# Associations between age discrimination and health and wellbeing: cross-sectional and prospective analysis of the English Longitudinal Study of Ageing

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## Summary

**Background** Age discrimination (or ageism) is pervasive in society. Other forms of discrimination (such as racism) have been linked with adverse health outcomes, but age discrimination has not been well studied in public health. We aimed to examine associations between perceived age discrimination and health and wellbeing in England.

**Methods** We did a longitudinal observational population study with data from the English Longitudinal Study of Ageing, a nationally representative sample of older men and women. Participants were aged 50 years or older and reported experiences of age discrimination via a face-to-face computer-assisted personal interview and a self-completed questionnaire between July, 2010, and June, 2011. Self-rated health, chronic health conditions, and depressive symptoms were assessed between July, 2010, and June, 2011, and between May, 2016, and June, 2017. We used logistic regression to test cross-sectional associations between perceived age discrimination and baseline health status and prospective associations between perceived age discrimination and incident ill health over 6 years. Analyses were adjusted for age, sex, and wealth.

**Findings** Our sample for cross-sectional analyses of 2010–11 data comprised 7731 people who took part in the face-to-face interview, returned the self-completion questionnaire, and had available data for age discrimination. Perceived age discrimination was reported by 1943 (25·1%) participants. Patients who perceived age discrimination were more likely to self-report fair or poor health (odds ratio [OR] 1·32 [95% CI 1·17–1·48]) and to have coronary heart disease (1·33 [1·14–1·54]), chronic lung disease (1·37 [1·11–1·69]), arthritis (1·27 [1·14–1·41]), limiting long-standing illness (1·35 [1·21–1·51]), and depressive symptoms (1·81 [1·57–2·08]) than those who did not perceive age discrimination. Follow-up data collected 6 years after the baseline assessment were available for 5595 participants. Longitudinally, perceived age discrimination was associated with the deterioration of self-rated health (OR 1·32 [95% CI 1·10–1·58]) and incident coronary heart disease (1·66 [1·18–2·35]), stroke (1·48 [1·08–2·10]), diabetes (1·33 [1·01–1·75]), chronic lung disease (1·50 [1·10–2·04]), limiting long-standing illness (1·32 [1·10–1·57]), and depressive symptoms (1·47 [1·16–1·86]) over 6 years.

**Interpretation** Among older adults living in England, perceived age discrimination was associated with increased odds of poor self-rated health and risk of incident serious health problems over a 6-year period. These findings underscore the need for effective interventions at the population level to combat age stigma and discrimination.

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## Introduction

Populations in England and other countries are growing older. Over recent decades there has been a marked increase in the number of older adults, because of increases both in the total size of the population and the proportion who survive into old age.[1] Ageism, which is defined as "systematic stereotyping of and discrimination against people because they are old",[2] is prevalent in society, and a substantial proportion of older adults report experiencing age-related discrimination in their everyday lives. In surveys of thousands of adults aged 52 years or older, 35% of those living in England and 29% of those in the USA experienced age-related discrimination a few times a year or more.[3] In another survey[4] of people aged 50 years or older in Canada and the USA, only 11% of participants reported never experiencing any form of ageism.

In the past 30 years, a growing body of research has focused on discrimination as a social determinant of health and wellbeing.[5] The experience of discrimination can be interpreted by the body as a social stressor, and could affect health directly via activation of the hypothalamic–pituitary–adrenal axis, resulting in subsequent release of cortisol, and by heightening systemic inflammation.[6] Discrimination can also promote intended and unintended unhealthy behaviours—either by acting as a barrier to healthy lifestyle (eg, people might avoid the gym for fear of discrimination) or by leading people to engage in such behaviours as a means of coping with or escaping the negative affect that discrimination can evoke.[7,8]

## Research in context

### Evidence before this study

We searched MEDLINE with the keywords "age discrimination" AND/OR "ageism", "health", and "wellbeing" for articles published in any language up to July 1, 2018. Because we identified so few studies specifically related to ageism and health or wellbeing, we loosened our selection criteria to include any study in which perceived discrimination was related to health and wellbeing. The results of this expanded review showed that, although other forms of discrimination (such as racism) have been linked with adverse health outcomes, little had been published about the prospective relationship between ageism and health and wellbeing.

### Added value of this study

This study represents, to our knowledge, the first effort to examine comprehensively the associations between perceived age discrimination, health, and wellbeing in a large prospective cohort study. Independent of age, sex, and wealth, adults aged 50 years or older who perceived age discrimination had increased odds of fair or poor self-rated health, coronary heart disease, chronic lung disease, arthritis, limiting long-standing illness, and depressive symptoms in cross-sectional analyses, and increased odds of a decline in self-rated health and incident coronary heart disease, stroke, diabetes, chronic lung disease, limiting long-standing illness, and depressive symptoms over 6 years in prospective analyses, compared with those who did not report age-related discrimination.

### Implications of all the available evidence

Taken together with existing evidence, our findings underscore the need for effective interventions at the population level to combat age stigma and discrimination.

Previous studies have predominantly focused on racism or experiences of perceived discrimination in general,[9] and have shown substantial evidence of the harmful effects of discrimination on mental health[5] and, to a lesser extent, on physical health.[5,9] However, very little research has been done about the health effects of age-related discrimination, despite the clear need for further investigation.[9,10]

In this study, we examined cross-sectional and prospective associations between perceived age discrimination and health and wellbeing in a large population-based sample of older adults living in England. Specifically, we were interested in cross-sectional associations between perceived age discrimination and self-rated health, chronic health diagnoses (cancer, diabetes, coronary heart disease, stroke, chronic lung disease, and arthritis), limiting long-standing illness, and depressive symptoms, and prospective associations between perceived age discrimination and deterioration in self-rated health and incident disease and depressive symptoms over 6 years.

## Methods

### Study design and population

We used data from the English Longitudinal Study of Ageing (ELSA) covering a 6-year period. ELSA is a population-based longitudinal panel study of a representative sample of men and women aged 50 years or older living in England, which is designed to explore a range of social, economic, biological, and psychological factors relevant to ageing. It started in 2002 (wave 1), with participants recruited from an annual cross-sectional survey of households and followed up every 2 years. For our study, baseline data were from wave 5 (June, 2010–July, 2011), the only wave in which discrimination was assessed. Follow-up data were from wave 8 (May, 2016–June, 2017), the latest wave for which data were available. The primary form of data collection in ELSA is a computer-assisted personal interview, which is done face to face in the participant's home or residence. Further data are obtained from self-completion questionnaires that respondents return to the research office by post after the computer-assisted personal interview. Ethical approval for ELSA was obtained from the National Research Ethics Service. All participants provided written informed consent. Separate ethical approval and consent were not required for our analyses because data were fully anonymised.

### Procedures

Questions about perceived discrimination were based on items developed and used widely in other longitudinal studies—specifically the Midlife Development in the United States survey and the Health and Retirement Study.[11] Participants were asked how often they encountered the following five discriminatory situations in their day-to-day life: "you are treated with less respect or courtesy", "you receive poorer service than other people in restaurants and stores", "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". No specific timeframe for experiences of discrimination was defined. Response options were on a 6-point scale ranging from "never" (score of 1) to "almost every day" (score of 6). Data in ELSA were highly skewed because most participants reported never experiencing discrimination, and thus to obtain a sample who had recent experience of discrimination, we dichotomised responses to the first four discriminatory situations according to whether or not participants had experienced discrimination in the past year (a few times or more a year *vs* less than once a year or never). For the fifth item, which pertained to treatment by doctors or hospitals, we dichotomised responses according to whether or not respondents had ever experienced discrimination from doctors or hospitals (never *vs* ever).[3] In a follow-up question,

participants who reported discrimination in any situation were asked to indicate the reason or reasons that they attributed their experience to from a list of options including age, sex, race, physical disability, weight, physical appearance, sexual orientation, and financial status. Those who attributed any experience of discrimination to their age were treated in our study as cases of perceived age discrimination.

Self-rated health was assessed by a single item in the computer-assisted personal interview, in which participants rated their health as poor, fair, good, very good, or excellent. We analysed the proportion of individuals who rated their health as fair or poor, as has been done in other investigations.[12] Information about six doctor-diagnosed chronic diseases (cancer, diabetes, coronary heart disease, stroke, chronic lung disease, and arthritis) was self-reported. To cover any conditions not included in this list, we also included data for self-reported limiting long-standing (ie, "anything that has troubled you over a period of time or that is likely to affect you over a period of time") illness, which was assessed with two questions in ELSA. Participants were first asked "Do you have any long-standing illness, disability, or infirmity?" If they responded yes, they were subsequently asked "Does this illness or disability limit your activities in any way?" Affirmation of a long-standing illness and any form of limitation led to classification of the participant as having a limiting long-standing illness in our study.

Depressive symptoms were assessed with an eight-item version of the Center for Epidemiologic Studies Depression (CES-D) scale.[13] Respondents were asked to indicate (via a binary yes or no response) if they had experienced depressive symptoms (eg, restless sleep and being unhappy) during the past month. Total scores ranged from 0 to 8, with higher scores suggesting more depressive symptoms. Data in ELSA were skewed for this measure, so we dichotomised scores on the basis of an established and widely used cutoff (<4 *vs* ≥4) that suggests clinically significant symptoms.[13]

To measure potential confounders, we included information about age (continuous variable), sex, and household non-pension wealth quintile (a sensitive indicator of socioeconomic status in this population)—factors that are known to be associated with both perceived discrimination and health status.

### Statistical analysis

We tested bivariate associations between perceived age discrimination and covariates (assessed at baseline) by using independent-samples *t* tests for continuous variables and Pearson's $\chi^2$ tests for categorical variables. We used multivariable logistic regression to test cross-sectional associations between perceived age discrimination and baseline health status and prospective associations between perceived age discrimination and incident ill health over 6 years. Prospective models excluded participants with the outcome of interest at baseline. We adjusted our analyses for potential confounders: age (continuous variable), sex, and household non-pension wealth quintile. For each outcome, we report the odds ratio (OR) and 95% CI for those who reported perceived age discrimination relative to those who did not report perceived age discrimination. We used an online calculator to apply a false discovery rate correction[14] to all p values to adjust for multiple comparisons.

For the **online calculator** see https://www.sdmproject.com/utilities/?show=FDR

We also did seven sensitivity analyses. In the first, to test whether associations with depressive symptoms were robust to the dichotomy we used, we did multiple linear regression with continuous CES-D scores as the outcome. In the second, we replicated the self-rated health analyses with outcomes recoded as poor=1 and fair to excellent=0. In the third sensitivity analysis, to test for the possibility that one of the five discriminatory situations contributing to the measure of perceived age discrimination was primarily responsible for the findings, we did repeat analyses in which each discriminatory situation was omitted in turn. In the fourth, to test whether more pervasive discrimination was associated with poorer health outcomes, we repeated the logistic regression models but used a three-category measure of discrimination to compare participants who did not perceive age discrimination with those who reported perceived age discrimination and affirmed either one or two or more discriminatory situations, and did contrast analyses to assess linear gradients across the number of situations in which age discrimination was reported. In the fifth, we repeated models but separated the discrimination exposure into three groups: no age discrimination, age discrimination only, and age discrimination plus another form of discrimination. In the sixth sensitivity analysis, we tested the potential mediating role of depressive symptoms in associations between perceived age discrimination and other outcomes. Models were repeated with additional adjustment for continuous CES-D score. Finally, because ORs can give misleading results when the outcome is common, we repeated the primary analyses but used log-binomial regression, with results presented as relative risks with 95% CI. All analyses were done in SPSS (version 24.0).

### Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

## Results

In wave 5 of ELSA, 9090 core participants (77·5% of those eligible) took part in the face-to-face interview, of whom 8107 (93% of those eligible) returned the self-completion questionnaire. We excluded 376 participants for whom data about age discrimination or covariates

were missing. Thus, our final sample for cross-sectional analysis comprised 7731 people. This sample was slightly younger, wealthier, and healthier than were wave 5 ELSA participants who were not analysed (appendix p 1).

See Online for appendix

Perceived age discrimination was reported by 1943 (25·1%) of 7731 respondents and was substantially more prevalent than discrimination based on other characteristics, which were all reported by fewer than 10% of respondents (data not shown). Among the 1943 participants who reported perceived age discrimination, 1406 (72·4%) reported being treated with less respect or courtesy, 877 (45·1%) reported being treated as if they were not clever, 804 (41·4%) reported receiving poorer service or treatment in medical settings, 685 (35·3%) reported receiving poorer service in restaurants or shops, and 357 (18·4%) reported being threatened or harassed. The descriptive analyses showed that age, sex, and wealth were significantly associated with perceived age discrimination—specifically, perceived age discrimination was more common in older than in younger people, in men than in women, and in less wealthy than in more wealthy participants (table 1). Follow-up data collected 6 years after the baseline assessment (ie, wave 8) were available for 5595 (72·3%) participants. Participants lost to follow-up were significantly older, less wealthy, and less healthy than those who participated in the follow-up survey (appendix p 2). Loss to follow-up was not significantly associated with sex or perceived age discrimination (appendix p 2).

Cross-sectionally, participants who reported age discrimination had higher odds of self-rating their health as fair or poor (OR 1·32 [95% CI 1·17–1·48]), and had higher odds of having coronary heart disease (1·33 [1·14–1·54]), chronic lung disease (1·37 [1·11–1·69]), arthritis (1·27 [1·14–1·41]), limiting long-standing illness (1·35 [1·21–1·51]), and depressive symptoms (1·81 [1·57–2·08]) than those who did not report age discrimination, after adjustment for age, sex, and wealth (table 2). Prospectively, among people who reported the absence of the relevant outcome at baseline, perceived age discrimination was associated with increased odds of incident fair or poor self-rated health (OR 1·32 [95% CI 1·10–1·58]), diabetes (1·33 [1·01–1·75]), coronary heart disease (1·66 [1·18–2·35]), stroke (1·48 [1·08–2·10]), chronic lung disease (1·50 [1·10–2·04]), limiting long-standing illness (1·32 [1·10–1·57]), and depressive symptoms (1·47 [1·16–1·86]), compared with those who did not report age discrimination, after adjustment for age, sex, and wealth (table 3). In sensitivity analyses, results for the associations between perceived age discrimination and depressive symptoms did not differ when depressive symptoms were analysed as a continuous outcome (cross-sectional β 0·54 [95% CI 0·45–0·63], p<0·0001; prospective 0·20 [0·10–0·29], p<0·0001). Likewise, associations between perceived age discrimination and self-rated health did not differ when self-rated health was analysed as poor

| | Perceived age discrimination (n=1943) | No perceived age discrimination (n=5788) | p value |
|---|---|---|---|
| **Age, years** | | | |
| Mean (SD) | 67·57 (8·34) | 67·00 (8·61) | 0·004 |
| <65 (n=3463) | 807 (23%) | 2656 (77%) | 0·001 |
| ≥65 (n=4268) | 1136 (27%) | 3132 (73%) | .. |
| **Sex** | | | |
| Male (n=3447) | 936 (27%) | 2511 (73%) | <0·0001 |
| Female (n=4284) | 1007 (24%) | 76 (76%) | .. |
| **Wealth quintile*** | | | |
| 1 (n=1252) | 348 (28%) | 904 (72%) | <0·0001 |
| 2 (n=1541) | 431 (28%) | 1110 (72%) | .. |
| 3 (n=1583) | 408 (26%) | 1175 (74%) | .. |
| 4 (n=1635) | 413 (25%) | 1222 (75%) | .. |
| 5 (n=1720) | 343 (20%) | 1377 (80%) | .. |

Data are n (%), unless otherwise specified. *Quintile 1 is the poorest, and quintile 5 is the richest.

***Table 1:*** **Associations between perceived age discrimination and sociodemographic factors**

| | Perceived age discrimination | | No perceived age discrimination | | Adjusted odds ratio* (95% CI) | p value |
|---|---|---|---|---|---|---|
| | n | % (95% CI)† | n | % (95% CI)† | | |
| Fair or poor self-rated health | 1942 | 28·6 (26·6–30·6) | 5784 | 24·0 (22·9–25·1) | 1·32 (1·17–1·48) | <0·0001 |
| Cancer | 1943 | 6·3 (5·3–7·5) | 5788 | 6·3 (5·7–6·9) | 1·00 (0·81–1·24) | 0·97 |
| Diabetes | 1943 | 11·8 (10·4–13·2) | 5788 | 11·0 (10·2–11·8) | 1·09 (0·93–1·28) | 0·33 |
| Coronary heart disease | 1943 | 16·5 (14·9–18·2) | 5788 | 13·3 (12·4–14·2) | 1·33 (1·14–1·54) | <0·0001 |
| Stroke | 1943 | 4·2 (3·3–5·1) | 5788 | 4·2 (3·7–4·7) | 1·04 (0·80–1·34) | 0·82 |
| Chronic lung disease | 1943 | 6·8 (5·7–7·9) | 5788 | 5·1 (4·5–5·7) | 1·37 (1·11–1·69) | 0·01 |
| Arthritis | 1943 | 43·6 (41·4–45·8) | 5788 | 38·3 (37·1–39·6) | 1·27 (1·14–1·41) | <0·0001 |
| Limiting long-standing illness | 1943 | 38·7 (36·5–40·9) | 5783 | 32·6 (31·4–33·8) | 1·35 (1·21–1·51) | <0·0001 |
| Depressive symptoms | 1928 | 19·2 (17·4–21·0) | 5718 | 12·0 (11·2–12·8) | 1·81 (1·57–2·08) | <0·0001 |

*Odds ratios are for the group reporting perceived age discrimination relative to the group not reporting perceived age discrimination, and are adjusted for age, sex, and wealth. †Data are the proportion of the sample reporting each listed health problem.

***Table 2:*** **Cross-sectional associations between perceived age discrimination and health status**

| | Perceived age discrimination | | No perceived age discrimination | | Adjusted odds ratio (95% CI)* | p value |
|---|---|---|---|---|---|---|
| | n | % (95% CI)† | n | % (95% CI)† | | |
| Fair or poor self-rated health | 1023 | 19·3 (16·9–21·7) | 3298 | 15·7 (14·5–16·9) | 1·32 (1·10–1·58) | 0·01 |
| Cancer | 1333 | 7·3 (5·9–8·7) | 3955 | 5·8 (5·1–6·5) | 1·28 (1·00–1·63) | 0·07 |
| Diabetes | 1256 | 6·2 (4·9–7·5) | 3783 | 4·8 (4·1–5·5) | 1·33 (1·01–1·75) | 0·05 |
| Coronary heart disease | 1194 | 4·3 (3·2–4·5) | 3725 | 2·6 (2·1–3·1) | 1·66 (1·18–2·35) | 0·01 |
| Stroke | 1368 | 4·5 (3·4–5·6) | 4039 | 3·2 (2·7–3·7) | 1·48 (1·08–2·10) | 0·02 |
| Chronic lung disease | 1343 | 4·6 (3·5–5·7) | 4011 | 3·1 (2·6–3·6) | 1·50 (1·10–2·04) | 0·02 |
| Arthritis | 802 | 18·4 (15·7–21·1) | 2623 | 16·6 (15·2–18·0) | 1·14 (0·93–1·40) | 0·26 |
| Limiting long-standing illness | 883 | 26·0 (23·1–28·9) | 2977 | 21·4 (19·9–22·9) | 1·32 (1·10–1·57) | 0·01 |
| Depressive symptoms | 1117 | 9·7 (8·0–11·4) | 3609 | 7·0 (6·2–7·8) | 1·47 (1·16–1·86) | 0·01 |

*Odds ratios are for the group reporting perceived age discrimination relative to the group not reporting perceived age discrimination, and are adjusted for age, sex, and wealth. †Data are the proportion of the sample reporting each listed health problem.

***Table 3:*** **Longitudinal associations between perceived age discrimination and incident health problems**

| | Perceived age discrimination not reported (n=5788) | | Perceived age discrimination reported in one situation* (n=801) | | Perceived age discrimination reported in two or more situations* (n=1142) | | p value (linear contrast) |
|---|---|---|---|---|---|---|---|
| | % (95% CI)† | Adjusted odds ratio (95% CI)‡ | % (95% CI)† | Adjusted odds ratio (95% CI)‡ | % (95% CI)† | Adjusted odds ratio (95% CI)‡ | |
| **Cross-sectional associations** | | | | | | | |
| Fair or poor self-rated health (n=7726) | 24·0 (22·9–25·1) | Ref | 25·1 (22·1–28·1) | 1·08 (0·90–1·29) | 31·1 (28·4–33·8) | 1·50 (1·29–1·73) | <0·0001 |
| Cancer (n=7731) | 6·3 (5·7–6·9) | Ref | 5·9 (4·3–7·5) | 0·93 (0·68–1·26) | 6·7 (5·3–8·2) | 1·06 (0·82–1·38) | 0·65 |
| Diabetes (n=7731) | 11·0 (10·2–11·8) | Ref | 10·0 (7·9–12·1) | 0·91 (0·71–1·16) | 13·0 (11·1–15·0) | 1·22 (1·01–1·48) | 0·04 |
| Coronary heart disease (n=7731) | 13·3 (12·4–14·2) | Ref | 13·5 (11·1–15·9) | 1·04 (0·83–1·29) | 18·6 (16·3–20·9) | 1·56 (1·31–1·85) | <0·0001 |
| Stroke (n=7731) | 4·2 (3·7–4·7) | Ref | 4·6 (3·2–6·1) | 1·14 (0·81–1·61) | 3·8 (2·7–4·9) | 0·96 (0·69–1·33) | 0·60 |
| Chronic lung disease (n=7731) | 5·1 (4·5–5·7) | Ref | 5·6 (4·0–7·2) | 1·11 (0·81–1·54) | 7·6 (6·1–9·1) | 1·55 (1·21–1·99) | 0·001 |
| Arthritis (n=7731) | 38·3 (37·1–39·6) | Ref | 43·5 (40·1–46·9) | 1·26 (1·08–1·47) | 43·7 (40·8–46·6) | 1·27 (1·11–1·45) | 0·001 |
| Limiting long-standing illness (n=7726) | 32·6 (31·4–33·8) | Ref | 35·6 (32·3–38·9) | 1·16 (0·99–1·36) | 41·0 (38·2–43·9) | 1·50 (1·31–1·71) | <0·0001 |
| Depressive symptoms (n=7646) | 11·9 (11·1–12·7) | Ref | 13·9 (11·5–16·3) | 1·21 (0·97–1·51) | 22·8 (20·4–25·2) | 2·26 (1·92–2·67) | <0·0001 |
| **Prospective associations** | | | | | | | |
| Fair or poor self-rated health (n=4321) | 15·7 (14·5–16·9) | Ref | 17·4 (13·9–21·0) | 1·16 (0·89–1·51) | 20·7 (17·4–24·0) | 1·45 (1·16–1·81) | 0·002 |
| Cancer (n=5288) | 5·8 (5·1–6·5) | Ref | 7·7 (5·5–9·9) | 1·34 (0·96–1·88) | 7·1 (5·3–8·9) | 1·23 (0·90–1·67) | 0·20 |
| Diabetes (n=5039) | 4·8 (4·1–5·5) | Ref | 6·4 (4·3–8·5) | 1·37 (0·94–2·00) | 6·1 (4·4–7·9) | 1·31 (0·93–1·83) | 0·14 |
| Coronary heart disease (n=4919) | 2·6 (2·1–3·1) | Ref | 4·7 (2·9–6·5) | 1·80 (1·14–2·83) | 4·0 (2·5–5·5) | 1·57 (1·02–2·40) | 0·05 |
| Stroke (n=5407) | 3·2 (2·7–3·7) | Ref | 4·3 (2·6–6·0) | 1·39 (0·90–2·14) | 4·7 (3·2–6·2) | 1·54 (1·06–2·24) | 0·03 |
| Chronic lung disease (n=5354) | 3·1 (2·6–3·6) | Ref | 5·3 (3·5–7·1) | 1·76 (1·17–2·64) | 4·0 (2·6–5·4) | 1·31 (0·88–1·95) | 0·22 |
| Arthritis (n=3425) | 16·6 (15·2–18·0) | Ref | 18·6 (14·4–22·8) | 1·15 (0·86–1·55) | 18·2 (14·7–21·7) | 1·13 (0·87–1·47) | 0·41 |
| Limiting long-standing illness (n=3860) | 21·4 (19·9–22·9) | Ref | 26·0 (21·6–30·4) | 1·31 (1·02–1·68) | 26·0 (22·2–29·8) | 1·33 (1·06–1·66) | 0·02 |
| Depressive symptoms (n=4726) | 7·0 (6·2–7·8) | Ref | 8·7 (6·2–11·2) | 1·29 (0·92–1·81) | 10·6 (8·2–13·0) | 1·61 (1·21–2·15) | 0·002 |

Ref=reference. *Participants were asked how often they encountered five discriminatory situations in their day-to-day life. †Data are the proportion of the sample reporting each listed health problem. ‡Odds ratios are for the groups reporting perceived age discrimination relative to the group not reporting perceived age discrimination, and are adjusted for age, sex, and wealth.

***Table 4:*** **Linear contrasts of health outcomes among participants reporting perceived age discrimination**

versus fair to excellent (cross-sectional OR 1·25 [95% CI 1·03–1·52], p=0·02; prospective 1·41 [1·09–1·83], p=0·01) Models in which each discriminatory situation was omitted in turn from the perceived age discrimination measure did not substantially deviate from the main analyses (appendix p 3).

Among the 1943 participants who reported age discrimination, 1142 (58·8%) had experienced discrimination in more than one of the five discriminatory situations assessed (486 [25·0%] in two situations, 354 [18·2%] in three situations, 216 [11·1%] in four situations, and 86 [4·4%] in all five situations). On the whole, the cross-sectional associations between perceived age discrimination and poorer health we noted in our primary analyses were stronger among those who had experienced discrimination in two or more situations than in those who reported discrimination in only one situation (table 4). However, arthritis occurred at a similar

frequency among those who reported perceived age discrimination in one situation and those who reported perceived age discrimination in two or more situations (table 4). These analyses also showed a significant cross-sectional association between perceived age discrimination in two or more situations and diabetes that was not noted in the primary analyses. Associations with cancer and stroke remained non-significant. In the prospective analyses, we noted linear associations between perceived age discrimination and self-rated health, stroke, and depressive symptoms, with stronger associations among those who reported discrimination in two or more situations than in those who reported discrimination in only one situation (table 4).

883 (45·4%) of the 1943 participants who reported perceived age discrimination also reported discrimination because of another characteristic (such as sex or physical disability; appendix p 4). Associations between perceived age discrimination and poorer health were stronger for participants who reported multiple forms of discrimination than for those who reported age discrimination only (appendix p 4). However, there also remained significant associations, despite the reduced sample size, between perceived age discrimination and coronary heart disease, stroke, chronic lung disease, and depressive symptoms among participants who did not report any other form of discrimination (appendix p 4).

In models with additional adjustment for baseline depressive symptoms, associations between perceived age discrimination and self-rated health were no longer significant (appendix p 5). Analysis of the data with log-binomial regression rather than logistic regression did not change the pattern of results (appendix p 5).

## Discussion

In this large prospective cohort of older adults, we noted associations between perceived age discrimination and adverse health outcomes. In cross-sectional analyses, perceived age discrimination was associated with increased odds of fair or poor self-rated health, coronary heart disease, chronic lung disease, arthritis, limiting long-standing illness, and depressive symptoms. Longitudinally, perceived age discrimination was associated with the deterioration of self-rated health and the incidence of coronary heart disease, stroke, diabetes, chronic lung disease, limiting long-standing illness, and depressive symptoms over 6 years. These results were independent of participants' age, sex, and socioeconomic status. To our knowledge, ours is the first prospective study to examine associations between perceived age discrimination and physical health and wellbeing.

Strengths of our study include a large sample representative of older adults living in England and the longitudinal design that allowed us to examine changes in health and the incidence of disease over several years. Most previous studies of the health effects of other forms of discrimination have relied on cross-sectional designs and convenience sampling,[5] which make it difficult to establish whether findings are causal (ie, inequalities in health status are being driven by experiences of discrimination) and whether the findings can be generalised to the wider populations from which the study sample was drawn. We are aware of only one other study of 2766 Americans aged 25–74 years,[15] by Yuan, in which the associations between perceived age discrimination and any health or wellbeing outcome were explored. Our study accords with and extends this study by examining a wider range of outcomes, including measures of physical health, and providing longitudinal evidence of effects. Additionally, our sample size was substantially larger than that of Yuan's study,[15] and, by focusing on older adults and not imposing an upper age limit, we had both a much larger number of cases of perceived age discrimination and greater representation of the elderly population than Yuan. Our findings are consistent with those of studies of other types of discrimination, which have shown associations between self-reported experiences of racism and poor self-rated health,[16] perceived discriminatory experiences and incident diabetes,[17] and perceived weight discrimination and risk of arteriosclerosis, diabetes, high cholesterol, myocardial infarction, minor heart conditions, and stomach ulcers.[18] Our results persisted after exclusion of participants who reported other forms of perceived discrimination.

Some limitations should be acknowledged. First, age discrimination was established by self-reports of past experiences and was therefore subject to recall bias and reflected participants' own perceptions. These results therefore pertain to the effect of thinking that one has been a target of age discrimination as opposed to the effect of age discrimination per se. For some participants, there were multiple potential explanations for experiences of discrimination, and in these instances we could not establish for certain whether an individual situation was because of age discrimination or another type of discrimination. However, by asking about a range of potential reasons for discrimination, age was not the apparent focus, which could have helped to avoid bias. Additionally, perceived discrimination has been assessed in ELSA at only one timepoint, which means that we could not establish the extent to which the exposure is persistent or changes over time. Some participants who perceived age discrimination might have changed their life conditions (eg, by changing health-care provider) during the study period to reduce exposure to discrimination. Second, we relied on participants self-reporting doctor-diagnosed illness, but self-report has generally been fairly consistent with doctors' actual diagnoses in previous studies of similar-aged adults.[19] Thirdly, attrition between data collection waves meant that follow-up data were not available for more than a quarter of participants who were included in our cross-sectional analyses. In line with retention in other

longitudinal studies,[20] the subsample lost to follow-up were older, less affluent, and less healthy than those included in our prospective analyses. This attrition could have confounded the identification of prospective associations between age discrimination and health, in that more vulnerable people were not retained in the analyses. Finally, although the population in this study was broadly representative of adults aged 50 years or older in England, our results might not apply to international settings. Data for perceived age discrimination are available in several cohort studies that also include detailed measures of health and wellbeing, such as the Health and Retirement Study and the Midlife Development in the United States survey in the USA,[11] offering opportunities for replication.

There are several mechanisms by which perceived age discrimination could lead to adverse health outcomes. One pathway might be via stress responses to a discriminatory event—both physiological (ie, cardiovascular reactivity and cortisol responses) and psychological (ie, decreased positive emotion and increased negative emotion). In Yuan's population-based study,[15] which was based on data from the Midlife Development in the United States survey, perceived age discrimination was associated with increased psychological distress and reduced positive wellbeing. Another experimental study[21] showed that older people (aged 62–82 years) exposed to negative ageing stereotypes had a heightened cardiovascular response to stress compared with those exposed to positive stereotypes about older people, suggesting that ageist stereotypes could contribute to adverse health outcomes. If an individual perceives discrimination on a regular basis, these stress responses could be activated frequently, potentially leading to a consistently negative emotional state. Thus, the experience of discrimination could contribute to health problems through an allostatic load that accumulates as a result of disturbed stress responses and negative emotional states.[22] In support of this hypothesis, we found that associations between perceived age discrimination and adverse health outcomes were attenuated, if not fully explained, when we adjusted for depressive symptoms.

Another pathway by which perceived age discrimination could lead to poor health is through effects on health risk behaviours (eg, smoking, alcohol, poor diet, physical inactivity). These behaviours might emerge as possible coping mechanisms when discrimination is experienced. Food, nicotine, and alcohol activate dopaminergic reward pathways in the brain[23] and could provide short–term relief from the adverse psychological effects of discrimination. Avoidance of situations in which discrimination might be anticipated (eg, the gym) could also act as a barrier to a healthy lifestyle.[24] These behaviours can have damaging effects on physical health and contribute to increased risk of numerous diseases. In support of these theorised pathways, a synthesis[5] of research about perceived discrimination and health showed that the perception of discrimination was associated with heightened physiological stress responses, more negative psychological stress responses, increased participation in unhealthy behaviours, and decreased participation in healthy behaviours.

An additional potentially important pathway from perceived age discrimination to adverse health outcomes is ageism in medical settings.[25] Age discrimination could be evident in how clinical staff communicate with older patients and in the quality of care older patients receive compared with younger patients.[26] In a previous analysis of ELSA, around 10% of adults in England older than 52 years reported age discrimination in a hospital or from a doctor.[27] Evidence suggests that older patients might not be diagnosed with conditions such as cancer as early as younger patients are, even when there are population-wide screening procedures in place.[28] This pattern might have led to underestimation in our analyses of doctor-diagnosed health conditions in the group who perceived age discrimination, who tended to be older than those who did not perceive age discrimination, which in turn would reduce the association between perceived age discrimination and health outcomes. Thus, if anything, our results underestimate differences related to age discrimination. Age-related biases related to recommended treatments are also common. Older patients with cancer are less likely than younger patients to receive treatments considered definitively or potentially curative,[28] and older age is an independent negative correlate of evidence-based cardiac drug use in patients with a history of heart disease.[29] Older patients with a chronic condition such as diabetes or pulmonary emphysema might also be less likely than younger patients with the same conditions to receive treatment for unrelated disorders.[30] Our results highlight the importance of health professionals maintaining an awareness of possible age-related bias when treating older patients and making every effort to make data-driven treatment decisions.

Although we have focused on pathways from perceived age discrimination to ill health because our prospective findings support causal associations in this direction, ill health could also possibly precede the perception of age discrimination. For example, the development of a physical illness or mental health difficulty could result in limitations in mobility or poor performance at work, which lead to criticism that is interpreted as age-related. Previous research[31] has suggested that people with poorer psychological wellbeing might be more likely to perceive discrimination than those with better psychological wellbeing. Future analyses testing reciprocal longitudinal relationships between perceived age discrimination and health could help to clarify this issue.

The role of multiple forms of discrimination in health and wellbeing outcomes is another area that warrants further investigation. Although we noted significant associations between perceived age discrimination and

health and wellbeing outcomes among participants who did not report any other form of perceived discrimination, effect sizes were larger among those who attributed experiences of discrimination to other personal characteristics (eg, sex, physical disability) in addition to age. Total discrimination burden might be more important than age discrimination itself as far as health is concerned.

Despite the high prevalence of age discrimination,[3,4] and the fact that everyone is potentially at risk of experiencing age discrimination at some point in life, the effects on health and wellbeing have barely been investigated.[9] With the number of older people increasing steadily, there is an urgent need for research to identify measures that can be taken to improve the health and wellbeing of people as they age. Ultimately, our results show the importance of tackling age-related discrimination, the potential benefits of which include improved mental health and wellbeing, maintenance of physical health, and prevention of disease in older adults. Unfortunately, addressing age-related discrimination is not likely to be easy, because ageist stereotypes are pervasive and deep-rooted in society. A two-pronged approach that aims both to reduce discriminatory behaviour across the population and to mitigate the effects of discrimination on health and wellbeing among older people (eg, by teaching effective coping strategies) might help to reduce the burden of age discrimination on health. On a societal level, increasing public awareness of what constitutes ageism and how such behaviours can affect health and wellbeing is important for the building of collective movements such as those that historically brought about legislative and social change for other forms of discrimination.[32,33] On a clinical level, raising the issue of perceived age discrimination with older patients could help to identify those at risk of future health problems. Further research into the processes underpinning age discrimination is important if appropriate policies and effective interventions are to be developed.

#### Contributors

SEJ and AS conceived and designed the study. SEJ analysed the data and drafted the Article. All authors provided critical revisions and approved the final submitted version.

#### Declaration of interests

We declare no competing interests.

#### Data sharing

For the **raw data** see https://beta.ukdataservice.ac.uk/datacatalogue/series/series?id=200011#!/access

The raw data are available from the UK Data Service.

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