



Prevalence and determinants of ageism experiences in the Singapore population: insights from the HEalthy Longevity (HELO) survey

Lara M. A. Bruschinski · E. J. Horberg · Paul A. O’Keefe · Belinda Wang · Anna Szücs · Johannes J. Meij · Aja L. Murray · Andrea B. Maier

Received: 9 February 2026 / Accepted: 19 March 2026
© The Author(s) 2026

Abstract Ageism refers to stereotypes, prejudice, and discrimination based on age. Ageism negatively impacts physical and mental health across the lifespan, yet knowledge about the experience of ageism in Singapore is limited. This study evaluated the prevalence of experienced ageism in Singapore and identified its key determinants within a nationally representative cohort. In the cross-sectional HEalthy

Longevity (HELO) survey ($N=3034$), ageism was measured using the newly launched World Health Organization (WHO) Ageism Experiences Scale. Associations with chronological age, perceived age, gender, socioeconomic, and health-related factors were examined using nonparametric tests and multivariable linear regression. Respondents’ median chronological age was 46 [interquartile range (IQR): 34–59] years, and 54.1% were female. Experiences of ageism were reported by 49.4% of respondents. Total ageism scores were on average 1.5 points higher among the youngest (21–30 years) and oldest (71+

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s11357-026-02236-5>.

L. M. A. Bruschinski · A. Szücs · J. J. Meij · A. B. Maier
NUS Academy for Healthy Longevity, Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore
e-mail: l.m.a.bruschinski@vu.nl

A. Szücs
e-mail: a.szuecs@vu.nl

J. J. Meij
e-mail: j.meij@amsterdamumc.nl

L. M. A. Bruschinski · A. Szücs · A. B. Maier (✉)
Department of Human Movement Sciences, @AgeAmsterdam, Faculty of Behavioural and Movement Sciences, Vrije Universiteit Amsterdam, Amsterdam, The Netherlands
e-mail: a.b.maier@vu.nl

E. J. Horberg · P. A. O’Keefe
Department of Management, University of Exeter Business School, Exeter, UK
e-mail: e.j.horberg@exeter.ac.uk

P. A. O’Keefe
e-mail: p.a.okeefe@exeter.ac.uk

B. Wang · A. B. Maier
Healthy Longevity Translational Research Programme, Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore
e-mail: belinda.wang@nus.edu.sg

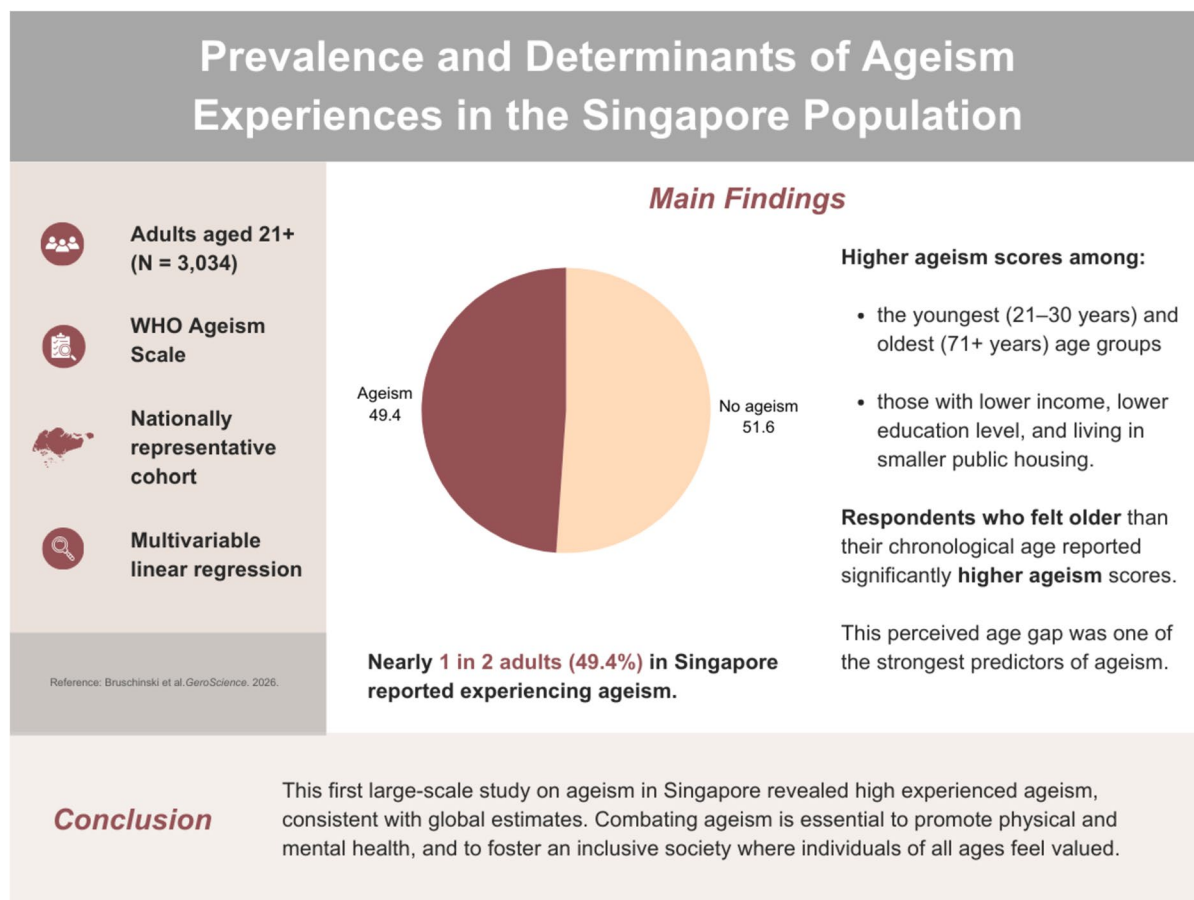
J. J. Meij
International Affairs, Amsterdam University Medical Centers, Amsterdam, The Netherlands

A. L. Murray
Department of Psychology, University of Edinburgh, Edinburgh, UK
e-mail: aja.murray@ed.ac.uk

years) age groups and approximately 1 point higher among respondents with lower socioeconomic status, particularly those with lower education levels. Respondents who felt older than their chronological age reported significantly higher ageism scores. This first large-scale study on ageism in Singapore reveals high experienced ageism, consistent with global

estimates, particularly among older and younger adults. Feeling older was one of the strongest ageism predictors. Addressing ageism by targeting social determinants and subjective ageing perceptions is essential to promote healthy ageing and to inform public health policy and interventions in Singapore.

Graphical Abstract



Keywords Ageing · Ageism · Healthspan · Lifespan · Longevity

Introduction

According to the World Health Organization (WHO), ageism is the most widespread and socially accepted prejudice today [1]. The Global Report on Ageism [2]

highlights that ageism affects people of all ages, and one in two people worldwide are ageist against older individuals. The term ageism was originally coined in 1969 by American gerontologist Robert Butler [3] and refers to the stereotypes, prejudice, and discrimination directed towards people based on their age [2]. Ageism can be self-directed, interpersonal, or institutional and is linked to adverse health outcomes [4] and broader societal costs [5]. The WHO ageism report [2],

a comprehensive synthesis of existing evidence on ageism, highlights that ageism is associated with a shorter lifespan, poorer physical and mental health, slower recovery from disability, and cognitive decline. Positive age beliefs can increase lifespan by up to 7.5 years, offering a greater survival advantage than low cholesterol or blood pressure (each adding 4 years) or avoiding smoking (3 years) [6]. A 2020 study estimated the 1-year healthcare cost of ageism in the United States at US\$63 billion in 2013, exceeding healthcare spending associated with morbid obesity [7]. Age discrimination in the workplace has cost the US economy approximately US\$850 billion in 2018, with projected losses reaching US\$3.9 trillion by 2050 [8].

Despite these costs, key determinants underlying the association between ageism and health, such as age-related attitudes, intergenerational contact, and individual health behaviours remain understudied [9]. Moreover, a systematic review from 2020 found that 78.2% of ageism research has been conducted in North America and Europe, indicating a need for more geographically diverse data [10]. In Singapore, age discrimination is the most common form of workplace discrimination, affecting 2.6% of workers, higher than discrimination based on race, nationality, or mental health status [11]. However, to our knowledge, there is no comprehensive Singapore data on the prevalence of ageism beyond the workplace, highlighting a critical gap in understanding its broader implications for healthy ageing in Singapore. Insight into the determinants of ageism and their impact on Singaporeans' physical and mental health is essential to drive interventions and policy promoting healthy longevity and improving the social inclusion of older adults.

This study aims to examine the prevalence of ageism in a representative sample of individuals in Singapore across demographic groups—including age, gender, ethnicity, and socioeconomic status derived from multiple sociodemographic factors—and to identify key determinants of ageism experiences.

Methods

Study design

The HEalthy LOngevity (HELO) study is a cross-sectional survey assessing public awareness of lifespan,

healthspan, and healthy longevity across multiple countries. The questionnaire includes 149 questions covering perceived health, general health knowledge, attitudes towards healthy longevity, lifestyle, and social environment, based on the HELO conceptual framework [12]. In Singapore, the survey was administered door-to-door from June 24 to August 11, 2024 ($n=2003$) and online through a Qualtrics Research Panel from July 8 to August 20, 2024 ($n=1031$). The survey was available in all four official languages: English, Chinese, Malay, and Tamil. Translations followed the TRAPD approach (translation, review, adjudication, pretest, and documentation) [13] to ensure linguistic and cultural accuracy. For the door-to-door data collection, multi-stage cluster sampling was used to randomly select postal codes from households and public spaces across all five regions of Singapore. Within-household selection was done via the “last birthday” method [14]. For the online panel, stratified random sampling was applied across age, gender, and ethnicity. While panel-based recruitment may introduce self-selection bias, the combined design and demographic stratification strengthen the overall sample representativeness.

Respondents were adults aged 21 years and older, living in Singapore. Door-to-door respondents received a S\$20 reimbursement, while online respondents were compensated through their panel provider (cash, points, gift cards, or vouchers). Exclusion criteria included nonresidency or an inability to provide informed consent due to physical or cognitive limitations. The ethics approval for the HELO study was obtained from the National University of Singapore Institutional Review Board (NUS-IRB-2023-672). All respondents gave written or electronic consent prior to data collection.

Ageism

The primary outcome, perceived ageism, was measured using the WHO 5-item Ageism Experiences Scale [15], developed by the WHO to assess experiences of ageism and includes the following statements: ‘Due to my age, I limit my participation in discussions even when they are about things that affect me’, ‘Others think that I have nothing valuable to contribute to society because of my age’, ‘Others feel frustrated with me due to my age’, ‘Others make decisions for me because of my age’, and ‘Policies made

by the government do not meet the needs of people my age' [4]. Each item was rated on a 5-point Likert scale (1=strongly disagree, 5=strongly agree), with a total ageism score (range 5–25) calculated by summing all five item responses. Respondents with any 'Don't Know/Not Applicable' responses were excluded from total score analyses, as incomplete data prevent accurate scoring. These responses were treated as valid and analysed separately to explore patterns.

Additionally, two other indicators were computed: a binary variable reflecting any reported ageism (defined as an 'agree' or 'strongly agree' response—i.e., scoring 4 or 5 on at least one item) and a three-level categorical variable to reflect the intensity of the experienced ageism based on the number of items that were agreed with (no ageism, moderate ageism [1–2 items], or significant ageism [3–5 items]). The latter variable was also limited to respondents without any 'Don't Know/Not Applicable' responses to ensure accurate classification. For each item, the percentage of respondents who agreed or strongly agreed was calculated to assess prevalence of specific ageism experiences.

Determinants

The survey included self-reported demographic, socioeconomic, lifestyle, and health-related variables. Chronological age was calculated from the respondents' reported birth year and analysed both as a continuous and categorical variable (grouped into six categories: 21–30, 31–40, 41–50, 51–60, 61–70, 71+ years). Perceived age was measured by asking respondents how old they felt in years [16]. A perceived age gap variable was calculated by subtracting chronological age from perceived age, where positive values indicated that respondents felt older than their chronological age and negative values indicated they felt younger. Gender was self-identified as female, male, nonbinary/third gender, or prefer not to say. Ethnicity was reported using the categories consistent with the Singapore context: Chinese, Indian, Malay, Caucasian, and Other.

Socioeconomic status was assessed through education level, monthly individual income, and housing type. Education ranged from no formal education to postgraduate degree and was categorised in three levels: low (no formal education to secondary school),

medium (diploma/certificate), and high (undergraduate degree and above). Income was collected across eight categories from no income to S\$10,001 or more and regrouped into three categories: low (no income to S\$1000), medium (S\$1001 to S\$5000), and high (above S\$5000). Housing was recoded into three categories: "Lower HDB" (1–2 room flats in public Housing Development Board estates), "Mid HDB" (3–5 room flats in public Housing Development Board estates), and "Private" (condominiums and landed property). A composite socioeconomic status (SES) score was created by averaging the three components, following common approaches in public health research [17] and in the Singapore context where housing type is considered a key SES indicator [18]. Higher SES scores indicated greater socioeconomic advantage.

Lifestyle indicators included self-reported alcohol consumption (none, 1–7, 8–14, or 15+ drinks per week), smoking status (never, previously, currently), and exercise frequency based on the number of days per week that respondents reported > 30 min of physical activity, recoded into low (0–2 days), medium (3–4 days), and high (5–7 days) [19]. Health status included the presence of chronic disease (yes/no) and participation in preventive health measures, such as annual health screenings (yes/no) and the national Healthier SG initiative (yes/no/not qualified).

Family and household structure were measured through binary indicators for having children and/or grandchildren, the presence of a family member over the age of 90 years, and by classifying the number of family generations in the household into categories ranging from 'no family members' to 'three or more generations'.

Statistical analysis

All analyses were conducted in R (version 2024.12.1+563), using the *tidyverse* package for data processing and visualisation, the *car* package for regression diagnostics, the *broom* and *gtsummary* packages for summarising regression results, and base R functions for regression modelling. Statistical significance was set at $\alpha=0.05$. Descriptive statistics were used to summarise study sample characteristics. Continuous variables were assessed for normality using visual inspection and statistical tests and summarised accordingly using medians and interquartile ranges.

Frequencies and percentages were used for categorical variables. Baseline characteristics included key sociodemographic variables, lifestyle indicators, and self-reported health status. Responses for perceived age exceeding 200 years were considered to likely not represent genuine responses and treated as extreme outliers and excluded from analysis.

Total ageism scores were assessed for normality using histograms, Q-Q plots, and the Kolmogorov–Smirnov test, which indicated a non-normal distribution. Nonparametric tests were used for most analyses: Spearman’s rank correlation for continuous predictors, Wilcoxon rank-sum test for binary group comparisons, and Kruskal–Wallis test for comparisons across multiple groups. To examine potential nonlinear associations between age-related predictors and total ageism scores, scatterplots with LOESS smoothing and quadratic regression were used for chronological age, perceived age, and perceived age gap.

Patterns of ‘Don’t Know/Not Applicable’ responses on any WHO-5 item were analysed separately to assess associations with demographic and socioeconomic variables. To examine whether the relationship between chronological age and ageism experiences differed by gender, a linear regression model including chronological age, gender, and their interaction was used.

A multivariable linear regression was conducted to assess the combined effects of various predictors on total ageism scores. Predictors were selected based on relevance and significance in univariate analyses. Age was included as a categorical variable (age groups) to improve interpretation and enable comparisons among age brackets. Alternative models using continuous age and its squared term were also tested to capture potential nonlinear associations. The final model included age group, perceived age gap, education, income, housing type, and gender. Multicollinearity among socioeconomic predictors was assessed using the variance inflation factor (VIF), with values below 5 indicating acceptable levels of multicollinearity [20].

Results

Sample characteristics

Median chronological age in the Singapore HELO cohort was 46 years [IQR: 34–59], with median

perceived age reported as 41 years [IQR: 32–56]. Gender distribution was 54.1% female and 45.2% male. Due to low numbers in other categories, gender-based analyses focused on female and male respondents. Ethnic composition was predominantly Chinese (71.0%), followed by Indian (11.8%) and Malay (11.6%). An overview of respondent characteristics is provided in Table 1.

Ageism scores and prevalence

Of the 3034 respondents, 97.3% ($n=2952$) provided a valid response (values 1–6) to all five WHO Ageism Scale items, including ‘Don’t Know/Not Applicable’ responses. Among those, 88.4% respondents ($n=2683$) had scorable responses (values 1–5), while 8.9% ($n=269$) selected at least one ‘Don’t Know/Not Applicable’ option. They were more likely to be female, have lower education and income levels, and report no alcohol consumption (p values <0.05 ; Online Resource Table 1). Among respondents with complete ageism scores ($n=2683$), the median total ageism score was 13 [IQR: 10–15]. Nearly half (49.4%) of all 3034 respondents reported experiencing some form of ageism. Among those with complete ageism scores ($n=2683$), 49.5% reported no ageism, 35.8% reported moderate ageism, and 14.8% reported significant ageism. Item-level analysis revealed that 30% of respondents agreed or strongly agreed that ‘policies made by the government do not meet the needs of people my age’, making it the most reported experience of ageism. This was followed by 27.5% agreeing they ‘limit participation in discussions’ due to age. Lower proportions reported feeling that because of their age ‘others think I have nothing valuable to contribute’ (19.6%), ‘others make decisions for me’ (15.1%), and ‘others feel frustrated with me’ (14.3%). Significant differences between age groups were found for all but the discussion participation item (p values <0.001 for those four items; $p=0.47$ for discussion participation). The youngest (21–30 years) and oldest (71+ years) age groups reported statistically significant higher agreement with the statement that policies do not meet their age group’s needs (Fig. 1).

Table 1 Respondent characteristics

Variable	<i>n</i>	Total (<i>N</i> =3034)
Age, year, median, IQR	3029	46 [34–59]
Age, grouped	3029	
21–30 years		514 (17.0)
31–40 years		689 (22.7)
41–50 years		582 (19.2)
51–60 years		540 (17.8)
61–70 years		475 (15.7)
71+ years		229 (7.6)
Perceived age, year, median, IQR	2999	41 [32–56]
Gender, female	3031	1641 (54.1)
Ethnicity	3032	
Chinese		2155 (71.0)
Indian		358 (11.8)
Malay		353 (11.6)
Caucasian		15 (0.5)
Other		151 (5.0)
Education	3033	
Low		781 (25.8)
Medium		864 (28.5)
High		1388 (45.8)
Individual monthly income	2795	
Low		783 (28.0)
Medium		1163 (41.6)
High		849 (30.4)
Housing type	3028	
Lower HDB		121 (4.0)
Mid HDB		2483 (82.0)
Private		424 (14.0)
Children, yes	3034	1847 (60.9)
Grandchildren, yes	3029	419 (13.9)
Family member 90+, yes	2773	873 (31.5)
Multigenerational household	3030	
No family members		304 (10.0)
One-generation household		685 (22.6)
Two-generation household		1809 (59.7)
Three- or more-generation household		232 (7.7)
Chronic disease, yes	3030	675 (22.3)
Health screening, yes	3034	1634 (53.9)
Healthier SG enrolled	3033	
No		1478 (48.7)
Yes		1435 (47.3)
Not qualified to enrol		120 (4.0)
Alcohol consumption (per week)	3033	
0		2098 (69.1)
1–7 drinks		796 (26.2)
8–14 drinks		54 (1.8)

Table 1 (continued)

Variable	<i>n</i>	Total (<i>N</i> =3034)
15+ drinks		37 (1.2)
Refuse to answer		48 (1.6)
Smoking	3030	
Never smoked		2442 (80.5)
Used to smoke regularly		312 (10.3)
Currently smoking		276 (9.1)
Exercise (days per week)	3028	
Low (0–2)		1496 (49.4)
Medium (3–4)		851 (28.1)
High (5–7)		681 (22.5)

Data are presented as *n* (%) unless otherwise indicated
IQR interquartile range

Associations between ageism and perceived and chronological age

Responses indicating perceived ages over 200 years were excluded as extreme outliers, accounting for less than 0.5% ($n=1$) of responses. Figure 2 shows the association of chronological age and perceived age gap with total ageism scores, by gender. Chronological age was analysed both as a continuous variable, showing a quadratic association with ageism scores ($F(2, 2676)=12.57, p<0.001$), and as a categorical variable, with total ageism scores varying significantly across six age groups ($\chi^2(5)=33.50, p<0.001$), where the highest scores were observed among the youngest (21–30 years) and oldest (71+ years) age groups. Perceived age was positively associated with total ageism scores ($\rho=0.056, p=0.004$) and showed a quadratic association in regression analysis ($F(2, 2651)=14.23, p<0.001$). Perceived age gap demonstrated a stronger positive association with total ageism scores ($\rho=0.147, p<0.001$) and was significantly linearly associated with total ageism scores ($\beta=0.065, p<0.001; R^2=0.013$), with no statistical improvement when including a quadratic term ($p=0.207$).

Other determinants of ageism

Determinants associated with ageism included gender, ethnicity, and socioeconomic factors. Males reported higher ageism scores than females (median [IQR]: 13 [10–16] vs. 12 [10–15], $p=0.001$), with

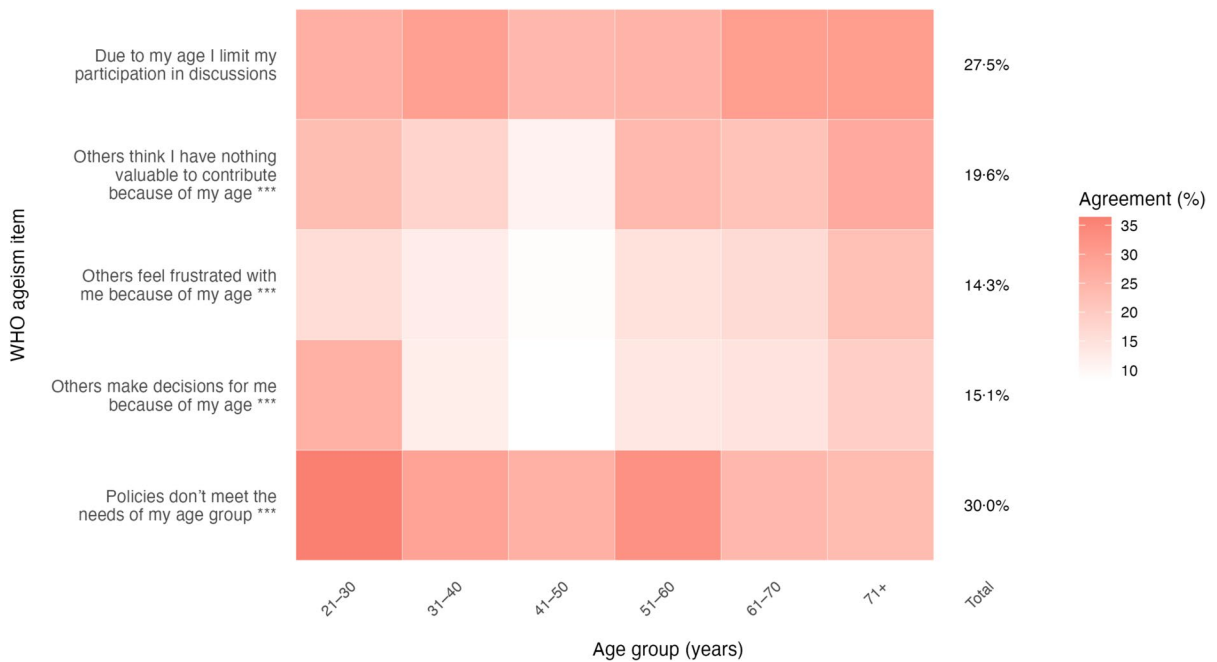


Fig. 1 Agreement with WHO-5 Ageism Scale items by age group. Heatmap showing percentage of agreement (‘agree’ or ‘strongly agree’) with WHO-5 Ageism Scale items in each age group. Darker colour represents a higher proportion of agree-

ment. The total column (‘Total’) shows the overall agreement percentage across respondents with complete WHO Ageism Scale responses. Significance stars indicate group differences based on Kruskal–Wallis tests: *** = $p < 0.001$

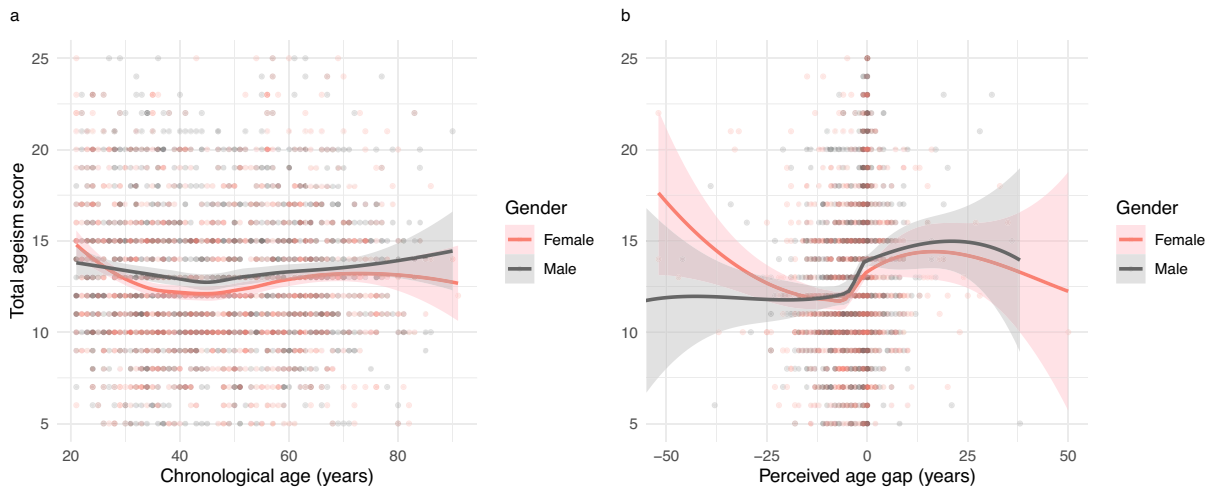


Fig. 2 Association of total ageism scores with **a** chronological age and **b** perceived age gap, separated by gender. Smoothed LOESS curves with 95% confidence intervals

no significant age-by-gender interaction ($p > 0.60$). Ageism score differences for ethnicity were driven by lower scores among Caucasians ($n = 11$); excluding this group resulted in no significant differences

($p = 0.55$). Higher education, higher income, and private housing were individually associated with lower ageism scores (see Fig. 3), and the composite SES score associated negatively with ageism ($\rho = -0.177$,

$p < 0.001$). Current smokers had higher ageism scores than nonsmokers ($p < 0.001$), while alcohol consumption, exercise frequency, chronic disease, and Healthier SG enrolment showed no significant associations. Respondents who had done a health screening in the past year reported lower ageism scores ($p = 0.019$). No associations were found with having a family member aged 90+ years, the number of generations in the household, or having children; those with grandchildren reported higher ageism scores ($p = 0.005$). See Table 2 for results.

The multivariable linear regression model including age group, perceived age gap, gender, education, income, and housing type explained 5.3% of variance in total ageism scores (adjusted $R^2 = 0.053$, $p < 0.001$). An alternative model including continuous age and its quadratic term was also tested and showed similar results (see Online Resource Table 2). Perceived age gap remained a strong predictor of ageism: Each additional year that respondents felt older than their chronological age was associated with a 0.07 point higher ageism score ($p < 0.001$) on the total scale (range 5–25).

Higher education levels (medium: $\beta = -0.53$, $p = 0.027$; high: $\beta = -1.33$, $p < 0.001$), living in larger public housing (3–5 room flats; $\beta = -0.82$, $p = 0.048$), and private housing ($\beta = -1.18$, $p = 0.011$) were associated with lower ageism scores. Age groups 31–40 and 41–50 years had significantly lower ageism

scores compared to the youngest group ($\beta = -0.60$, $p = 0.022$; $\beta = -1.04$, $p < 0.001$, respectively). Male gender was associated with slightly higher ageism scores ($\beta = 0.60$, $p < 0.001$). Income was not a significant predictor in the adjusted model. Full results are detailed in Table 3 and visually presented in Fig. 4.

Discussion

Nearly half of respondents in Singapore reported experiencing some form of ageism, with approximately 15% indicating significant levels. Higher ageism scores were observed among those with lower education and income levels and those living in smaller public housing. The youngest and oldest age groups reported the highest ageism scores. Feeling older was one of the strongest predictors of ageism experiences.

The nonlinear relationship between chronological age and ageism suggests that experiences of ageism are not limited to older adults but span the life course. Although research on ageism against younger people remains limited, the WHO Global Report on Ageism highlights that younger individuals experience age-based discrimination in various domains, including the workplace and legal systems [2]. The scale of perceived ageism by younger age groups in other

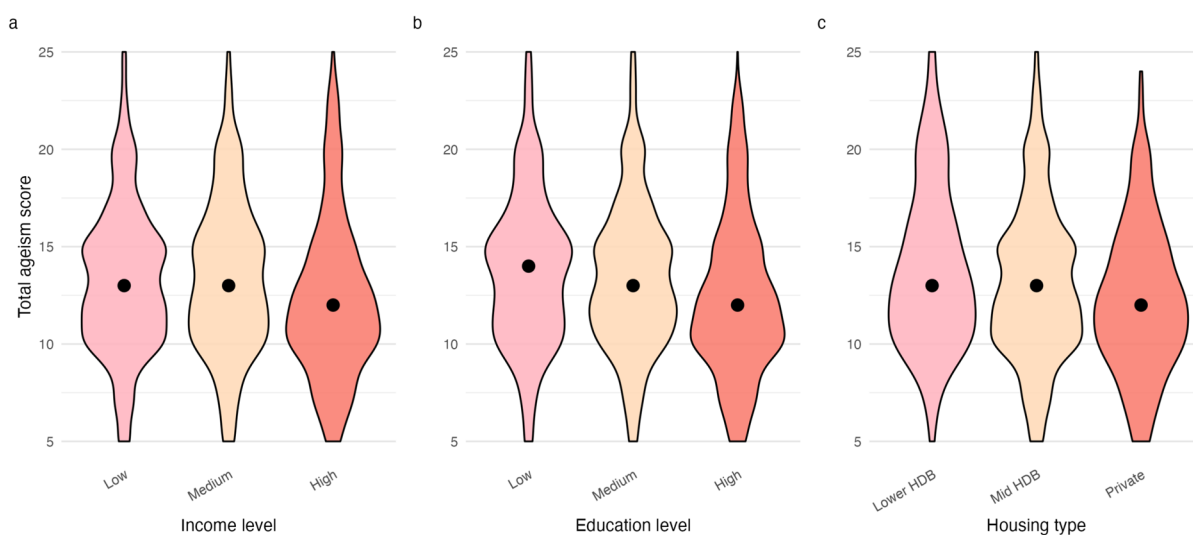


Fig. 3 Violin plots of total ageism scores by **a** income level, **b** education level, and **c** housing type

Table 2 Sociodemographic, lifestyle, and health variables and their univariate associations with total ageism scores

Variable	Categories/units	Statistic	<i>p</i> value
Age group	21–30, 31–40, 41–50, 51–60, 61–70, 71+ years	$\chi^2(5)=33.50$	<0.001
Perceived age	Years (continuous)	$\rho=0.056$	0.004
Perceived age gap	Years (continuous)	$\rho=0.147$	<0.001
Gender	Male, female (binary)	$W=822,624$	0.001
Ethnicity	Chinese, Malay, Indian, Caucasian, Other	$\chi^2(4)=16.30$	0.003
Income	Low, medium, high	$\chi^2(2)=48.10$	<0.001
Education	Low, medium, high	$\chi^2(2)=81.27$	<0.001
Housing	Lower HDB, mid HDB, private	$\chi^2(2)=18.63$	<0.001
SES composite	Score (continuous)	$\rho=-0.177$	<0.001
Smoking	Yes, no (binary)	$W=248,702$	<0.001
Alcohol	Consumption frequency	$\chi^2(4)=6.28$	0.180
Exercise	Low, medium, high	$\chi^2(2)=5.45$	0.065
Children	Yes, no (binary)	$W=872,092$	0.330
Grandchildren	Yes, no (binary)	$W=390,197$	0.005
Family member 90+ years	Yes, no (binary)	$\chi^2(2)=3.96$	0.138
Household structure	One generation, two generations, 3+ generations, no family	$\chi^2(3)=3.17$	0.366
Chronic disease	Yes, no (binary)	$W=598,250$	0.056
Health screening	Yes, no (binary)	$W=935,682$	0.019
Healthier SG	Yes, no, not qualified	$\chi^2(2)=1.82$	0.402

Variables are categorical unless specified. Statistics include Spearman's rank correlation coefficient (ρ), Wilcoxon rank-sum test (W), and chi-square test (χ^2) as appropriate

SES socioeconomic status

settings and diverse cultural contexts warrants further investigation.

The strong, persistent association between perceived age gap and ageism suggests that how old an individual feels relative to their chronological age significantly relates to their experienced ageism. Although poorer perceived health has been associated with feeling older [21], self-reported chronic disease was not a significant predictor of ageism experiences in this study, suggesting that subjective age perceptions contribute to experienced ageism independently of chronic disease presence. This aligns with the Stereotype Embodiment Theory (SET) [22], which states that subjective perceptions of ageing, also referred to as self-perceptions of ageing (SPA) [23], develop over the life span through internalising societal views about age, and shape attitudes and experiences of ageing in later years. Importantly, reducing ageism could have tangible health benefits as positive age beliefs can add up to 7.5 years to an individual's lifespan, underscoring the potential impact of addressing ageism and subjective ageing perceptions on physical

and mental health [6]. This study underlines the importance of considering subjective age alongside chronological age in ageism research, as subjective age may shape vulnerability to age-based prejudice and discrimination independently of health status.

Consistent with previous studies [7, 24] lower education levels were associated with higher ageism scores, suggesting education may serve as a protective factor against ageism. Education potentially enhances awareness of age-related stereotypes and biases, fostering critical thinking skills that enable resistance to internalising or perpetuating ageist attitudes. The observed associations with income and housing type further emphasise the role of socioeconomic status in shaping exposure to ageism. Individuals with lower income or living in less advantaged housing may face compounded vulnerabilities due to limited social capital and increased socioeconomic stressors, which can heighten perceptions of bias, including ageism. These findings are consistent with broader evidence on the influence of socioeconomic factors on ageism [25, 26] and the intersectionality of ageism with other

Table 3 Multivariable linear regression model predicting total ageism scores

Variable	Reference	Beta (est.)	Std. error	<i>p</i> value
Intercept		15.065	0.487	<0.001
Age 31–40 years	21–30 years	−0.595	0.260	0.022
Age 41–50 years	21–30 years	−1.041	0.276	<0.001
Age 51–60 years	21–30 years	−0.501	0.284	0.077
Age 61–70 years	21–30 years	−0.509	0.300	0.090
Age 71+ years	21–30 years	−0.435	0.394	0.269
Perceived age gap	N/A	0.068	0.012	<0.001
Education medium	Low	−0.529	0.238	0.027
Education high	Low	−1.326	0.244	<0.001
Income medium	Low	0.225	0.209	0.282
Income high	Low	−0.232	0.251	0.355
Housing mid HDB	Lower HDB	−0.818	0.414	0.048
Housing private	Lower HDB	−1.178	0.464	0.011
Gender male	Female	0.596	0.162	<0.001

Beta coefficients (estimates) represent the adjusted difference in ageism score relative to the reference group for categorical variables and the adjusted increase per unit for continuous variables. Beta (est.), standard errors, *p* values, and significance levels are shown for each predictor. Adjusted $R^2=0.053$, $F(13, 2433)=11.52$, $p<0.001$

HDB Housing Development Board

social biases [27], highlighting the need for multidimensional strategies that address social disparities to effectively reduce ageism. Interventions aimed solely at changing attitudes may fall short if they do not also target the socioeconomic contexts that shape an individual's lived experience. To design effective and equitable policies, further research is essential to explore the mechanisms linking socioeconomic disadvantage and ageism.

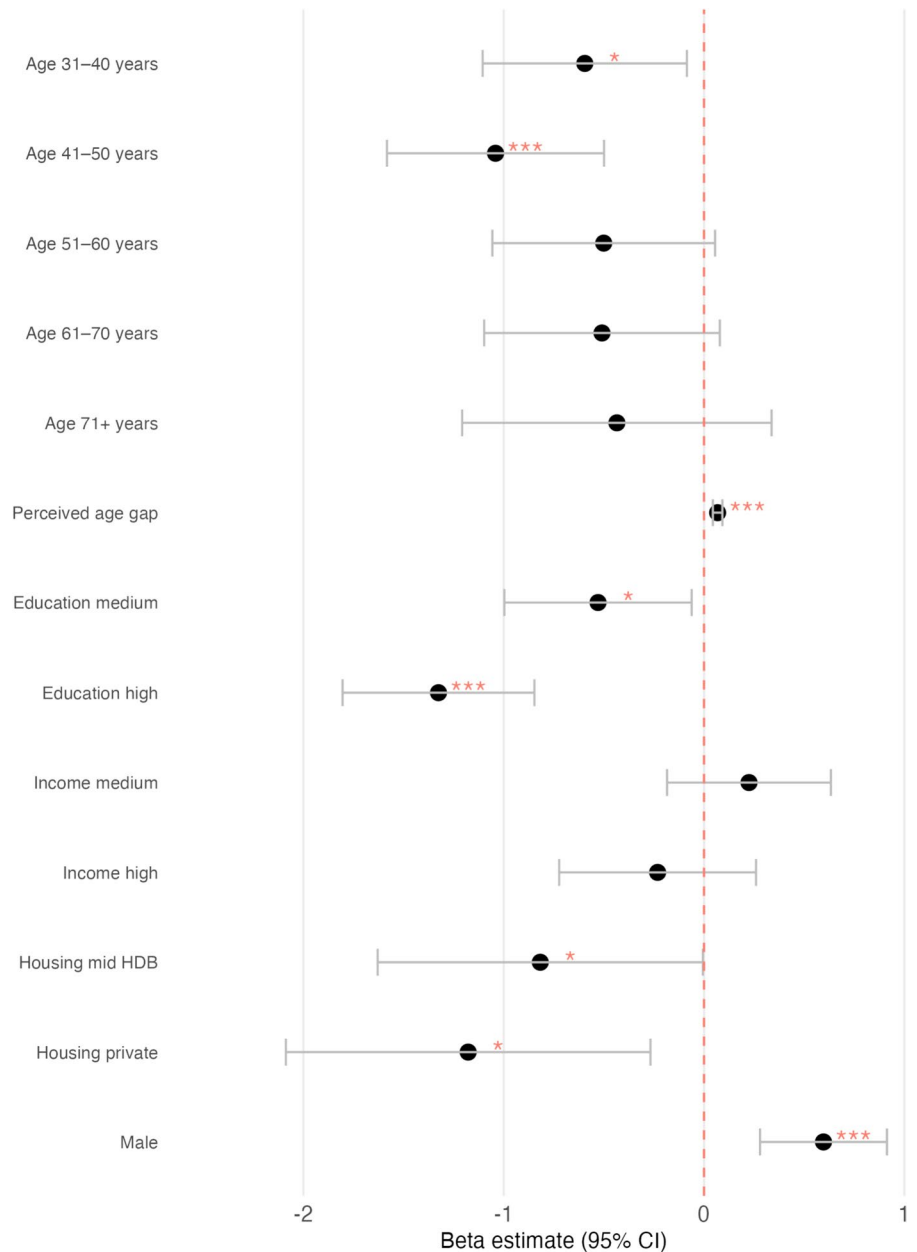
Gender is an important factor shaping experiences of ageism, often referred to as gendered ageism, which highlights greater age-based discrimination towards women [28, 29]. However, this study found that men reported slightly higher ageism scores, although the difference was small. This unexpected deviation may reflect Singapore's

unique socio-occupational landscape, characterised by a relatively high female workforce participation rate of 62.3%, notably higher than the United States (56.5%), the United Kingdom (57.3%), and well above the global average (49.1%) according to 2024 World Bank data [30]. Over the past decade, Singapore has consistently ranked top rank in the UN Gender Inequality Index (GII); according to the 2024 GII report, Singapore was ranked 8th globally and 1st in the Asia–Pacific region for exhibiting low levels of gender inequality [31]. The high female workforce engagement, combined with low gender inequality, could mitigate some forms of gendered ageism that women experience elsewhere. Conversely, men may face distinct pressures in Singapore's competitive job market and societal expectations regarding career and breadwinning roles, potentially contributing to their slightly higher reported ageism scores. Further research is needed to explore the contextual factors underlying these patterns.

Multigenerational household structure was not significantly associated with ageism scores, an unexpected result, as intergenerational contact is often viewed as a protector against ageism [24] and is one of the key WHO recommendations to effectively combat ageism [2]. Furthermore, interventions combining education and intergenerational contact have the largest effect on attitudes towards older individuals [32]. These results warrant further exploration, particularly in the Singapore context where intergenerational contact is a key element of ageing policy, rooted in principles of filial piety, harmonious family relations, and seeing older adults as a valuable resource rather than a burden [33].

This study benefits from a large, diverse, and nationally representative sample and employs a recently launched measurement scale of ageism. The WHO Ageism Scale is the only global measurement tool that assesses all domains of ageism: stereotypes, prejudice, and discrimination (including self-directed and institutional ageism) [34]. No formal population-level benchmarks currently exist for the 5-item WHO Ageism Experiences Scale (range 5–25). Given that the present study draws on a nationally representative sample and is among the first to use this measure at population level, the observed score distribution (median 13, IQR 10–15) may serve as a preliminary reference for future comparative research.

Fig. 4 Forest plot from a multivariable linear regression model testing associations between ageism scores and individual characteristics such as age group, perceived age gap, education, income, housing type, and gender. Reference categories: age 21–30 years, low education, low income, lower HDB housing, and female gender. Error bars indicate 95% confidence intervals. Significance: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$



Incorporating the WHO Ageism Scale in future studies will improve comparability across diverse populations.

The combined door-to-door and online recruitment strategy enabled a broad demographic reach across Singapore's districts. By including a wide range of sociodemographic, lifestyle, health, and knowledge variables, the analysis provided an in-depth understanding of the relative importance of various predictors. As the first large-scale investigation of ageism in

Singapore, this study establishes an important baseline reference for future research. Moreover, given the limited scientific literature on ageism in non-Western populations compared to Western contexts [9, 10], this study contributes valuable insights from an underrepresented region, enriching the global relevance and cultural diversity of ageism research.

Despite these strengths, some limitations must be considered. Respondents who selected 'Don't Know/Not Applicable' on the WHO 5-Item Ageism

Scale were excluded from total score analyses; supplementary analysis indicated these responses were not missing at random, occurring more frequently among women and individuals with lower education and income. This exclusion may have introduced bias, potentially underrepresenting groups that are most likely to experience ageism [27]. Given the cross-sectional study design, causal or temporal relationships between perceived age and ageism experiences cannot be determined. Future longitudinal research would be valuable to explore how perceived age and ageism evolve over time and potentially influence each other, thereby enhancing the understanding of their impact on individual health. The model explained 5.3% of variance in total ageism scores, suggesting that additional determinants remain unexplored. Future research examining psychosocial and environmental factors including social connectedness, workplace experiences, media exposure, neighbourhood and built environment aspects, as well as cultural attitudes towards ageing, which are especially relevant in Singapore's diverse population, is needed to better understand the determinants of ageism. Lastly, all data were self-reported, which may introduce recall or social desirability bias.

Although effect sizes were relatively small, their public health relevance should not be overlooked. Given that approximately half of this nationally representative sample reported ageism experiences, even modest associations translate into a substantial population-level burden when scaled across Singapore's population. Ageism arises from deeply ingrained stereotypes and social norms that assign a certain value or limitations based on age, often displayed through media, institutional policies, and interpersonal interactions. Age-based bias and stereotyping contribute to discrimination and exclusion across the life course, making it essential to challenge and dismantle them through targeted strategies and interventions. From a policy perspective, comprehensive efforts, including public education campaigns that raise awareness of ageism, challenge age-based stereotypes, and promote age-inclusive narratives, are crucial to effectively reduce ageism. Targeted interventions should operate at multiple levels, involving education, community stakeholders, and policy initiatives and address self-directed as well as interpersonal and institutional ageism. Given that younger adults particularly reported feeling that policies do not meet the needs of their age

group, ageism interventions must be tailored to the unique concerns of specific demographic groups. For example, campaigns targeting younger adults could promote youth representation and participation in policy discussions and decision-making forums, enhance access to career development opportunities free from age bias, and address stereotypes that dismiss young people's contributions. Interventions for older adults might focus on showcasing positive examples of active ageing, providing training to combat workplace age discrimination, and counter stereotypes about frailty and dependency. Although this study did not find a significant association between multigenerational household structure and experiences of ageism, intergenerational programmes remain an important strategy recommended by the WHO [2] to foster mutual understanding and reduce age-based prejudice. Such programmes can facilitate intergenerational learning, challenge stereotypes, and build solidarity across age groups. The association between lower SES and higher ageism scores supports prioritising age-inclusive outreach within lower-SES communities in Singapore through existing infrastructure such as the various Active Ageing Centres. Additionally, age-integrated built environment initiatives such as Kampung Admiralty, which co-locates care facilities for older individuals, childcare, and community amenities within a single HDB development, represent a promising model for fostering intergenerational contact and age-inclusive norms. Given that both the youngest and oldest age groups reported the highest ageism scores, such initiatives should span the full adult life course rather than targeting older adults alone. Finally, it is crucial to increase attention to understudied groups such as nonbinary individuals, ethnic minorities, and those excluded due to missing data, to develop more inclusive and effective strategies against ageism in diverse populations.

Conclusion

This study explored the prevalence and determinants of ageism in a large, nationally representative sample in Singapore. Nearly half of all adults reported experiencing ageism, demonstrating that age-based bias is widespread. Subjective age perceptions consistently predicted higher ageism scores in the study population. Notably, ageism not

only affects older adults but also younger and middle-aged individuals, highlighting the importance of addressing ageism across the lifespan. Tackling these challenges is essential for promoting physical and mental health, while fostering an inclusive society where individuals of all ages feel valued. As Singapore faces a rapidly ageing population, coordinated action from policymakers, healthcare professionals, and community organisations is vital to reduce ageism and promote healthy ageing for all.

Acknowledgements The authors wish to thank Dr Vanessa Wazny for the guidance and insightful discussions, as well as all participants and staff members who invested their time and energy in this study.

Author contribution L. Bruschinski: conceptualisation, data curation, formal analysis, investigation, methodology, project administration, visualisation, and writing the original manuscript draft. A. Maier: supervision, conceptualisation, methodology, and reviewing and editing the manuscript. All other authors (E. Horberg, P. O’Keefe, B. Wang, A. Szücs, J. Meij, and A. Murray) contributed to the development and conceptualisation of the main HELO survey and reviewed and edited the manuscript. All authors had access to the underlying data. L. Bruschinski and A. Maier verified the data. All authors have approved the final manuscript and accept the responsibility to submit the manuscript for publication.

Funding Unrestricted grant of the National University of Singapore received by Andrea B. Maier.

Data availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Conflict of interest The authors declare no competing interests.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article’s Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article’s Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

1. Officer A, de la Fuente-Núñez V. A global campaign to combat ageism. *Bull World Health Organ.* 2018;96:295–6.
2. World Health Organization. Global report on ageism. Geneva: World Health Organization; 2021.
3. Butler RN. Age-ism: another form of bigotry. *Gerontologist.* 1969;9:243–6.
4. Murray AL, de la Fuente-Núñez V. Development of the item pool for the ‘WHO-ageism scale’: conceptualisation, item generation and content validity assessment. *Age Ageing.* 2023;52:iv149–57.
5. Mikton C, de la Fuente-Núñez V, Officer A, et al. Ageism: a social determinant of health that has come of age. *Lancet.* 2021;397:1333–4.
6. Levy BR, Slade MD, Kunkel SR, et al. Longevity increased by positive self-perceptions of aging. *J Pers Soc Psychol.* 2002;83:261–70.
7. Levy BR, Slade MD, Chang E-S, et al. Ageism amplifies cost and prevalence of health conditions. *Gerontologist.* 2020;60:174–81.
8. Accius J, Suh JY. The economic impact of age discrimination: how discriminating against older workers could cost the U.S. economy \$850 billion. Washington, DC: AARP Thought Leadership; 2020.
9. Coelho-Junior HJ, Calvani R, Picca A, et al. The influence of ageism on the hallmarks of aging: where age stigma and biology collide. *Exp Gerontol.* 2024;196.
10. Chang E-S, Kanno S, Levy S, et al. Global reach of ageism on older persons’ health: a systematic review. *PLoS One.* 2020;15.
11. Manpower Research and Statistics Department, Ministry of Manpower. Fair employment practices report. Singapore: Ministry of Manpower; 2024.
12. Wang B, Szücs A, Sandalova E, et al. Awareness, knowledge, and motivations about lifespan, healthspan, and healthy longevity medicine in the general population: the HEalthy LOngevity (HELO) conceptual framework. *Geroscience.* 2025. <https://doi.org/10.1007/s11357-025-01562-4>.
13. Walde P, Völlm BA. The TRAPD approach as a method for questionnaire translation. *Front Psychiatry.* 2023;14.
14. Salmon CT, Nichols JS. The next-birthday method of respondent selection. *Public Opin Q.* 1983;47:270–6.
15. Murray A, Li X, Booth T. Exploring the psychometric robustness of a 5-item version of the WHO ageism experiences scale in a UK adult sample. 2025, https://doi.org/10.31234/osf.io/cbdh5_v1.
16. Rippon I, Steptoe A. Feeling old vs being old: associations between self-perceived age and mortality. *JAMA Intern Med.* 2015;175:307–9.
17. Lindberg MH, Chen G, Olsen JA, et al. Combining education and income into a socioeconomic position score for use in studies of health inequalities. *BMC Public Health.* 2022;22.
18. Lim DYZ, Wong TH, Feng M, et al. Leveraging open data to reconstruct the Singapore Housing Index and other building-level markers of socioeconomic status for

- health services research. *International Journal for Equity in Health*. 2021;20:218.
19. Milton K, Bull FC, Bauman A. Reliability and validity testing of a single-item physical activity measure. *Br J Sports Med*. 2011;45:203–8.
 20. Kim JH. Multicollinearity and misleading statistical results. *Korean J Anesthesiol*. 2019;72:558–69.
 21. Sabatini S, Ukoumunne OC, Ballard C, et al. What does feeling younger or older than one's chronological age mean to men and women? Qualitative and quantitative findings from the PROTECT study. *Psychol Health*. 2023;38:324–47.
 22. Levy B. Stereotype embodiment. *Curr Dir Psychol Sci*. 2009;18:332–6.
 23. Diehl M, Wahl H-W. Self-perceptions of aging: a conceptual and empirical overview. *Curr Opin Psychol*. 2024;55.
 24. Lytle A, Macdonald J, Apriceno M, et al. Reducing ageism with brief videos about aging education, ageism, and intergenerational contact. *Gerontologist*. 2021;61:1164–8.
 25. Weldrick R, Canham SL. Intersections of ageism and homelessness among older adults: implications for policy, practice, and research. *Gerontologist*. 2024;64.
 26. Gutterman A. Ageism and socioeconomic status SSRN Journal. 2023. <https://doi.org/10.2139/ssrn.4517503>.
 27. Allen JO, Elias LK, Greenwood JC. Differences and disparities in ageism affecting older US adults: a review. *Curr Epidemiol Rep*. 2023;10:17–32.
 28. Rochon PA, Kalia S, Higgs P. Gendered ageism: addressing discrimination based on age and sex. *Lancet*. 2021;398:648–9.
 29. Merodio G, de Zárate AMO, Zhu F, et al. The impact of gendered ageism and related intersectional inequalities on the health and well-being of older women. *Research on Ageing and Social Policy*. 2024;12:146–65.
 30. World Bank. Labor force participation rate (% of population), 2024.
 31. Ministry of Social and Family Development. Progress on Singapore women's development 2024. Singapore, 2024.
 32. Burnes D, Sheppard C, Henderson CR, et al. Interventions to reduce ageism against older adults: a systematic review and meta-analysis. *Am J Public Health*. 2019;109:e1–9.
 33. Zhan S, Huang L. State familism in action: aging policy and intergenerational support in Singapore. *Chin Popul Dev Stud*. 2023;7:111–29.
 34. Murray AL, Li X. Rapid review to inform the selection of a set of brief set of universal indicators for use in large-scale cross-national ageism research. *Aging Ment Health*. 2025;29:669–78.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.