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Research Article

Ethnic Differences in Functional Limitations by Age Across the Adult Life Course

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Abstract

Background: Despite compelling evidence from the United States of ethnic inequalities in physical functioning and ethnic differences in risk factors for poor physical functioning, very little is known about ethnic differences in the United Kingdom. Furthermore, the life stage at which these ethnic differentials are first observed has not been examined.

Methods: Using cross-sectional data from Wave 1 of the UK Household Longitudinal Study (UKHLS), we compared self-reported physical functioning among 35,816 White British, 4,450 South Asian and 2,512 African Caribbean men and women across different stages of adulthood (young adulthood, early middle age, late middle age, older age). Regression analyses examined ethnic differences in functional limitations, with adjustment for socioeconomic and clinical covariates. Ethnicity by sex and ethnicity by age-group interactions were examined, and subgroup heterogeneity was explored.

Results: Compared with White British adults over the age of 60, older South Asian men and women reported higher odds of functional limitations (odds ratio [OR] 2.77 [95% confidence interval {CI}: 2.00–3.89] and OR 3.99 [2.61–6.10], respectively); these ethnic differentials were observed as early as young adulthood. Young African Caribbean men had lower odds of functional limitations than White British men (OR 0.56 [0.34–0.94]), yet African Caribbean women reported higher odds of functional limitations in older age (OR 1.84 [1.21–2.79]).

Conclusions: There is an elevated risk of functional limitations relating to ethnicity, even in young adulthood where the impact on future health and socioeconomic position is considerable. When planning and delivering health care services to reduce ethnic inequalities in functional health, the intersectionality with age and sex should be considered.

Keywords: Ethnicity, Physical functioning, Adulthood, Inequalities

Functional disability is a major threat to healthy aging (1) and substantial ethnic group differences in functional limitations and disability have been well documented in U.S. populations (2–7). This work has consistently demonstrated ethnic inequalities in functional disability and functional limitations among older adults (2–5,7), with lower functioning among African Americans compared with White Americans, the majority of which is explained by known risk factors including socioeconomic deprivation (5–7). However, in the U.S. health care system, socioeconomically deprived groups are particularly disadvantaged (8) compared with the United Kingdom, where, at least at the point of access, all groups have equitable care. In addition, race relations and migration patterns vary significantly between U.S. and UK ethnic groups (9).

Despite established ethnic inequalities in a range of chronic diseases (10), ethnic group differences in physical function and disability have not been well explored in the United Kingdom. The elevated cardiometabolic risk experienced by people of South Asian (originating from the Indian subcontinent) and African Caribbean descent is observed as early as childhood (11). It is possible that these elevated risk profiles may translate to reduced physical function across life, resulting in greater prevalence of functional limitations. One of the few UK studies to examine physical functioning across the UK's major ethnic groups was the community-based Southall And Brent Revisited (*SABRE*) study of older adults (12). South Asians (with a mean age of 69) reported two to four times higher objectively measured and self-reported functional limitations and

disability compared with Whites, whereas the African Caribbean sample showed similar, or after adjustment, lower levels of severe disability compared with White Europeans (12).

To the best of our knowledge, this is the first study to use a national UK sample to examine patterns of different measures of physical functioning across the entire adult life course among the UK's major ethnic groups. We hypothesized that South Asian men and women will report higher levels of functional limitations and that African Caribbean adults report lower levels throughout adulthood compared with Whites.

Methods

Cross-sectional data from Wave 1 (2009) of the UK Household Longitudinal Study (UKHLS) were used. Detailed information on the sampling frame and data collection procedures are available elsewhere (13,14). In brief, the UKHLS is a longitudinal panel survey, which began in 2009, with a representative sample of 40,000 UK households and a boost of ethnic minority participants (13), designed to include at least 1,000 individuals from each of the five major ethnic groups in the United Kingdom: Indian, Pakistani, Bangladeshi, Caribbean, and African. Participants are surveyed annually, completing a computer-assisted interview providing information on socioeconomic position, attitudes, behaviors, and medical history. Due to substantial reduction in sample size for follow-up data from Waves 1 to 2 (particularly apparent among South Asian and African Caribbean participants, with losses of up to 44% of the Wave 1 sample (15)), cross-sectional data from Wave 1 only were used to examine patterns of physical functioning across different adult life stages in these analyses of the UK's major ethnic groups.

Physical Functioning

Self-reported physical functioning was assessed using two different instruments. The SF-12 is a well-validated measure of perceived health status (16), and has been used internationally in studies of chronic disease and in multiethnic populations (17,18). A dichotomous variable was created using responses to two SF-12 items that assessed whether participants' health limited them in climbing stairs and participating in moderate activities (these SF-12 items most closely relate to physical functioning and most closely resemble items from other functional limitations questionnaires (19)). Where participants reported any level of limitation in response to either of these two questions, they were classified as having functional limitations.

Alongside functional limitations (which was chosen as the primary outcome of interest because it represents less severe dysfunction than other available measures and was expected to have greater discriminating ability across the full range of ages including in younger age-groups), we also examined the following measures in sensitivity analyses. The SF-12 Physical Component Score (PCS) was calculated to give a continuous measure of physical functioning; scores range from 0 to 100 (higher scores indicating more favorable levels of functioning). Participants were also asked five questions asking whether "health problem(s) or disability(ies) mean that you have substantial difficulties with any of these areas of your life?" These five areas of life were associated with physical function: mobility, lifting, carrying/moving objects, manual dexterity, physical co-ordination/balance, and difficulties with own personal care (eg, dressing, taking a bath). If a participant recorded any level of difficulty for any of these questions, they were categorized as having a functional disability.

Ethnicity

Ethnic identity was self-identified by participants on the basis of a modified version of the Office for National Statistics 2011 Census ethnic group question (20). The ethnic groups for comparison in this study were White British, South Asian and African Caribbean (n = 4,815 with a self-identified ethnicity other than these three groups were excluded from analyses).

Covariates

Demographic, socioeconomic, anthropometric, and medical variables were selected a priori from the UKHLS dataset on the basis of variables known to vary by ethnicity and identified previously as important drivers of functional decline, Table 1 (2,4,12). As a variable of interest, age was divided into four adult life stages (adapted from a previous categorization (21)): *early adulthood* (18–34 years), *early middle age* (35–49 years), *late middle age* (50–59 years), and *older age* (60+ years). While 65 years has been used as the cutoff for older age elsewhere (21), we lowered this limit to 60 to increase the number in our *older* category for analyses because of an under-representation of UKHLS adults aged 65+. Education was divided into four categories, ranging from *no education* to *degree and higher.* Marital status was divided into *married/cohabiting* versus *not married*. Clinical history data including diagnoses of cardiovascular disease (CVD), diabetes, and hypertension were collected through self-report and body mass index (BMI) was calculated based on self-reported height and weight, kilograms divided by meters squared.

Data Analysis

UKHLS participants with complete data on all variables of interest were included in analyses. Baseline characteristics were compared across ethnic groups (White British as reference category), using chi-square tests, independent samples t-tests, and Mann–Whitney U-tests as appropriate.

Logistic regression analyses tested ethnic differences in functional limitations (White British as reference category). Interactions between ethnicity and age-group and between ethnicity and sex were formally tested and where observed, subsequent models were stratified by age-group and sex. Model 1 adjusted for age (continuously modeled to account for potential confounding by age within age-groups), model 2 included additional adjustment for education and marital status, and model 3 additionally adjusted for CVD, diabetes, hypertension, and BMI.

Sensitivity Analysis

To test the robustness of observed ethnic differences in functional limitations and to examine whether differences were specific to one measure of physical functioning, we used regression analyses to examine ethnic differences in continuous PCS scores (multiple linear regression) and functional disability (logistic regression).

To examine heterogeneity within ethnic groups, logistic regression analyses (stratified by sex and age-group) were performed with ethnic groups split into subgroups (White British, Indian, Pakistani, Bangladeshi, Caribbean, and African), with White British as the reference group (adjustment for age only).

Results

Sample Characteristics

Compared with UKHLS participants who had incomplete data (n = 3,339, of whom 3,316 were missing data on self-identified

Table 1. Wave 1 Sample Characteristics (UKHLS Participants With Complete Data)

	White British		South Asian		African Caribbean	
	Men (n = 15,613)	Women (n = 20,203)	Men (n = 2,223)	Women (n = 2,227)	Men (n = 1,034)	Women (n = 1,478)
Age (years)	48.7 (18.4)	48.2 (18.3)	37.6 (15.2)*	36.1 (13.8)*	41.2 (16.5)*	40.1 (14.7)*
Age range (%)						
18–34	24.9	26.0	48.8	53.2	37.8	39.3
35–49	26.8	28.0	30.1	29.9	36.7	37.4
50–59	16.7	16.5	11.2	9.5	11.0	12.6
60+	31.6	29.5	9.8*	7.4*	14.5*	10.7*
Education (%)						
Below GCSE/no education	15.8	9.6	17.9	23.1	14.2	14.9
Up to GCSE or equivalent	42.7	41.3	27.3	30.9	32.6	32.0
Up to A-level or equivalent	13.6	10.1	13.1	14.7	14.9	13.0
Degree and higher	27.9	29.1	41.7*	31.4*	38.3*	40.1*
Marital status (%)						
Married/cohabiting	54.0	48.1	63.0*	65.0*	41.3*	31.1*
Single	31.5	27.8	32.9	22.5	46.6	47.6
Separated	1.9	2.9	1.8	4.4	3.6	7.3
Divorced	8.3	11.5	1.4	3.9	6.0	9.0
Widowed	4.3	9.8	0.9	4.2	2.5	5.1
Country of birth (%)						
Born in the United Kingdom	97.5	97.7	28.4*	35.7*	27.1*	29.8*
Employment (%)						
Currently employed	58.1	52.1	62.4*	35.4*	49.8*	50.3
Functional limitations (%)	25.6	33.2	22.7*	34.0	17.8*	29.5*
SF12 PCS	49.4 (11.3)	48.9 (12.1)	51.0 (10.2)*	48.8 (11.3)	52.2 (9.8)*	49.8 (11.2)*
Functional disability (%)	19.8	22.6	13.1*	16.1*	11.1*	14.9*
Long-term limiting illness (%)	38.6	39.7	21.7*	24.2*	20.9*	25.2*
Cardiovascular disease (%)	9.6	5.8	5.4*	3.0*	2.9*	2.5*
Diabetes (%)	7.0	4.8	10.1*	9.4*	6.4	6.5*
Age of diabetes diagnosis	52.6 (17.2)	51.2 (18.3)	45.8 (13.5)*	40.6 (15.0)*	47.9 (14.6)*	46.1 (14.5)*
Hypertension (%)	20.8	19.7	11.1*	11.1*	13.4*	19.0
Body mass index (kg/m^2)	25.5 (7.7)	23.1 (10.9)	22.9 (9.3)*	20.7 (11.9)*	22.7 (11.2)*	21.3 (14.6)*

Note: Data presented as mean (*SD*) or percentages as appropriate.
PCS = Physical Component Score; UKHLS = UK Household Longitudinal Study.
*Ethnic group comparisons with White British as reference category, $p < .05$.

ethnicity and 23 people with coded ethnicity [White British, South Asian or African Caribbean] were missing data on other variables of interest), participants with complete data and who were therefore included in the main analyses (n = 42,778) were more likely to be female ($p < .001$), older ($p < .001$), more likely to be degree-educated ($p < .001$) and employed at a managerial level ($p < .001$). While there were no differences in functional limitations, those people with complete data were more likely to report functional disability ($p < .001$).

The Wave 1 total household response rate was 57.6% in the general population sample and 52.0% for the ethnic minority boost sample (15). Of the 42,778 participants with complete data, 35,816 were White British, 4,450 were South Asian, and 2,512 were African Caribbean. The mean age of this sample was 47 years (*SD* 18.2) and 44% were male (Table 1). South Asian and African Caribbean participants were significantly younger than White British participants. South Asian and African Caribbean groups were more likely to be degree-educated and a higher proportion of South Asians were married. In terms of health profiles in the full analytical sample across all age ranges, compared with South Asian and African Caribbean men, White British men were more likely to have a functional limitation, functional disability, long-term limiting condition, CVD, hypertension and higher BMI, yet a significantly lower risk of diabetes (compared with South Asian men only). White British women were more likely to have a functional disability, long-term limiting condition, CVD, hypertension (compared with South Asian women only) and higher BMI, and yet lower risk of diabetes. The less healthy profiles in White British participants were likely to be attributable to their older mean age (when age adjustments were made, ethnic differences in health status were less marked and, in many cases, reversed, with South Asian and African Caribbean participants shown to have less healthy profiles).

Ethnic group, age-group, and sex-specific values for functional limitations are detailed in Table 2 (see Supplementary Table S1, for equivalent tables for Physical Component Score and functional disability). There was clear evidence of increasing prevalence of functional limitations with increasing age in all ethnic groups, as well as dramatic ethnic differences in outcomes between White British and South Asian participants.

Ethnic Group Differences in Functional Limitations

Interactions between ethnicity and sex and between ethnicity and age were observed for ethnic group comparisons of functional limitations among South Asian versus White British (p = .001 and $p < .001$, respectively) and among African Caribbean versus White British (p = .001 and p = .002, respectively). Therefore, ethnic group comparisons were stratified by sex and age-group.

Table 2. Functional Limitations by Ethnic Group, Age-Group, and Sex

Men	White British	South Asian	African Caribbean
	% with any functional limitation		
18–34	8.1	9.5	4.8*
35–49	14.7	22.4*	15.0
50–59	26.0	41.6*	22.3
60+	48.3	67.9*	55.0
Women			
18–34	15.1	20.2*	14.9
35–49	23.3	39.2*	27.5*
50–59	35.8	59.0*	43.2*
60+	57.2	79.9*	74.5*

Note: White British men n = 15,613; South Asian men n = 2,223; African Caribbean men n = 1,034; White British women n = 20,203; South Asian women n = 2,227; African Caribbean women n = 1,478.

*Ethnic group differences based on logistic regression models, adjusted for age, with White British as the reference category, $p < .05$.

South Asian men at every stage of adulthood (ie, aged 18–60+) were more likely to report functional limitations compared with White British men (Table 2). These strong ethnic group differences persisted after controlling for socioeconomic and clinical covariates, which did not substantively influence the effect estimates (Figure 1). The 'fully' adjusted South Asian excess risk became more marked with increasing age (18–34 years: odds ratio [OR] 1.63 (95% confidence interval [CI] 1.26–2.11); 35–49 years: OR 1.88 (1.49–2.37); 50–59 years: OR 2.10 (1.52–2.88)), culminating in nearly three times greater odds in older South Asian men (OR 2.77 (2.00–3.89)) compared with older White British men.

In comparison, there was no ethnic group difference in likelihood of functional limitations between African Caribbean and White British men during any stage of adulthood (Figure 1).

South Asian women had a higher likelihood of reporting functional limitations throughout adulthood compared with White British women, even after adjustment (18–34 years: OR 1.74 (1.44–2.09); 35–49 years: OR 2.37 (1.95–2.89); 50–59 years: OR 1.82 (1.30–2.55). Older South Asian women had nearly four times the odds of functional limitations than older White British women (OR 3.99 (2.61–6.10)).

African Caribbean women had elevated odds of functional limitations in early and late middle age compared with White British women (OR 1.32 (1.06–1.63) and 1.43 (1.04–1.97) respectively); however, this was attenuated with the inclusion of additional covariates in models 2 and 3. Older African Caribbean women reported increased odds of functional limitations compared with older White British women and this association was maintained in the 'fully' adjusted model (OR 1.84 (1.21–2.79)).

Sensitivity Analyses

Ethnic group differences in Physical Component Score and functional disability

When models were rerun using the continuous PCS score and functional disability as outcomes in place of functional limitations, these sensitivity analyses showed broadly similar results to the main analyses and therefore are presented in Supplementary Tables S2 and S3).

Subgroup differences

Within South Asians, subgroup heterogeneity was observed for men and women, justifying exploring subgroups separately (see Supplementary File). In general, all South Asian groups showed greater odds of functional limitations compared with White British, with an accentuated risk in Pakistani and Bangladeshi adults (Supplementary Table S3). Caribbean men did not differ from White British men, while African men displayed lower odds of functional limitations in early adulthood, but no difference thereafter. Caribbean women showed a trend towards greater odds of functional limitations than White British women throughout adulthood, while African women demonstrated higher odds after early adulthood.

Discussion

Using data from a robustly-designed UK population survey (UKHLS), this paper provides a nationally representative analysis of physical functioning across the adult life course in the UK's major ethnic groups. Compared with White British adults, South Asian men and women were found to report higher functional limitations from middle age onwards. In comparison, African Caribbean men demonstrated a significantly reduced risk of functional limitations in young adulthood, while African Caribbean women demonstrated greater functional limitations in older age compared with White British women.

There is a surprising lack of research examining ethnic group variations in physical functioning in the United Kingdom. To the best of our knowledge, this is one of the first studies to include young adults in the examination of functional limitations and disability, demonstrating associations across the full adult life course, thus providing considerable insight into ethnic group differences in physical functioning in the United Kingdom.

Our findings corroborate those from our examination of the community-based *SABRE* study (12), demonstrating similar ethnic group patterns of functional limitations and functional disability with a national sample. We extend those results by examining all adult life stages beyond *SABRE*'s focus on older adults, by investigating sex differences and by including additional subgroup variation that the *SABRE* sample did not allow. Despite the difference in measures of physical functioning, the comparability of findings between the two studies provides generalizability and weight to the evidence on ethnic inequalities in functional health observed in the United Kingdom.

The increased odds of functional limitations observed in men and women throughout adulthood across all South Asian subgroups supports other literature of higher risk in South Asian populations in the United Kingdom and elsewhere (12,22,23). This excess risk for both sexes strengthened with increasing age, while in each age-group, the magnitude of ethnic difference was greater in women than in men. Similar trends were observed for functional limitations and other outcome measures (ie, continuous PCS and functional disability), and the increased risk among South Asians was not explained by socioeconomic differences or major clinical comorbidities to which South Asians have particular propensity (10,24–26). It is perhaps surprising that, given diabetes is a strong risk factor for functional disability (27) and has been associated with a higher attributable risk for muscle weakness in South Asian compared with White middle aged adults (28), the high prevalence of diabetes did not account for the elevated odds of functional limitations observed in the South Asian groups. In fact, with chronic disease risk factors in the final models, the South Asian excess was often accentuated. However, it is possible that the crude assessment of diabetes diagnosis in the UKHLS did not capture the full profile of diabetes exposure,

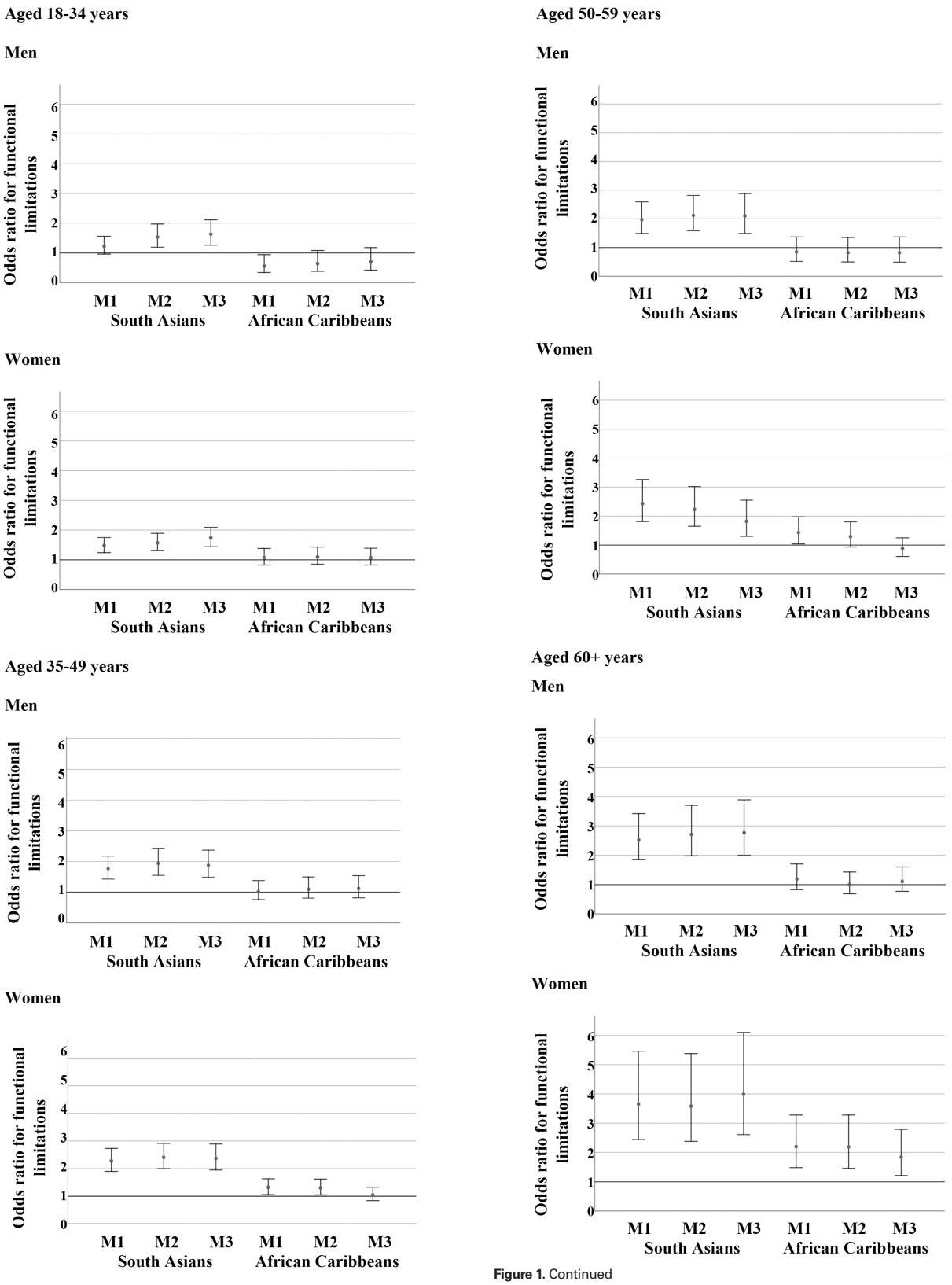

Figure 1. Odds ratios of functional limitations by ethnic group and age group (White British = reference, OR = 1). M: Model. Model 1 adjusted for age. Model 2 additionally adjusted for education and marital status. Model 3 additionally adjusted for cardiovascular disease, type 2 diabetes, hypertension, and body mass index. Ethnicity × sex interaction for South Asian versus White, $p = .001$, and African Caribbean versus White, $p = .001$. Ethnicity × age-group interaction for South Asian versus White, $p < .001$, and African Caribbean versus White, $p = .002$.

Figure 1. Continued

including younger age of onset and worse glycemic profiles after diagnosis (29) that could impact physical functioning.

In support of the *SABRE* findings, among African Caribbean men in the UKHLS there was a trend towards lower odds of functional limitations compared with White men, although the scale of

this difference was often diminished once covariates were taken into account. It is possible that this reduced risk may be the result of average differences in body composition including higher levels of muscle mass observed in Black groups (30); however, some work has shown that this does not translate into favorable muscle function (31). Further research is needed to understand these findings.

Among women, African Caribbeans demonstrated an excess risk of functional limitations compared with White women in mid to late adulthood. While this does not support the *SABRE* findings (in *SABRE*, women and men were pooled and so a risk specific to women would not have been detected), it does support previous U.S. literature that has shown high levels of functional disability among Black American women (32). This excess has previously been explained by a range of factors including socioeconomic disadvantage, perceived discrimination, high levels of obesity, and diabetes (5,7,33,34). In our study, the elevated risk in the United Kingdom was observed in both African and Caribbean women relative to Whites, and socioeconomic position and chronic conditions, in particular obesity and hypertension, appeared to play a role in explaining some, yet not all, of the African Caribbean female excess risk.

The significant ethnicity by sex interactions in these analyses highlight the importance of comparing the ethnic groups separately by sex. It is well established that women experience greater functional disability throughout the life course than men (19); however, it is unclear why South Asian women and, to a lesser extent, African Caribbean women would be predisposed to functional limitations compared with White women. What is clear is that these findings highlight the service implications of addressing women's health needs, as well as demonstrating the importance of taking into account the intersectionality of ethnicity and age in the planning and delivery of women's health care services.

Warner and Brown found that *persistent inequality* explained the continued excess risk of disability throughout the life course among Black women in their sample (32). Our cross-sectional results suggest that *cumulative advantage/disadvantage* impacts functional health inequalities, with ethnic differentials widening across the life course. Although, we controlled for education in our analyses, residual confounding by lifetime socioeconomic circumstances could have explained our findings.

The findings of this study were unlikely to result from migration experiences since nearly a third of South Asians and African Caribbean were UK-born. Melvin and colleagues' U.S. study demonstrated the 'healthy migrant effect,' with foreign-born participants demonstrating lower functional limitations compared with U.S.-born Whites (35). While our sample sizes could not accommodate formal comparison of UK- versus foreign-born participants, stratified analyses controlling for age indicated that foreign-born South Asian and African Caribbean participants, in fact, reported more functional limitations than UK-born participants (results not shown).

As one of the first studies to include young adults in the examination of functional limitations and disability, the significant interactions observed for age with ethnicity emphasized important age/cohort differences that required examination. While not as strong as at older ages, some associations were shown to exist at younger ages, which could significantly impact employment opportunities through the most economically active stage of adulthood, middle age (36); this highlights the need for action in earlier adulthood when there may be more opportunity to effectively intervene, preventing functional decline in high-risk groups and reducing the impact on other health and socioeconomic outcomes.

Limitations

While the study has several strengths including a large multiethnic national sample, there are some limitations to consider. There were other risk factors for which data were not available within the UKHLS that may have helped explain the ethnic differentials observed. For example, ethnic differences in pain tolerance (37) may contribute to South Asians' lower physical functioning, although adjustment for pain within the *SABRE* analyses did not attenuate ethnic inequalities (12). We acknowledge our findings could be explained by residual confounding due to factors not collected and therefore included in analyses (eg, depression, health behaviors) or factors included but not adequately captured (eg, diabetes and lifetime socioeconomic position).

Physical function data included were self-reported. Although grip strength was measured during Wave 2, numbers of participants from ethnic minority groups with this measure precluded inclusion in analyses (eg, n = 17 for African Caribbeans aged 60+ years). We have shown previously that objective measures of disability mirrored ethnic differentials in self-reported disability (12). There is also evidence to suggest that self-reports reflect real lived experience and therefore have independent value (38). There has been a lack of standardization in disability measurement in research; while UKHLS did not measure Activities of Daily Living (19), its questions were able to capture functional limitations and functional disability. The patterns observed across the three outcome measures indicate robustness of findings and demonstrates that they are not specific to one definition.

The sample bias associated with the UKHLS sample has been discussed elsewhere; overall, although the response rate at Wave 1 was 58%, key characteristics of the Wave 1 general population sample were similar to Census figures (39). Furthermore, bias introduced by including only participants with complete data meant that women and people of higher socioeconomic position were over-represented. A more detailed breakdown by age over 60 years was not possible due to small samples; we would expect heterogeneity within this group, that is, that a 60-year old's functioning would likely differ significantly from a 90-year old.

Cooper and colleagues highlight the paucity of research examining physical functioning in ethnic minority groups in the United Kingdom (40) and while this study was not able to examine the longitudinal relationship between physical functioning and ethnicity, we have conducted the first UK-based analysis of ethnic group variation across adulthood, which provides sufficient ethnic diversity and sampling to explore subgroup differences and adjust for a range of socioeconomic and clinical risk factors. In order to develop therapeutic interventions to directly address these inequalities, we need to understand the predictors of functional disability across ethnic groups. Future qualitative research is therefore needed to understand why South Asians experience lower levels of physical functioning compared with other ethnic groups and why African Caribbean men show some protection against it. The unexplained excess functional limitations among South Asian people in the United Kingdom throughout adulthood, but especially as early as young adulthood, is likely to have significant implications for South Asian health, well-being and socioeconomic position. Thus, there is a clear need for action before old age is reached, through improved planning and delivery of preventative health care services.

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series A: Biological Sciences and Medical Sciences* online.

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Authors' Contribution

E.D.W., A.C., and R.C. conceived the study design, E.D.W. analyzed the data. All authors contributed to writing the manuscript and final review.

Conflict of Interest

None reported.

References

1. Ostir GV, Carlson JE, Black SA, Rudkin L, Goodwin JS, Markides KS. Disability in older adults. 1: prevalence, causes, and consequences. *Behav Med*. 1999;24:147–156. doi:10.1080/08964289.1999.11879271
2. Barnes LL, Wilson RS, Hebert LE, Scherr PA, Evans DA, Mendes de Leon CF. Racial differences in the association of education with physical and cognitive function in older blacks and whites. *J Gerontol B Psychol Sci Soc Sci*. 2011;66:354–363. doi:10.1093/geronb/gbr016
3. Bowen ME, González HM. Racial/ethnic differences in the relationship between the use of health care services and functional disability: the health and retirement study (1992–2004). *Gerontologist*. 2008;48:659–667. doi:10.1093/geront/48.5.659
4. Haas S, Rohlfsen L. Life course determinants of racial and ethnic disparities in functional health trajectories. *Soc Sci Med*. 2010;70:240–250. doi:10.1016/j.socscimed.2009.10.003
5. Kington RS, Smith JP. Socioeconomic status and racial and ethnic differences in functional status associated with chronic diseases. *Am J Public Health*. 1997;87:805–810. doi:10.2105/ajph.87.5.805
6. Mendes de Leon CF, Barnes LL, Bienias JL, Skarupski KA, Evans DA. Racial disparities in disability: recent evidence from self-reported and performance-based disability measures in a population-based study of older adults. *J Gerontol B Psychol Sci Soc Sci*. 2005;60:S263–S271. doi:10.1093/geronb/60.5.s263
7. Thorpe RJ, Koster A, Kritchevsky SB, et al. Race, socioeconomic resources, and late-life mobility and decline: findings from the Health, Aging, and Body Composition Study. *J Gerontol A Biol Sci Med Sci*. 2011;66A:1114–1123. doi:10.1093/gerona/glr102
8. U.S. Department of Health and Human Services. *HHS Action Plan to Reduce Racial and Ethnic Health Disparities: A Nation Free of Disparities in Health and Health Care*. Washington, DC: Department of Health and Human Services; 2011.
9. Zilanawala A, Davis-Kean P, Nazroo J, Sacker A, Simonton S, Kelly Y. Race/ethnic disparities in early childhood BMI, obesity and overweight in the United Kingdom and United States. *Int J Obes (Lond)*. 2015;39:520–529. doi:10.1038/ijo.2014.171
10. Smith GD, Chaturvedi N, Harding S, Nazroo J, Williams R. Ethnic inequalities in health: a review of UK epidemiological evidence. *Crit Public Health*. 2000;10:375–408. doi:10.1080/09581590010005331
11. Whincup PH, Nightingale CM, Owen CG, et al. Early emergence of ethnic differences in type 2 diabetes precursors in the UK: the Child Heart and Health Study in England (CHASE Study). *PLoS Med*. 2010;7:e1000263. doi:10.1371/journal.pmed.1000263
12. Williams ED, Tillin T, Whincup P, Forouhi NG, Chaturvedi N. Ethnic differences in disability prevalence and their determinants studied over a 20-year period: a cohort study. *PLoS One*. 2012;7:e45602. doi:10.1371/journal.pone.0045602
13. Berthoud R, Fumagalli L, Lynn P, Platt L. *Design of the Understanding Society Ethnic Minority Boost Sample*. Colchester, UK: Institute for Social and Economic Research, University of Essex (Understanding Society Working Paper 2009-02); 2009.
14. Buck N, McFall S. Understanding Society: design overview. *Longitudinal and Life Course Studies*. 2011;3:5–17. doi:10.14301/llcs.v3i1.159
15. Lynn P, Burton J, Kaminska O, Knies G, Nandi A. *An Initial Look at Non-Response and Attrition in Understanding Society*. Colchester, UK: Institute for Social and Economic Research, University of Essex; 2012.
16. Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care*. 1992;30:473–483.
17. Jenkinson C, Wright L, Coulter A. Criterion validity and reliability of the SF-36 in a population sample. *Qual Life Res*. 1994;3:7–12. doi:10.1007/bf00647843
18. Burdine JN, Felix MR, Abel AL, Wiltraut CJ, Musselman YJ. The SF-12 as a population health measure: an exploratory examination of potential for application. *Health Serv Res*. 2000;35:885–904.
19. Verbrugge LM, Jette AM. The disablement process. *Soc Sci Med*. 1994;38:1–14. doi:10.1016/0277-9536(94)90294-1
20. McFall S, Nandi A, Platt L. *Understanding Society (UKHLS):User Guide to Ethnicity and Immigration Research*. Colchester, UK: Institute for Social and Economic Research, University of Essex; 2017.
21. Wilkinson LR, Ferraro KF, Mustillo SA. Wealth in middle and later life: examining the life course timing of women's health limitations. *Gerontologist*. 2018;59:902–911. doi:10.1093/geront/gny048
22. Lindesay J, Jagger C, Hibbett MJ, Peet SM, Moledina F. Knowledge, uptake and availability of health and social services among Asian Gujarati and white elderly persons. *Ethn Health*. 1997;2:59–69. doi:10.1080/13557858.1997.9961815
23. Ng TP, Niti M, Chiam PC, Kua EH. Prevalence and correlates of functional disability in multiethnic elderly Singaporeans. *J Am Geriatr Soc*. 2006;54:21–29. doi:10.1111/j.1532-5415.2005.00533.x
24. Bhopal R, Unwin N, White M, et al. Heterogeneity of coronary heart disease risk factors in Indian, Pakistani, Bangladeshi, and European origin populations: cross sectional study. *BMJ*. 1999;319:215–220. doi:10.1136/bmj.319.7204.215
25. Hippisley-Cox J, Coupland C, Vinogradova Y, et al. Predicting cardiovascular risk in England and Wales: prospective derivation and validation of QRISK2. *BMJ*. 2008;336:1475–1482. doi:10.1136/bmj.39609.449676.25
26. Tillin T, Hughes AD, Mayet J, et al. The relationship between metabolic risk factors and incident cardiovascular disease in Europeans, South Asians, and African Caribbeans: SABRE (Southall and Brent Revisited) – a prospective population-based study. *J Am Coll Cardiol*. 2013;61:1777–1786. doi:10.1016/j.jacc.2012.12.046
27. Gregg EW, Mangione CM, Cauley JA, et al. Diabetes and incidence of functional disability in older women. *Diabetes Care*. 2002;25:61–67. doi:10.2337/diacare.25.1.61
28. Ntuk UE, Celis-Morales CA, Mackay DF, Sattar N, Pell JP, Gill JMR. Association between grip strength and diabetes prevalence in black, South-Asian, and white European ethnic groups: a cross-sectional analysis of 418 656 participants in the UK Biobank study. *Diabet Med*. 2017;34:1120–1128. doi:10.1111/dme.13323
29. Millett C, Gray J, Saxena S, Netuveli G, Khunti K, Majeed A. Ethnic disparities in diabetes management and pay-for-performance in the UK: the Wandsworth Prospective Diabetes Study. *PLoS Med*. 2007;4:e191. doi:10.1371/journal.pmed.0040191
30. Silva AM, Shen W, Heo M, et al. Ethnicity-related skeletal muscle differences across the lifespan. *Am J Hum Biol*. 2010;22:76–82. doi:10.1002/ajhb.20956
31. Araujo AB, Chiu GR, Kupelian V, et al. Lean mass, muscle strength, and physical function in a diverse population of men: a population-based cross-sectional study. *BMC Public Health*. 2010;10:508. doi:10.1186/1471-2458-10-508
32. Warner DF, Brown TH. Understanding how race/ethnicity and gender define age-trajectories of disability: an intersectionality approach. *Soc Sci Med*. 2011;72:1236–1248. doi:10.1016/j.socscimed.2011.02.034

33. Kalyani RR, Rodriguez DC, Yeh HC, Golden SH, Thorpe RJ Jr. Diabetes, race, and functional limitations in older U.S. men and women. *Diabetes Res Clin Pract.* 2015;108:390–397. doi:10.1016/j.diabres.2015.04.003
34. Whitson HE, Hastings SN, Landerman LR, Fillenbaum GG, Cohen HJ, Johnson KS. Black-white disparity in disability: the role of medical conditions. *J Am Geriatr Soc.* 2011;59:844–850. doi:10.1111/j.1532-5415.2011.03401.x
35. Melvin J, Hummer R, Elo I, Mehta N. Age patterns of racial/ethnic/nativity differences in disability and physical functioning in the United States. *Demogr Res.* 2014;31:497–510. doi:10.4054/DemRes.2014.31.17
36. Herzog AR, Kahn RL, Morgan JN, Jackson JS, Antonucci TC. Age differences in productive activities. *J Gerontol.* 1989;44:S129–S138. doi:10.1093/geronj/44.4.s129
37. Watson PJ, Latif RK, Rowbotham DJ. Ethnic differences in thermal pain responses: a comparison of South Asian and White British healthy males. *Pain.* 2005;118:194–200. doi:10.1016/j.pain.2005.08.010
38. Kivinen P, Sulkava R, Halonen P, Nissinen A. Self-reported and performance-based functional status and associated factors among elderly men: the Finnish cohorts of the Seven Countries Study. *J Clin Epidemiol.* 1998;51:1243–1252. doi:10.1016/s0895-4356(98)00115-2
39. Lynn P, Borkowska M. *Some Indicators of Sample Representativeness and Attrition Bias for BHPS and Understanding Society*. Colchester, UK: Institute for Social and Economic Research, University of Essex; 2018.
40. Cooper R, Hardy R, Sayer AA, Kuh D. A life course approach to physical capability. In: Kuh D, Cooper R, Hardy R, Richards M, Ben-Shlomo Y, eds. *A Life Course Approach to Healthy Ageing*. Oxford, UK: Oxford University Press; 2014:16–31. doi:10.1093/acprof:oso/9780199656516.001.0001