Successful Aging: The Contribution of Early-Life and Midlife Risk Factors

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OBJECTIVES: To test whether early-life factors (education, height, father's social position) and midlife social, behavioral, and psychosocial factors were associated with entering older age without disease and with good functioning.

DESIGN: A longitudinal, British civil service–based cohort study. Participants were followed for 17 years to assess successful aging. This was defined as being free of major disease and in the top tertile of physical and cognitive functioning measured in 2002 to 2004.

SETTING: Twenty London-based Civil Service departments.

PARTICIPANTS: Four thousand, one hundred forty men and 1,823 women, free of major disease at baseline in 1985 to 1988 (mean age 44, range 35–55).

MEASUREMENTS: Behavioral, biological, and psychosocial risk factors; physical and cognitive functioning; and disease outcomes.

RESULTS: Five hundred forty eight (12.8%) men and 246 (14.6%) women were successfully aging at follow-up. Midlife socioeconomic position strongly predicted this (age-adjusted odds ratio, highest vs lowest = 7.1, 95% CI = 3.4–14.6, for men and 7.7, 95% CI = 4.9–12.1, for women). Height, education (in men), not smoking, diet, exercise, moderate alcohol (in women), and work support (in men) were related to a favorable older life after adjustment for age and socioeconomic position.

CONCLUSION: Interventions to promote healthy adult behavior may attenuate harmful effects of less-modifiable risk factors and reduce social inequalities. **J Am Geriatr Soc 56:1098–1105, 2008.**

Key words: aging; cohort studies; health behaviors; inequalities

We live in a global aging society. The World Health Organization estimates that there were 600 million people aged 60 and older in 2000 and that this will increase to 1.2 billion by 2025 and 2 billion by 2050.[1] Aging can be seen to be a societal achievement, but it is also a challenge in terms of provisions for health care and continued healthy functioning for this growing group of individuals. Thus, it is important to ensure not only that these extra years are free from major disease, but also that there is maintenance of mental and physical functioning. This will reduce the enormous economic and social responsibility that society faces. It is estimated that nearly half of lifetime healthcare expenditure is realized during after aged 65,[2] and total U.S. per capita costs due to aging are projected to increase 18% between 2000 and 2050.[3]

One of the most commonly used terms to describe a good old age is "successful aging," often attributed to R. J. Havighurst in the 1960s, who defined it as "adding life to the years."[4] Interest in successful aging remained high through the successive decades, and there was a general realization among biomedical researchers that *quality* of life may be as important as *quantity* of years added to life.[5] Although a precise definition of successful aging has not been agreed on, there is general consensus that it includes freedom from chronic disease and the ability to continue to function effectively, both physically and mentally, in old age.[6,7]

Key research and policy areas include investigating the factors that permit individuals to continue to function effectively, both physically and mentally, into older age and determining whether these factors are modifiable. Prospective epidemiological studies with substantial numbers of participants with phenotypic information useful for gerontololgical research are rare but essential to identify risk factors for health and survival at older ages.[8] Previous research has shown income,[9] education,[8,10,11] ethnicity,[9,10] exercise,[10,12–14] diet,[14] smoking habits,[8,9,14–17] and social networks[10,12] all to be related to successful aging. The relative importance of these factors remains unclear, and the primary objective of the current study was to compare early- and midlife predictors of successful aging.

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METHODS

The Whitehall II study was established in 1985 as a longitudinal population-based study to examine the socioeconomic gradient in health and disease of 10,308 civil servants (6,895 men and 3,413 women).[18] All civil servants aged 35 to 55 in 20 London-based departments were invited to participate by letter; 73% of those invited agreed to take part in Phase 1. Baseline examination (Phase 1) took place during 1985 to 1988 and involved a clinical examination and a self-administered questionnaire containing sections on demographic characteristics, health, lifestyle factors, work characteristics, social support, and life events. Clinical examination included measures of blood pressure, anthropometry, biochemical measurements, neuroendocrine function, and subclinical markers of cardiovascular disease. Subsequent phases of data collection have alternated between mail questionnaire alone (Phases 2, 4, 6) and mail questionnaire accompanied by a clinical examination (Phases 1, 3, 5, and 7). The median length of follow-up from Phase 1 to Phase 7 was 17 years, with 535 individuals dying during this period. Six thousand nine hundred forty-four participants attended the clinical examination in which physical functioning and cognitive tests were administered, Phase 7. The University College London ethics committee approved the study.

Measures of Socioeconomic Position at Phase 1

Based on salary and work role, the civil service defines a hierarchy of employment grades ranging from senior executive officers to clerical and support staff. This is a three-level variable representing high (administrative grades), intermediate (professional or executive grades), and low (clerical or support grades) socioeconomic position (SEP). People in the three SEP groups differ with respect to salary, social status and level of responsibility. Although mostly white collar, respondents covered a wide range of SEP, with annual salaries in 1995 ranging from £4,995 to £150,000.

Early-life factors (father's social class, age when left education, and adult height) were ascertained from self-completed questionnaire and clinic data. Adult height was used in this way, because it has been shown to be associated with prenatal and childhood exposures.[19]

Measures of Health Behaviors at Phase 1

Smoking, exercise, diet, and alcohol were assessed using a questionnaire. Smoking was grouped as current, exsmoker, and never-smoker. Exercise was derived from questions on frequency and number of hours per week spent on activities that were mildly energetic, moderately energetic, or vigorous. These were grouped as vigorous or moderate if they performed 1 or more hours per week of these or as none or mild. A summary index of poor diet was defined if two or three of the following applied: most frequently used bread was white, usually used milk was whole, and fruit or vegetables were eaten less often than daily. Alcohol consumption in the previous week was expressed in units of alcohol, with 1 U = 8 g ethanol.

Measures of Psychosocial Factors at Phase 1

The first set of factors were work based and consisted of the central components of the job strain model, that is, psychological job demands, decision latitude, and social support at work.[20] Four items addressed psychological job demands, and 15 items addressed decision authority and skill discretion, which were combined into an index of decision latitude (or job control). Social support at work is the sum of two subscales: support from coworkers and support from supervisor. Social network was assessed using an adapted version of the Berkman and Syme scale (1979). This scale assesses the number of friends, relatives, and work colleagues seen and the frequency with which they are seen and participation in social and religious groups; higher scores indicate a larger network.[21]

Sample Selection

Participants were classed as aging successfully if they were free from major disease up to Phase 7 and had good physical and mental functioning at Phase 7. For the analysis of successful aging, the 5,823 men and women with no prevalent disease at Phase 1 who had measures of functioning at phase 7 and had attended five or more phases of follow-up were included. The exclusion of those who had attended fewer than five phases of follow-up was to reduce potential reporting bias, because those who attend the most phases have the greatest opportunity for declaring the presence of major diseases. Adjusting for the number of phases attended in all analyses removed any residual confounding due to this. Prevalent disease at Phase 1 was defined as a self-report on the questionnaire of coronary heart disease (CHD), cancer, diabetes mellitus, or depression. The incidence of disease (CHD, stroke, cancer, diabetes mellitus, depression, or Adult Treatment Panel III metabolic syndrome) was determined from all relevant data collected between Phase 1 and Phase 7 from self-reports in questionnaires, medication use, and clinical examinations (for metabolic syndrome), together with supporting evidence from general practitioners and hospitals (for CHD). Good functioning at Phase 7 was defined as being in the best third of the sex-specific distribution for three or four of the four measures: Walking speed, lung function, Alice Heim 4-I cognitive test, and the physical component score of the 36-item Short Form General Health Survey[22] (or two or three in the top third for the 26% of subjects who had only three of the four measures). A trained study nurse measured walking speed over a clearly marked 8-foot walking course. Participants were asked to "Walk to the other end of the course at your usual walking pace, just as if you were walking down the street to go the shops. Walk all the way past the other end of the tape before you stop." Times were recorded in seconds to two decimal places. Three tests were conducted, and the mean walk time was used in the analysis. Lung function was assessed using forced expiratory volume, which is the volume of air expelled in the first second of a forced expiration starting from full inspiration.[23] The Alice Heim 4-I is composed of a series of 65 verbal and mathematical reasoning items of increasing difficulty. This is a test of inductive reasoning that measures the ability to identify patterns and infer principles and rules.[24]

Statistical Analysis

Logistic regression analyses were performed, separately in men and women, to determine the association between

Phase 1 factors and successful aging at Phase 7. All analyses were adjusted for age at Phase 1 and the number of phases attended (5, 6, or 7) to remove potential reporting bias, because participants who came to more phases had more opportunities to report adverse health outcomes. The overall effect of early-life factors, midlife health behaviors, and psychosocial factors were summarized by creating a score for each from the individual factors (Appendix 1). A high score on each summary measure indicates a more-favorable level. The effect of each of these on successful aging was expressed per standard deviation change in each score.

Sensitivity Analyses

Additional sets of sensitivity analyses were undertaken using slight variations on the definition of successful aging to assess whether it influenced the role of risk factors for successful aging. First, successful aging was defined using only the disease criteria and then only the functioning criteria. Second, the occurrence of metabolic syndrome was excluded from the definition of disease in recognition that it measures a constellation of risk factors and not a clinical disease. Finally, cognitive functioning was excluded from the definition of successful aging.

RESULTS

Of the 10,308 participants in the study, 402 (6%) men and 238 (7%) women had prevalent disease at Phase 1. Of the remaining subjects, 77% (5,179 men and 2,231 women) attended five or more of the seven phases of the study. A further 1,039 men and 548 women were excluded, because they did not attend Phase 7, had missing data on functioning at Phase 7, or had unknown metabolic syndrome status at any phase. The remaining 5,823 subjects (4,140 men and 1,683 women) form the sample for this analysis. The 4,485 subjects excluded from the analyses tended to be older (mean age at Phase 1, 45.1 vs 43.9), more often female (39% vs 29%), and from the lowest SEP group (33% vs 15%). Of the 5,823 subjects in the analysis, 548 (12.8%) men and 246 (14.6%) women were successfully aging at phase 7. During follow-up, 2,286 participants (38.9%) developed at least one of the specified major diseases (CHD, stroke, cancer, diabetes mellitus, depression, metabolic syndrome) (Table 1).

Table 1. Incidence of Disease and Prevalence of Good Functioning by Phase 7 in Men and Women*

Disease and Functioning	Men n = 4,140	Women n = 1,683
Age at Phase 1, mean ± standard deviation	43.8 ± 5.9	44.3 ± 5.9
Disease, n (%)		
Coronary heart disease or stroke	655 (15.8)	315 (18.7)
Cancer	125 (3.0)	77 (4.6)
Diabetes mellitus	175 (4.2)	99 (5.9)
Depression	253 (6.1)	131 (7.8)
Metabolic syndrome	855 (20.7)	320 (19.0)
Any of the above	1,591 (38.4)	695 (41.3)
No disease, n (%)	2,549 (61.6)	988 (58.7)
Good functioning, n (%)†	757 (18.3)	361 (21.5)
No disease and good functioning: "successful aging," n (%)	548 (12.8)	246 (14.6)

* Of those who had no prevalent disease at Phase 1, who attended 5 or more phases of follow-up, and had measures of functioning Phase 7.
† Good functioning is defined as being in the best third of the sex-specific distribution for three or four of the four measures (or two or three in the top third for the 26% of subjects who had only three of the four measures).

As would be expected, participants who were younger at the start of the study were more likely to be disease free and functioning well at follow-up. (Average age at Phase 7 of those who were successfully aging vs those who were not was 57.5 vs 60.8 for men and 57.3 vs 61.3 for women.) Therefore, all analyses were adjusted for age. SEP in midlife (employment grade) was strongly related to successful aging for men and women. Those in the highest employment grades were much more likely to be successfully aging than those in the lowest grades (age-adjusted odds ratio (OR) = 7.1, 95% confidence interval (CI) = 3.4–14.6, for men; OR = 7.7, 95% CI = 4.9–12.1, for women). Because this effect was so strong and was related to many other risk factors, the age- and age- and SEP-adjusted odds ratios are presented in Table 2. With age adjustment alone, education, height, smoking, diet, physical activity, decision latitude, and work support were associated with successful aging for men. After additional adjustment for SEP, decision latitude was no longer statistically significant. For women, the affects of SEP adjustment were more pronounced. Height, smoking, alcohol, and physical activity remain associated with successful aging after adjustment for age and SEP.

The relative importance of early-life factors, midlife SEP, and midlife behavioral and psychosocial factors are shown in Table 3. A 1–standard deviation improvement in grouped early-life factors was associated with a greater likelihood of successful aging (OR = 1.41, 95% CI = 1.27–1.57 for men; OR = 1.61, 95% CI = 1.36–1.90, for women). When all the factors are adjusted for each other, the strongest effects are seen for SEP for men and women, but independent, significant effects are seen for all other groupings except psychosocial factors in women. When stratified into two age categories (data not shown), early-life and behavioral factors were more important for young men (35–44 at baseline) then older men (45–55 at baseline). There were no interactions with age in women.

Sensitivity Analysis

The sensitivity analysis (Supplementary Tables 2A, 2B, 2C, 2D), undertaken with different definitions of successful aging, does not substantially change the original conclusions, although there were changes in magnitudes of effects. For example, much stronger effects of social position were found when successful aging was defined as high functioning (Supplementary Table 2B) than when successful aging was defined as avoidance of disease (i.e., ignoring functioning) (Supplementary Table 2A). Exclusion of metabolic syndrome had little effect (Supplementary Table 2C). Excluding cognitive functioning from the definition reduced the effects of education and social position, but all other effects were broadly similar (Supplementary Table 2D).

Further analyses removing the adjustment for the number of phases attended made only a small difference to the magnitude of the estimates presented. When the partici-

Table 2. Likelihood of Successful Aging at Phase 7 Associated with Demographic Factors, Early-Life Factors, Health Behaviors, and Psychosocial Factors at Phase 1

	Men (528 Successfully Aged/4,140)			Women (246 Successfully Aged/1,683)		
		OR* (95% CI)			OR * (95% CI)	
Characteristic	N	Age Adjusted	Age and SEP Adjusted	N	Age Adjusted	Age and SEP Adjusted
Socioeconomic position						
Employment grade						
High	1,728	7.1 (3.4–14.6)		272	7.7 (4.9–12.1)	
Medium	2,197	2.8 (1.3–5.8)		753	3.6 (2.4–5.5)	
Low	215	1.0		658	1.0	
P-value for trend		<.001			<.001	
Early-life factors						
Father's social class						
Nonmanual	2,448	1.1 (0.9–1.4)	1.0 (0.8–1.2)	849	1.8 (1.3–2.5)	1.3 (0.9–1.7)
Manual	1,465	1.0	1.0	667	1.0	1.0
P-value		.30	.78		<.001	.18
Age left education, years						
>18	1,862	2.1 (1.6–2.8)	1.4 (1.0–1.8)	533	2.3 (1.6–3.3)	1.1 (0.7–1.7)
17–18	1,033	1.6 (1.2–2.1)	1.3 (1.0–1.8)	366	1.8 (1.2–2.6)	1.2 (0.8–1.8)
≤16	1,094	1.0	1.0	688	1.0	1.0
P-value for trend		<.001	.03		<.001	.65
Height tertile						
Tallest	1,442	1.9 (1.5–2.4)	1.6 (1.3–2.1)	615	2.9 (1.9–4.2)	2.0 (1.4–3.0)
Middle	1,408	1.5 (1.2–2.0)	1.4 (1.1–1.8)	575	1.8 (1.2–2.7)	1.5 (1.0–2.2)
Shortest	1,286	1.0	1.0	493	1.0	1.0
P-value for trend		<.001	<.001		<.001	<.001
Health behaviors						
Smoking						
Never	2,079	3.2 (2.1–4.7)	2.7 (1.8–4.1)	969	2.4 (1.5–3.9)	2.2 (1.3–3.7)
Ex-smoker	1,520	2.6 (1.8–4.0)	2.5 (1.6–3.7)	411	2.6 (1.5–4.5)	2.2 (1.3–3.7)
Current smoker	509	1.0	1.0	292	1.0	1.0
P-value for trend		<.001	<.001		.007	.006
Alcohol, units/wk						
0	429	1.0 (0.7–1.4)	1.2 (0.9–1.8)	405	0.3 (0.2–0.5)	0.5 (0.3–0.9)
1–14	2,401	1.0 (0.8–1.2)	1.0 (0.8–1.2)	1,083	0.8 (0.5–1.1)	1.0 (0.7–1.5)
15	1,280	1.0	1.0	175	1.0	1.0
P-value for trend		.87	.39		<.001	.01
Poor diet						
No	2,226	1.6 (1.3–1.9)	1.4 (1.1–1.7)	1,024	1.5 (1.1–2.1)	1.1 (0.8–1.6)
Yes	1,799	1.0	1.0	570	1.0	1.0
P-value		<.001	.001		.008	.53
Physical activity						
Vigorous	2,254	2.4 (1.5–3.7)	1.9 (1.2–3.1)	485	2.2 (1.5–3.4)	1.7 (1.1–2.6)
Moderate	1,508	1.8 (1.1–2.8)	1.5 (0.9–2.4)	771	1.7 (1.1–2.6)	1.4 (0.9–2.2)
None or mild	364	1.0	1.0	412	1.0	1.0
P-value for trend		<.001	<.001		<.001	.03
Psychosocial factors						
Decision latitude						
High	1,789	1.9 (1.4–2.5)	1.2 (0.9–1.6)	393	2.7 (1.9–3.9)	1.4 (0.9–2.0)
Medium	1,417	1.4 (1.1–1.9)	1.1 (0.8–1.4)	517	2.0 (1.4–2.8)	1.3 (0.9–1.9)
Low	918	1.0	1.0	741	1.0	1.0
P-value for trend		<.001	.18		<.001	.15
Job demands						

(*Continued*)

Table 2. (Contd.)

	Men (528 Successfully Aged/4,140)			Women (246 Successfully Aged/1,683)		
		OR* (95% CI)			OR * (95% CI)	
Characteristic	N	Age Adjusted	Age and SEP Adjusted	N	Age Adjusted	Age and SEP Adjusted
Low	932	0.9 (0.7–1.1)	1.3 (0.9–1.6)	596	0.6 (0.4–0.8)	1.2 (0.8–1.8)
Medium	1,838	1.0 (0.8–1.3)	1.2 (1.0–1.5)	710	1.0 (0.7–1.4)	1.4 (0.9–1.9)
High	1,361	1.0	1.0	360	1.0	1.0
P-value for trend		.27	.08		.003	.43
Work support						
High	1,410	1.4 (1.1–1.7)	1.3 (1.0–1.7)	528	1.2 (0.8–1.7)	1.1 (0.8–1.6)
Medium	1,393	1.1 (0.9–1.4)	1.0 (0.8–1.3)	502	1.1 (0.8–1.5)	1.0 (0.7–1.4)
Low	1,322	1.0	1.0	635	1.0	1.0
P-value for trend		.008	.02		.33	.54
Network index						
High	1,571	1.1 (0.9–1.4)	1.0 (0.8–1.3)	560	1.0 (0.7–1.4)	0.9 (0.6–1.3)
Medium	1,510	1.0 (0.8–1.3)	1.0 (0.8–1.3)	631	1.0 (0.7–1.4)	0.9 (0.6–1.2)
Low	1,026	1.0	1.0	470	1.0	1.0
P-value for trend		.32	.69		.89	.70

* All odds ratios (ORs) were adjusted for number of phases attended in addition to adjustments given.
CI = confidence interval.

pants with fewer than five visits were included in the analyses, the OR estimates of SEP in Table 2 increased at most 4%, and the age- and SEP-adjusted ORs for all other factors showed only small changes. Analysis of the 535 deaths that occurred between Phase 1 and Phase 7 showed that low SEP was associated with greater mortality, with a hazard ratio for low versus high SEP being 2.33 (95% CI = 1.71–3.18) in men ($P < .001$) and 1.67 (95% CI = 1.02–2.72) in women ($P = .04$).

DISCUSSION

Position in the social hierarchy in midlife is strongly associated with the chances of entering early old age free from major disease and with good functioning. Independent of SEP, there are contributions from early-life factors, midlife health behaviors, and midlife psychosocial factors. Therefore, strategies aimed at attenuating the modifiable risk factors would lessen the inequalities encountered in childhood and experienced throughout the life course and thus increase everyone's chances of living to a successful old age. Previous analyses of cohorts in which variables assessed before the age of 50 and several factors that were under some personal control (and therefore potentially modifiable) predicted successful aging and support this finding.[11]

Although a precise definition of successful aging does not exist, most researchers agree that it needs to include freedom from chronic disease and high function.[6,7] In the analysis shown in this article, it was decided to interpret this broad definition to include high physical and cognitive functioning. The decision to include good cognition in the definition of successful aging was based on the fact that increasing lifespan makes cognition an increasingly important health measure for older adults. In developed countries, dementia prevalence is approximately 1.5% at age 65 and doubles every 4 years to reach 30% at age 80.[25] Thus, it is important to consider cognitive function in research on successful aging, particularly a measure of cognition that is

Table 3. Likelihood of Successful Aging Associated with a 1–Standard Deviation Improvement in Socioeconomic Position, Early-Life Factors, Health Behaviors, and Psychosocial Factors

	Men (426 Successfully Aged/3,329 Men)		Women (198 Successfully Aged/1,196 Women)	
	Age Adjusted	Fully Adjusted*	Age Adjusted	Fully Adjusted*
Grouped Factors	OR† (95% Confidence Interval) *P*-Value			
Socioeconomic position	1.70 (1.52–1.90) <.001	1.52 (1.34–1.72) <.001	1.85 (1.57–2.18) <.001	1.58 (1.31–1.92) <.001
Early-life factors	1.41 (1.27–1.57) <.001	1.19 (1.06–1.33) .003	1.61 (1.36–1.90) <.001	1.23 (1.01–1.49) .04
Health behaviors	1.41 (1.26–1.56) <.001	1.29 (1.16–1.44) <.001	1.45 (1.22–1.71) <.001	1.29 (1.09–1.54) .003
Psychosocial factors	1.19 (1.07–1.31) <.001	1.12 (1.01–1.24) .03	1.18 (1.01–1.37) .03	1.10 (0.94–1.28) .25

* Adjusted for age and all the other factors in the table.
† All odds ratios (ORs) were adjusted for number of phases attended in addition to adjustments given.

subject to age-related decline,[26] although to ensure that one aspect of the definition of successful aging did not determine the results, sensitivity analyses were undertaken using different definitions of successful aging. These results suggest that there are no major differences in the importance of the predictors of successful aging. For instance, removing cognition from the definition reduces the importance of social position somewhat, but it remains a strong predictor of successful aging.

Examination of the sensitivity of the results to the effect of removing and controlling for participants who did not attend all phases of the study showed that the effects of social position may have been marginally underestimated but had little effect on the other factors. In addition, attrition of the cohort due to mortality was greater in those of lower social position and reinforces the observations that those of higher social position age more successfully. Hence, the gradient of successful aging with SEP would be greater if the definition of successful aging also included death.

There were some differences between the importance of predictors in men and women (Table 2). In the early-life factors, education was important for men, and height, was more important in women. Of the health behaviors, diet was important for men and alcohol for women. Finally, of the psychosocial factors, work support did not play a role in women. These sex differences in the importance of predictors for successful aging warrant further investigation. All predictors were assessed early in midlife (average age for men was 43.8 and for women 44.3), and their effect on successful aging might vary later in the lifecourse. This is likely to be particularly true of measures of social support and social network, which are likely to become important for older adults.

There are a number of limitations to this study. Caution is needed when extrapolating results to the whole population, because the study consisted of London-based office workers. In particular, there were not sufficient numbers to examine the effects of ethnicity. Second, the probability of having good physical and mental functioning in later life in those with chronic disease was not examined, because prevalent disease was excluded at baseline. It would be interesting to explore the factors that enable those with comorbidities and disabilities to continue to function and maintain independence. Some consider this to be "successful aging."[5] A strength of this study is that disease incidence was determined using ongoing surveillance and exposure variables measured before disease diagnosis. Therefore, the sequence of events is clear, and the problem of reverse causation, whereby health behaviors change because of disease labeling, was avoided.

The importance of socioeconomic factors for health through the life-course is well documented,[18,27] although the role of socioeconomic factors in predicting successful aging remains little explored. One exception to this general rule is the investigation into predictors of dementia in old age. Education is widely believed to have a protective effect against dementia.[28,29] Data from a population-based study were recently used to develop an equation for the prediction of the risk of late-life dementia in people of middle age.[30] Age, low education, and vascular risk factors like hypertension, hypercholesterolemia, and obesity in midlife were found to be highly predictive of dementia during the 20-year follow-up period.

Results from the Berlin Aging Study showed successful aging to be relatively free from the effects of social class,[31] although because the analysis was based on those aged 70 and older, it was necessarily restricted to those who had survived up to this age. It is possible that the effects of SEP are diluted when examined in the oldest old. Factors believed to protect against dementia earlier in life have been found to have little effect at the end of life.[32] The focus of the current analysis was on successful aging in early old age, and the results showed SEP to be an important correlate. The measure of SEP was a global measure and was linked to education, income, cognitive complexity of occupation, and perhaps other lifestyle factors. SEP was shown to be associated with successful aging after adjustments for early-life factors, health behaviors, and some psychosocial factors. The precise mechanisms through which SEP influences disease and functioning outcomes needs further investigation; the influence of factors associated with SEP is large.

This study showed that, even with a disadvantaged start to life (including little education and poor parents), midlife health behaviors and exposure to psychosocial stressors influence the likelihood of entering old age with enhanced physical and mental capabilities. From a public health perspective, the results provide a reflection of the definition of "successful aging" and the predictors of successful aging. In terms of definition, it is vital to emphasize the importance of a disease-free and high-functioning status. The analysis of the predictors of successful aging suggests that targeting modifications to health behaviors in early midlife might be beneficial for successful aging. A focus on health behaviors might also have the consequence of reducing social inequalities in health at older ages.[33,34]

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Table A1. Scores Allocated to Each Measure to Create Socioeconomic Position, Early-Life Factor, Health Behaviors, and Psychosocial Factor

Measure	Score
Socioeconomic position	
Employment grade	2
High	
Medium	1
Low	0
Early-life factors	
Father's social class	
Nonmanual	1
Manual	0
Age left education	
>18	2
17–18	1
≤16	0
Height	
Tallest third	2
Middle third	1
Shortest third	0
Health behaviors	
Smoking	
Never smoker	2
Ex-smoker	1
Current smoker	0
Alcohol, drinks/wk	
0	0
1–14	1
≥15	0
Physical activity	
Vigorous	2
Moderate	1
None or mild	0
Diet	
Good	1
Bad	0
Psychosocial factors	
Decision latitude	
High	2
Medium	1
Low	0
Job demands	
Low	2
Medium	1
High	0
Work support	
High	2
Medium	1
Low	0

Supplementary Material

The following supplementary material is available for this article:

Supplementary tables—sensitivity analyses for reviewers and potentially on-line access

Table 2A. Odds ratios for staying disease free at Phase 7 associated with demographic factors, early life factors, health behaviors, and psychosocial factors at Phase 1.

Table 2B. Odds ratios for good functioning at Phase 7 associated with demographic factors, early life factors, health behaviors, and psychosocial factors at Phase 1.

Table 2C. Odds ratios for successful aging at Phase 7 associated with demographic factors, early life factors, health behaviors, and psychosocial factors at Phase 1.

NOTE: Disease definition EXCLUDES metabolic syndrome from disease definition.

Table 2D. Odds ratios for successful aging at Phase 7 associated with demographic factors, early-life factors, health behaviors, and psychosocial factors at Phase 1.

NOTE: Functioning definition EXCLUDES the Alice Heim 4-I cognitive test. Good functioning is defined as being in the top tertile of functioning for two or more of the three functioning measures (or the top tertile of both functioning measures when only two are known).

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