants who were unable to do the gait speed test due to health reasons were excluded at baseline, we ran a sensitivity analysis. At baseline and at follow-up, individuals were categorized into 5 groups on the basis of gait speed as follows: unable to carry/complete out the walking speed test due to health reasons or because the interviewer felt it would be unsafe for them to do the test, gait speed up to 0.4 m/s, gait speed > 0.4 m/s – 0.8 m/s, > 0.8 m/s – 1.2 m/s, and ≥ 1.2 m/s. A multinomial logistic regression was run with individuals who were unable to do the test as the reference category. For cognitive function, a sensitivity analysis was carried out excluding participants who reported a diagnosis of Alzheimer’s disease or dementia, to ensure their scores did not unduly affect findings. All analyses were carried out using IBM SPSS v.22.

**Results**

At baseline, 1922 (39.3%) of participants reported being discriminated at least a few times a year. The mean age of participants was just under 70 years and more than half were women. Just over 2% were non-White, over two-thirds were married or cohabiting, about a quarter had no formal educational qualifications and just under 15% were in the lowest wealth group. Participants who reported having experienced discrimination were significantly younger, more likely to be men, be married or cohabiting, from an ethnic minority group and less wealthy. There were no significant differences between the two groups in educational level. Mean depressive symptom scores were low, and just over 12% had a CES-D score of 4 and above, indicating caseness. Depressive symptoms and caseness were significantly higher among participants who reported having experienced discrimination. Nearly a third of participants had CVD and 42.2% had arthritis. Prevalence of Alzheimer’s disease and dementia was low (< 1%). There were no significant differences between the groups on most health status variables. However, CVD and lung disease were both more common among those who reported discrimination. Scores on recall and verbal fluency declined over time, as did gait speed. At baseline and at follow-up, participants who reported being discriminated against had significantly poorer verbal fluency and recall, as well as slower gait speed when compared with those who had not experienced discrimination (see Table 1).

*Associations with cognitive function*

In a minimally adjusted model, individuals who experienced discrimination showed poorer recall at follow-up when compared with those who did not experience discrimination (Table 2, Step 1 for recall). This effect remained significant following adjustments for socioeconomic status, marital status and ethnicity, as well as health status (Table 2; Steps 2 and 3 for recall). The association was attenuated when depression was added to the model, however, discrimination remained significantly associated with decreases in recall over time. Perceived discrimination was associated with decreases in verbal fluency after adjustment for age, gender and baseline verbal fluency (Table 2, Step 1 for verbal fluency). This association was no longer significant following additional adjustments (Table 2, Steps 2, 3 & 4 for verbal fluency).

Results for both measures of cognitive function remained identical when excluding participants with a diagnosis of Alzheimer’s disease or dementia at baseline.

*Associations with physical function*

In a model adjusted for age, gender and baseline gait speed, perceived discrimination was associated with decreases in gait speed at follow-up. The association remained significant following adjustment for socioeconomic factors, health status and depression (Table 3).

The sensitivity analysis included participants who at baseline were unable to do the gait speed test due to health reasons. In a model adjusting for all covariates and using the category unable to perform the test as the reference category, being discriminated against was not associated with an increase in the odds of being in either the slowest category (OR: 0.83, 95%CI: 0.57 – 1.21, for gait speed of up to 0.4 m/s) or the next higher category (OR: 0.90, 95%CI: 0.69 – 1.17, for gait speed > 0.4 m/s – 0.8 m/s). However individuals who were discriminated against were significantly less likely to be in the two highest speed categories (OR: 0.76, 95%CI: 0.59 – 0.99, for gait speed > 0.8 m/s – 1.2 m/s; OR: 0.68, 95%CI: 0.48 – 0.96, for gait speed ≥ 1.2 m/s).

**Discussion**

In this sample, nearly two-fifths of older adults reported having experienced discrimination at least a few times a year. This perceived discrimination was associated with poorer recall and gait speed over a 4-year period. The associations were independent of socioeconomic status, baseline health status and depressive symptoms.

Studies in in the US have found higher levels of perceived discrimination among older adults (Ayalon & Gum, 2011). The lower figure in the current analysis is possibly due to the way the ‘*discriminated*’ category was defined, as this did not include participants who reported relatively infrequent experiences of discrimination (i.e. less than once a year). In the context of racism, incidents of everyday discrimination have been termed as acts of *‘micro-aggression’* (Franklin & Boyd-Franklin, 2000). Such micro-aggressions are believed to lead to defensive anxiety and a state of chronic stress, compromising the individual’s psychological and physical health over time (Britt-Spells et al., 2016; Franklin & Boyd-Franklin, 2000; Williams & Williams-Morris, 2000). Relatively infrequent experiences of such events may not adequately capture exposure to these stressors, and hence we did not consider these in our analyses. Perceived discrimination was associated with poorer gait speed and recall over the 4-year period. Depression attenuated but did not completely eliminate the effect of perceived discrimination on outcomes. This suggests that depression may be a partial mediator of the perceived discrimination – functional decline relationship. However, this would need to be assessed using formal mediation analyses.

There are also other pathways through which perceived discrimination affects health. The stress associated with frequent experience of discriminatory events may lead to a range of behavioral and biological changes. For instance, discrimination has been associated with risky health behaviors such as smoking (Purnell et al., 2012; Sims et al., 2015) and cardiovascular risk factors such as higher levels of adiposity (Hunte, 2011; Lewis, Kravitz, Janssen, & Powell, 2011), inflammation (Lewis et al., 2010; Sutin et al., 2014) and allostatic load (Brody et al., 2014). The above risky behaviors and biological changes have also been implicated in declines in cognitive function (Gustafson, 2006; Kanaya et al., 2009; Karlamangla, Singer, McEwen, Rowe, & Seeman, 2002; North et al., 2015) and physical function (Beavers et al., 2013; Karlamangla et al., 2002; North et al., 2015; Sousa et al., 2016). These may represent potential mechanisms through which perceived discrimination affects functioning in older age.

Individuals who have experienced discrimination may be particularly vulnerable to stereotype threat, where being in a situation where their performance may serve to reinforce existing stereotypes about the particular group(s) they belong to might lead to underperformance in that domain (Steele & Aronson, 1995). Previous research using the ELSA data show that approximately a third of participants report experiencing discrimination due to their age (Rippon et al., 2014). A meta-analysis of experimental studies found that older adults performed more poorly on a cognitive tests when age-based stereotypes were activated (Lamont, Swift, & Abrams, 2015). One of the ways in which stereotype threat may affect performance may be through the depletion of working memory, as resources are directed towards monitoring performance and suppressing negative thoughts (Spencer, Logel, & Davies, 2016). This in particular may have important implications for cognitive function tests. Only a small number of studies of age-based stereotype threat have examined physical performance, and the overall effect size was not significant in the meta-analysis (Lamont et al., 2015).

An alternative explanation relies on Levy’s stereotype embodiment theory, where the experience of discrimination and exposure to stereotypes leads individuals to internalize negative stereotypes held about their group (Levy, 2009). In the context of ageing, individuals holding more negative self-stereotypes or self-perceptions have been found to perform more poorly on cognitive and physical function tests in lab situations (Levy, 2003). Observational data from the Baltimore Longitudinal Study of Aging showed that negative ageing stereotypes were associated with declines in cognitive performance over 38 years (Levy, Zonderman, Slade, & Ferrucci, 2012), as well as changes in biological markers of Alzheimer’s disease such as greater declines in hippocampal volume, and more accumulation of amyloid plaques and neurofibrillary tangles (Levy et al., 2016). Data from the Ohio Longitudinal Study of Aging and Retirement also show that older adults who had more positive perceptions of their aging had slower declines in physical functioning (measured as the ability to do tasks around the house, socialise, work full-time, etc.) over a 20-year period (Levy, Slade, & Kasl, 2002).

Recent evidence suggests that perceived discrimination may be associated with changes in personality over time, including increases in neuroticism and decreases in conscientiousness (Sutin, Stephan, & Terracciano, 2016), both of which have been associated with an increased risk of developing mild cognitive impairment and dementia (Low, Harrison, & Lackersteen, 2013) and chronic diseases (Sutin, Zonderman, Ferrucci, & Terracciano, 2013). Cross-sectional studies also suggest an association between neuroticism and poor physical functioning and disability (Chapman, Duberstein, & Lyness, 2007; Jaconelli, Stephan, Canada, & Chapman, 2013; Suchy, Williams, Kraybill, Franchow, & Butner, 2010).

Perceived discrimination was associated with declines in recall but not in verbal fluency. Barnes and colleagues suggest that this is in line with the view of discrimination as a social stressor, given findings on the deleterious effects of stress on episodic memory (Barnes et al., 2012). As noted earlier, findings from previous work on the effects of discrimination on physical function have been mixed. This may be due to cross-sectional designs, relatively short follow-up periods, and also due to the choice of outcomes. Previous work has shown that there may be a lag in the experience of discrimination and poor health outcomes (Pavalko et al., 2003). While longer follow-ups may be necessary to observe changes in disability levels, changes in gait speed may be apparent earlier. Declines in gait speed may be indicative of subclinical disease (Cooper et al., 2011), and it has been shown to be a powerful predictor later disability and mortality (Guralnik et al., 2000; Studenski et al., 2011). Thus using such measures may help identify the harmful health effects of discrimination at an earlier stage.

*Strengths and limitations*

This analysis uses data from a large nationally representative, multidisciplinary cohort study which makes it possible to adjust for a range of sociodemographic and health status covariates. We were also able to obtain multiple measures of cognitive function and an objective measure of physical functioning using a standardized protocol. The measures of health status were self-reports of doctor diagnosed conditions, and hence may be subject to bias. At baseline there were several differences in health status between individuals who had experienced discrimination and those who had not, and hence the possibility that poor health or functioning may have led to the experience of discrimination cannot be ruled out. However, the 4-year follow-up ensured that we were able to examine changes in functioning over time. Further, previous research has not found support for the pathway from poor health to perceived discrimination (Pavalko et al., 2003; Schunck et al., 2015). One of the main limitations of this analysis is the dropout between waves. Individuals who dropped out were likely to be in poorer health, from a lower SES, and have poorer functioning. Thus our findings may underestimate the associations between perceived discrimination and physical and cognitive function. However, it must be noted that declines in recall were very small and it is unclear to what extent these declines are likely to affect daily activities or be indicative of more severe memory ailments. In a minimally adjusted model, discrimination was associated with a decrease of 0.03 m/s in gait speed. Among community dwelling adults, a change 0.03-0.05 m/s in walking speed would be regarded as clinically meaningful (Kwon et al., 2009; Perera, Mody, Woodman, & Studenski, 2006). Hence, addressing discrimination may have clinically meaningful effects on physical function.

Our measure of perceived discrimination assessed exposure to everyday discrimination. The focus of these analyses was on the association between the experience of discrimination and functioning in later life, without reference to individuals’ attributions. Similar approaches have been employed elsewhere (e.g. Everson-Rose et al., 2015; Friedman, Williams, Singer, & Ryff, 2009). Naturally, it is possible to measure other dimensions of discrimination (Pascoe & Richman, 2009), and a consideration of these dimensions of may provide a fuller picture of an individual’s experiences (Williams & Mohammed, 2009). Most past research has focused on racial discrimination in relation to physical and cognitive function, and future work might usefully consider associations with different attributions (e.g. Sutin et al. 2015). It is also valuable to reiterate that this study examines perceptions of discrimination, rather than observed discrimination. This refers to a subjective, interpretative process (Major & Kaiser, 2008). There are naturally concerns associated with using such measures, such as incorrectly attributing certain acts to discrimination or failing to report acts for a variety of reasons (Major & Kaiser, 2008; Quillian, 2006). The individual’s perception of being discriminated against, however, remains important to his/her health (Luo et al., 2012; Pascoe & Richman, 2009).

**Conclusions**

The experience of discrimination is common among older adults, and is associated poorer functioning over time. Addressing the issues around discrimination among older adults is important, and may play a role in reducing functional decline in this age group.

**References**

Abellan Van Kan, G., Rolland, Y., Andrieu, S., Bauer, J., Beauchet, O., Bonnefoy, M., . . . Vellas, B. (2010). Gait speed at usual pace as a predictor of adverse outcomes in community-dwelling older people an International Academy on Nutrition and Aging (IANA) Task Force. *The journal of nutrition, health & aging, 13*(10), 881-889. doi:10.1007/s12603-009-0246-z

Alvarez-Galvez, J. (2015). Measuring the effect of ethnic and non-ethnic discrimination on Europeans’ self-rated health. *International Journal of Public Health*, 1-8. doi:10.1007/s00038-015-0728-1

Ayalon, L., & Gum, A. M. (2011). The relationships between major lifetime discrimination, everyday discrimination, and mental health in three racial and ethnic groups of older adults. *Aging & Mental Health, 15*(5), 587-594. doi:10.1080/13607863.2010.543664

Banks, J., & Oldfield, Z. (2007). Understanding Pensions: Cognitive Function, Numerical Ability and Retirement Saving. *Fiscal Studies, 28*(2), 143-170. doi:10.1111/j.1475-5890.2007.00052.x

Banks, K. H., Kohn-Wood, L. P., & Spencer, M. (2006). An Examination of the African American Experience of Everyday Discrimination and Symptoms of Psychological Distress. *Community Mental Health Journal, 42*(6), 555-570. doi:10.1007/s10597-006-9052-9

Barnes, L. L., Lewis, T. T., Begeny, C. T., Yu, L., Bennett, D. A., & Wilson, R. S. (2012). Perceived Discrimination and Cognition in Older African Americans. *Journal of the International Neuropsychological Society : JINS, 18*(5), 856-865. doi:10.1017/S1355617712000628

Barnes, L. L., Mendes de Leon, C. F., Lewis, T. T., Bienias, J. L., Wilson, R. S., & Evans, D. A. (2008). Perceived Discrimination and Mortality in a Population-based Study of Older Adults. *American journal of public health, 98*(7), 1241-1247. doi:10.2105/AJPH.2007.114397

Batty, G. D., Deary, I. J., & Zaninotto, P. (2016). Association of Cognitive Function With Cause-Specific Mortality in Middle and Older Age: Follow-up of Participants in the English Longitudinal Study of Ageing. *American Journal of Epidemiology, 183*(3), 183-190. doi:10.1093/aje/kwv139

Beavers, K. M., Hsu, F.-C., Houston, D. K., Beavers, D. P., Harris, T. B., Hue, T. F., . . . Nicklas, B. J. (2013). The Role of Metabolic Syndrome, Adiposity, and Inflammation in Physical Performance in the Health ABC Study. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 68*(5), 617-623. doi:10.1093/gerona/gls213

Bostock, S., & Steptoe, A. (2012). Association between low functional health literacy and mortality in older adults: longitudinal cohort study. *British Medical Journal, 344*. doi:dx.doi.org/10.1136/bmj.e1602

Brandt, J., Spencer, M., & Folstein, M. (1988). The Telephone Interview for Cognitive Status. *Neuropsychiatry, Neuropsychology, & Behavioral Neurology, 1*(2), 111-117.

Britt-Spells, A. M., Slebodnik, M., Sands, L. P., & Rollock, D. (2016). Effects of Perceived Discrimination on Depressive Symptoms Among Black Men Residing in the United States: A Meta-Analysis. *American Journal of Men's Health*. doi:10.1177/1557988315624509

Brody, G. H., Lei, M.-K., Chae, D. H., Yu, T., Kogan, S. M., & Beach, S. R. H. (2014). Perceived Discrimination Among African American Adolescents and Allostatic Load: A Longitudinal Analysis With Buffering Effects. *Child Development, 85*(3), 989-1002. doi:10.1111/cdev.12213

Brown, C. J., & Flood, K. L. (2013). Mobility limitation in the older patient: A clinical review. *JAMA, 310*(11), 1168-1177. doi:10.1001/jama.2013.276566

Byers, A. L., & Yaffe, K. (2011). Depression and risk of developing dementia. *Nat Rev Neurol, 7*(6), 323-331. Retrieved from <http://dx.doi.org/10.1038/nrneurol.2011.60>

Chapman, B., Duberstein, P., & Lyness, J. M. (2007). Personality Traits, Education, and Health-Related Quality of Life Among Older Adult Primary Care Patients. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 62*(6), P343-P352.

Cooper, R., Kuh, D., Cooper, C., Gale, C. R., Lawlor, D. A., Matthews, F., . . . On behalf of The FALCon and HALCyon Study Teams. (2011). Objective measures of physical capability and subsequent health: a systematic review. *Age and Ageing, 40*(1), 14-23. doi:10.1093/ageing/afq117

Cooper, R., Stafford, M., Hardy, R., Aihie Sayer, A., Ben-Shlomo, Y., Cooper, C., . . . On behalf of the HALCyon study team. (2014). Physical capability and subsequent positive mental wellbeing in older people: findings from five HALCyon cohorts. *Age, 36*(1), 445-456. doi:10.1007/s11357-013-9553-8

Crowe, M., Sartori, A., Clay, O. J., Wadley, V. G., Andel, R., Wang, H.-X., . . . Allman, R. M. (2010). Diabetes and Cognitive Decline: Investigating the Potential Influence of Factors Related to Health Disparities. *Journal of aging and health, 22*(3), 292-306. doi:10.1177/0898264309357445

Cruz-Jentoft, A. J., Baeyens, J. P., Bauer, J. M., Boirie, Y., Cederholm, T., Landi, F., . . . Zamboni, M. (2010). Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People. *Age and Ageing, 39*(4), 412-423. doi:10.1093/ageing/afq034

da Silva, J., Gonçalves-Pereira, M., Xavier, M., & Mukaetova-Ladinska, E. B. (2013). Affective disorders and risk of developing dementia: systematic review. *The British Journal of Psychiatry, 202*(3), 177-186. doi:10.1192/bjp.bp.111.101931

Dawson, A. Z., Walker, R. J., Campbell, J. A., & Egede, L. E. (2014). Effect of perceived racial discrimination on self-care behaviors, glycemic control, and quality of life in adults with type 2 diabetes. *Endocrine, 49*(2), 422-428. doi:10.1007/s12020-014-0482-9

Demakakos, P., Cooper, R., Hamer, M., de Oliveira, C., Hardy, R., & Breeze, E. (2013). The Bidirectional Association between Depressive Symptoms and Gait Speed: Evidence from the English Longitudinal Study of Ageing (ELSA). *PLoS ONE, 8*(7), e68632. doi:10.1371/journal.pone.0068632

Dolezsar, C. M., McGrath, J. J., Herzig, A. J. M., & Miller, S. B. (2014). Perceived racial discrimination and hypertension: A comprehensive systematic review. *Health Psychology, 33*(1), 20-34. doi:10.1037/a0033718

Everson-Rose, S. A., Lutsey, P. L., Roetker, N. S., Lewis, T. T., Kershaw, K. N., Alonso, A., & Diez Roux, A. V. (2015). Perceived Discrimination and Incident Cardiovascular Events: The Multi-Ethnic Study of Atherosclerosis. *American Journal of Epidemiology, 182*(3), 225-234. doi:10.1093/aje/kwv035

Forsyth, J., Schoenthaler, A., Chaplin, W. F., Ogedegbe, G., & Ravenell, J. (2014). Perceived Discrimination and Medication Adherence in Black Hypertensive Patients: The Role of Stress and Depression. *Psychosomatic Medicine, 76*(3), 229-236. doi:10.1097/psy.0000000000000043

Franklin, A. J., & Boyd-Franklin, N. (2000). Invisibility syndrome: A clinical model of the effects of racism on African-American males. *American Journal of Orthopsychiatry, 70*(1), 33-41. doi:10.1037/h0087691

Friedman, E. M., Williams, D. R., Singer, B. H., & Ryff, C. D. (2009). Chronic discrimination predicts higher circulating levels of E-selectin in a national sample: the MIDUS study. *Brain, behavior, and immunity, 23*(5), 684-692. doi:10.1016/j.bbi.2009.01.002

Gee, G. C. (2002). A Multilevel Analysis of the Relationship Between Institutional and Individual Racial Discrimination and Health Status. *American journal of public health, 92*(4), 615-623.

Goosby, B. J., Malone, S., Richardson, E., Cheadle, J. E., & Williams, D. (2015). Perceived Discrimination and Markers of Cardiovascular Risk among Low-Income African American Youth. *American journal of human biology : the official journal of the Human Biology Council, 27*(4), 546-552. doi:10.1002/ajhb.22683

Grollman, E. A. (2012). Multiple Forms of Perceived Discrimination and Health among Adolescents and Young Adults. *Journal of Health and Social Behavior*. doi:10.1177/0022146512444289

Guralnik, J. M., Ferrucci, L., Pieper, C. F., Leveille, S. G., Markides, K. S., Ostir, G. V., . . . Wallace, R. B. (2000). Lower Extremity Function and Subsequent Disability: Consistency Across Studies, Predictive Models, and Value of Gait Speed Alone Compared With the Short Physical Performance Battery. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 55*(4), M221-M231. doi:10.1093/gerona/55.4.M221

Gustafson, D. (2006). Adiposity indices and dementia. *The Lancet Neurology, 5*(8), 713-720. doi:<http://dx.doi.org/10.1016/S1474-4422(06)70526-9>

Harris, R., Tobias, M., Jeffreys, M., Waldegrave, K., Karlsen, S., & Nazroo, J. (2006). Racism and health: The relationship between experience of racial discrimination and health in New Zealand. *Social Science & Medicine, 63*(6), 1428-1441. doi:<http://dx.doi.org/10.1016/j.socscimed.2006.04.009>

Hunte, H. E. R. (2011). Association Between Perceived Interpersonal Everyday Discrimination and Waist Circumference Over a 9-Year Period in the Midlife Development in the United States Cohort Study. *American Journal of Epidemiology, 173*(11), 1232-1239. doi:10.1093/aje/kwq463

Jaconelli, A., Stephan, Y., Canada, B., & Chapman, B. P. (2013). Personality and Physical Functioning Among Older Adults: The Moderating Role of Education. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 68*(4), 553-557. doi:10.1093/geronb/gbs094

Kanaya, A. M., Lindquist, K., Harris, T. B., Launer, L., Rosano, C., Satterfield, S., . . . for the Health, A. B. C. s. (2009). Total and Regional Adiposity and Cognitive Change in Older Adults: The Health, Aging, and Body Composition study. *Archives of neurology, 66*(3), 329-335. doi:10.1001/archneurol.2008.570

Karlamangla, A. S., Singer, B. H., McEwen, B. S., Rowe, J. W., & Seeman, T. E. (2002). Allostatic load as a predictor of functional decline: MacArthur studies of successful aging. *Journal of Clinical Epidemiology, 55*(7), 696-710. doi:<http://dx.doi.org/10.1016/S0895-4356(02)00399-2>

Kessler, R. C., Mickelson, K. D., & Williams, D. R. (1999). The prevalence, distribution, and mental health correlates of perceived discrimination in the United States. *Journal of Health and Social Behavior, 40*(3), 208-230.

Kwon, S., Perera, S., Pahor, M., Katula, J. A., King, A. C., Groessl, E. J., & Studenski, S. A. (2009). What is a meaningful change in physical performance? Findings from a clinical trial in older adults (the LIFE-P study). *JNHA - The Journal of Nutrition, Health and Aging, 13*(6), 538-544. doi:10.1007/s12603-009-0104-z

Lamont, R. A., Swift, H. J., & Abrams, D. (2015). A Review and Meta-Analysis of Age-Based Stereotype Threat: Negative Stereotypes, Not Facts, Do the Damage. *Psychology and Aging, 30*(1), 180-193. doi:10.1037/a0038586

Levy, B. (2003). Mind Matters: Cognitive and Physical Effects of Aging Self-Stereotypes. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 58*(4), P203-P211. doi:10.1093/geronb/58.4.P203

Levy, B. (2009). Stereotype Embodiment: A Psychosocial Approach to Aging. *Current directions in psychological science, 18*(6), 332-336.

Levy, B., Ferrucci, L., Zonderman, A. B., Slade, M. D., Troncoso, J., & Resnick, S. M. (2016). A culture–brain link: Negative age stereotypes predict Alzheimer’s disease biomarkers. *Psychology and Aging, 31*(1), 82-88. doi:10.1037/pag0000062

Levy, B., Slade, M. D., & Kasl, S. V. (2002). Longitudinal Benefit of Positive Self-Perceptions of Aging on Functional Health. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 57*(5), P409-P417. doi:10.1093/geronb/57.5.P409

Levy, B., Zonderman, A. B., Slade, M. D., & Ferrucci, L. (2012). Memory Shaped by Age Stereotypes over Time. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 67*(4), 432-436. doi:10.1093/geronb/gbr120

Lewis, T. T., Aiello, A. E., Leurgans, S., Kelly, J., & Barnes, L. L. (2010). Self-reported Experiences of Everyday Discrimination are associated with Elevated C-Reactive Protein levels in older African-American Adults. *Brain, behavior, and immunity, 24*(3), 438-443. doi:10.1016/j.bbi.2009.11.011

Lewis, T. T., Kravitz, H. M., Janssen, I., & Powell, L. H. (2011). Self-reported Experiences of Discrimination and Visceral Fat in Middle-aged African-American and Caucasian Women. *American Journal of Epidemiology, 173*(11), 1223-1231. doi:10.1093/aje/kwq466

Low, L.-F., Harrison, F., & Lackersteen, S. M. (2013). Does Personality Affect Risk for Dementia? A Systematic Review and Meta-Analysis. *The American Journal of Geriatric Psychiatry, 21*(8), 713-728. doi:<http://dx.doi.org/10.1016/j.jagp.2012.08.004>

Luo, Y., Xu, J., Granberg, E., & Wentworth, W. M. (2012). A Longitudinal Study of Social Status, Perceived Discrimination, and Physical and Emotional Health Among Older Adults. *Research on Aging, 34*(3), 275-301. doi:10.1177/0164027511426151

Major, B., & Kaiser, C. R. (2008). Perceiving and Claiming Discrimination. In L. B. Nielsen & R. L. Nelson (Eds.), *Handbook of Employment Discrimination Research: Rights and Realities* (pp. 285-299). New York, NY: Springer New York.

North, T.-L., Palmer, T. M., Lewis, S. J., Cooper, R., Power, C., Pattie, A., . . . Day, I. N. M. (2015). Effect of smoking on physical and cognitive capability in later life: a multicohort study using observational and genetic approaches. *BMJ Open, 5*(12), e008393. doi:10.1136/bmjopen-2015-008393

Ofstedal, M. B., Fisher, G. G., & Herzog, A. R. (2005). *Documentation of Cognitive Functioning Measures in the Health and Retirement Study*. Retrieved from Ann Arbor, Michigan:

Pascoe, E. A., & Richman, L. S. (2009). Perceived Discrimination and Health: A Meta-Analytic Review. *Psychological bulletin, 135*(4), 531-554. doi:10.1037/a0016059

Pavalko, E. K., Mossakowski, K. N., & Hamilton, V. J. (2003). Does Perceived Discrimination Affect Health? Longitudinal Relationships between Work Discrimination and Women's Physical and Emotional Health. *Journal of Health and Social Behavior, 44*(1), 18-33.

Perera, S., Mody, S. H., Woodman, R. C., & Studenski, S. A. (2006). Meaningful Change and Responsiveness in Common Physical Performance Measures in Older Adults. *Journal of the American Geriatrics Society, 54*(5), 743-749. doi:10.1111/j.1532-5415.2006.00701.x

Prince, M., Bryce, R., Albanese, E., Wimo, A., Ribeiro, W., & Ferri, C. P. (2013). The global prevalence of dementia: A systematic review and metaanalysis. *Alzheimer's & Dementia, 9*(1), 63-75.e62. doi:<http://dx.doi.org/10.1016/j.jalz.2012.11.007>

Purnell, J. Q., Peppone, L. J., Alcaraz, K., McQueen, A., Guido, J. J., Carroll, J. K., . . . Morrow, G. R. (2012). Perceived Discrimination, Psychological Distress, and Current Smoking Status: Results From the Behavioral Risk Factor Surveillance System Reactions to Race Module, 2004–2008. *American journal of public health, 102*(5), 844-851. doi:10.2105/AJPH.2012.300694

Quillian, L. (2006). New Approaches to Understanding Racial Prejudice and Discrimination. *Annual Review of Sociology, 32*(1), 299-328. doi:doi:10.1146/annurev.soc.32.061604.123132

Rippon, I., Kneale, D., de Oliveira, C., Demakakos, P., & Steptoe, A. (2014). Perceived age discrimination in older adults. *Age and Ageing, 43*(3), 379-386. doi:10.1093/ageing/aft146

Rozzini, R., Frisoni, G. B., Ferrucci, L., Barbisoni, P., Bertozzi, B., & Trabucchi, M. (1997). The effect of chronic diseases on physical function. Comparison between activities of daily living scales and the Physical Performance Test. *Age and Ageing, 26*(4), 281-287.

Schmitt, M. T., Branscombe, N. R., Postmes, T., & Garcia, A. (2014). The consequences of perceived discrimination for psychological well-being: A meta-analytic review. *Psychological bulletin, 140*(4), 921-948. doi:10.1037/a0035754

Schunck, R., Reiss, K., & Razum, O. (2015). Pathways between perceived discrimination and health among immigrants: evidence from a large national panel survey in Germany. *Ethnicity & Health, 20*(5), 493-510. doi:10.1080/13557858.2014.932756

Sims, M., Diez-Roux, A. V., Gebreab, S. Y., Brenner, A., Dubbert, P., Wyatt, S., . . . Taylor, H. (2015). Perceived discrimination is associated with health behaviours among African-Americans in the Jackson Heart Study. *Journal of Epidemiology and Community Health*. doi:10.1136/jech-2015-206390

Sousa, A. C. P. A., Zunzunegui, M.-V., Li, A., Phillips, S. P., Guralnik, J. M., & Guerra, R. O. (2016). Association between C-reactive protein and physical performance in older populations: results from the International Mobility in Aging Study (IMIAS). *Age and Ageing, 45*(2), 274-280. doi:10.1093/ageing/afv202

Spencer, S. J., Logel, C., & Davies, P. G. (2016). Stereotype Threat. *Annual Review of Psychology, 67*(1), 415-437. doi:doi:10.1146/annurev-psych-073115-103235

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology, 69*(5), 797-811. doi:10.1037/0022-3514.69.5.797

Steffick, D. E. (2000). *Documentation of Affective Functioning Measures in the Health and Retirement Study*. Retrieved from Ann Arbor:

Steptoe, A., Breeze, E., Banks, J., & Nazroo, J. (2013). Cohort Profile: The English Longitudinal Study of Ageing. *International Journal of Epidemiology, 42*(6), 1640-1648. doi:10.1093/ije/dys168

Sternthal, M., Slopen, N., & Williams, D. R. (2011). Racial Disparities in Health: How Much Does Stress Really Matter? *Du Bois Review, 8*(1), 95-113.

Studenski, S., Perera, S., Patel, K., Rosano, C., Faulkner, K., Inzitari, M., . . . Guralnik, J. (2011). Gait Speed and Survival in Older Adults. *JAMA : the journal of the American Medical Association, 305*(1), 50-58. doi:10.1001/jama.2010.1923

Suchy, Y., Williams, P. G., Kraybill, M. L., Franchow, E., & Butner, J. (2010). Instrumental Activities of Daily Living Among Community-Dwelling Older Adults: Personality Associations With Self-Report, Performance, and Awareness of Functional Difficulties. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 65B*(5), 542-550. doi:10.1093/geronb/gbq037

Sutin, A. R., Stephan, Y., Carretta, H., & Terracciano, A. (2015). Perceived Discrimination and Physical, Cognitive, and Emotional Health in Older Adulthood. *The American journal of geriatric psychiatry : official journal of the American Association for Geriatric Psychiatry, 23*(2), 171-179. doi:10.1016/j.jagp.2014.03.007

Sutin, A. R., Stephan, Y., Luchetti, M., & Terracciano, A. (2014). Perceived weight discrimination and C-reactive protein. *Obesity, 22*(9), 1959-1961. doi:10.1002/oby.20789

Sutin, A. R., Stephan, Y., & Terracciano, A. (2016). Perceived discrimination and personality development in adulthood. *Developmental Psychology, 52*(1), 155-163. doi:10.1037/dev0000069

Sutin, A. R., Zonderman, A. B., Ferrucci, L., & Terracciano, A. (2013). Personality Traits and Chronic Disease: Implications for Adult Personality Development. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 68*(6), 912-920. doi:10.1093/geronb/gbt036

Tombaugh, T. N., Kozak, J., & Rees, L. (1999). Normative Data Stratified by Age and Education for Two Measures of Verbal Fluency: FAS and Animal Naming. *Archives of Clinical Neuropsychology, 14*(2), 167-177. doi:<http://dx.doi.org/10.1016/S0887-6177(97)00095-4>

Vaughan, L., Corbin, A. L., & Goveas, J. S. (2015). Depression and frailty in later life: a systematic review. *Clinical Interventions in Aging, 10*, 1947-1958. doi:10.2147/CIA.S69632

Wang, S., & Blazer, D. G. (2015). Depression and Cognition in the Elderly. *Annual Review of Clinical Psychology, 11*(1), 331-360. doi:doi:10.1146/annurev-clinpsy-032814-112828

Williams, D. R., & Mohammed, S. A. (2009). Discrimination and racial disparities in health: evidence and needed research. *Journal of behavioral medicine, 32*(1), 20. doi:10.1007/s10865-008-9185-0

Williams, D. R., & Williams-Morris, R. (2000). Racism and Mental Health: The African American experience. *Ethnicity & Health, 5*(3-4), 243-268. doi:10.1080/713667453

**Table 1. Baseline characteristics (N = 4886)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable** | **Total sample**  **(N = 4886)** | **Not discriminated**  **(N = 2964)** | **Discriminated**  **(N = 1922)** | **p-value** |
| Age in years – Mean (SD) | 69.6 (7.2) | 69.8 (7.1) | 69. 3 (7.2) | 0.025 |
| Men (%) | 44.4 | 41.2 | 49.4 | < 0.001 |
| Non-White (%) | 2.2 | 1.7 | 3.1 | < 0.001 |
| Married/cohabiting (%) | 68.7 | 69.8 | 66.9 | 0.027 |
| No formal qualifications (%) | 25.6 | 24.8 | 26.9 | 0.098 |
| Lowest wealth group (%) | 14.8 | 13.3 | 17.0 | < 0.001 |
| Depressive symptoms |  |  |  |  |
| Mean (SD) | 1.3 (1.8) | 1.1 (1.6) | 1.7 (2.0) | < 0.001 |
| Caseness (score ≥ 4) (%) | 12.3 | 8.8 | 17.8 | < 0.001 |
| Health status (%) |  |  |  |  |
| CVD | 31.9 | 30.8 | 34.0 | 0.011 |
| Asthma | 13.4 | 13.3 | 13.7 | 0.732 |
| Lung disease | 6.6 | 5.9 | 7.7 | 0.013 |
| Arthritis | 42.2 | 41.6 | 43.1 | 0.286 |
| Osteoporosis | 9.2 | 9.3 | 8.9 | 0.669 |
| Alzheimer’s disease | 0.1 | 0.1 | 0.1 | 0.762 |
| Dementia | 0.8 | 0.6 | 1.1 | 0.109 |
| Gait speed (m/s) – Mean (SD) |  |  |  |  |
| Baseline | 0.91 (0.27) | 0.92 (0.27) | 0.89 (0.27) | < 0.001 |
| Follow-up | 0.84 (0.28) | 0.86 (0.29) | 0.82 (0.27) | < 0.001 |
| Recall – Mean (SD) |  |  |  |  |
| Baseline | 10.5 (3.5) | 10.7 (3.4) | 10.1 (3.4) | < 0.001 |
| Follow-up | 9.8 (3.8) | 10.1 (3.8) | 9.4 (3.8) | < 0.001 |
| Verbal fluency – Mean (SD) |  |  |  |  |
| Baseline | 20.8 (6.5) | 21.2 (6.5) | 20.2 (6.5) | < 0.001 |
| Follow-up | 20.1 (7.2) | 20.4 (7.1) | 19.6 (7.3) | < 0.001 |

**Table 2. Cognitive function (recall and verbal fluency) at follow-up regressed onto baseline perceived discrimination (N = 4886)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Step 1**  **B (95%CI)** | **Step 2**  **B (95%CI)** | **Step 3**  **B (95%CI)** | **Step 4**  **B (95%CI)** |
| **Recall** |  |  |  |  |
| **Perceived discrimination** | -0.41ǂ  (-0.59 to -0.23) | -0.32ǂ  (-0.50 to -0.14) | -0.32\*\*  (-0.49 to -0.14) | -0.26\*\*  (-0.44 to -0.08) |
| **Verbal Fluency** |  |  |  |  |
| **Perceived discrimination** | -0.37\*  (-0.69 to 0.04) | -0.24  (-0.55 to 0.09) | -0.23  (-0.56 to 0.09) | -0.12  (-0.45 to 0.22) |

Step 1: Adjusted for age, gender, and baseline cognitive function

Step 2: + educational level, wealth group, marital status/cohabitation, and ethnicity

Step 3: + health status (CVD, Alzheimer’s disease, dementia)

Step 4: + depressive symptoms (CES-D total score)

ǂ p < 0.001, \*\*p < 0.01, \*p < 0.05

**Table 3. Physical function (gait speed in m/s) at follow-up regressed onto baseline perceived discrimination (N = 4886)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Step 1**  **B (95%CI)** | **Step 2**  **B (95%CI)** | **Step 3**  **B (95%CI)** | **Step 4**  **B (95%CI)** |
| **Perceived discrimination** | -0.03ǂ  (-0.04 to -0.01) | -0.02\*\*  (-0.03 to -0.01) | -0.02\*\*  (-0.03 to -0.01) | -0.02\*  (-0.03 to -0.004) |

Step 1: Adjusted for age, gender, and baseline gait speed

Step 2: + educational level, wealth group, marital status/cohabitation and ethnicity

Step 3: + health status (CVD, lung disease, asthma, arthritis, osteoporosis)

Step 4: + depressive symptoms (CES-D total score)

ǂp < 0.001, \*\*p < 0.01, \*p < 0.05