

Socioeconomic Inequalities and Smoking-Related Differences in Healthy Working Life Expectancy: An Examination Using U.S. Population-based Estimates from the Health and Retirement Study at Age 50

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1. Introduction

The aging of the population and the increase in the old-age dependency ratio have driven numerous governments to enact or plan policies designed to raise the statutory retirement age, often entailing the elimination or reduction of early retirement benefits. For example, Germany, Spain, and the United Kingdom will raise their retirement age to 67 from 2023 to 2029 (Parker et al., 2020). While these changes extend individuals' participation in the labor force, they can potentially result in higher social costs, particularly associated with adverse consequences of aging, such as unhealthy working conditions, unemployment, and reliance on disability benefits (Dudel, 2021). Notably, the impact of health on the individual ability to participate in work becomes particularly significant at age 50 and older (Parker et al., 2020). This factor must be considered if governments aim to achieve and maintain sustainable extended careers.

In this context, healthy and unhealthy working life expectancy are relevant policy indicators. Healthy Working Life Expectancy (HWLE) measures the time spent working in good health, while Unhealthy Working Life Expectancy (UWLE) tracks the time spent working in poor health (Dudel, 2021; Parker et al., 2020). These indicators help assess progress in extending working life and its potential impact on health when compared across countries over time. Moreover, HWLE and UWLE provide insightful summaries of individual working trajectories and they show how inequalities accumulate during the life course (Hayward & Lichter 1998). Trends in healthy working life expectancy exhibit substantial variations among countries. For example, it increased in England but declined in the U.S. for men (Boissonneault, and Rios, 2021). Additionally, unhealthy working life expectancy increased in most countries. Possible explanations include improved treatment allowing unhealthy individuals to work longer and financial pressures forcing them to stay in the labor market. Notably, sociodemographic factors are also linked to health and work outcomes (Dudel, 2021; Shiri, Hiilamo, and Lallukka, 2021). Among the potential factors of working life expectancy are the institutional setting and economic conditions and the individual health behaviours and preferences (Dudel, 2021; Parker et al., 2020). For instance, research has shown that smoking and other unhealthy behaviours (e.g., lack of leisure-time physical activity, overweight, exposure to high physical work demands) increase the risk of shorter employment trajectories (Shiri, Hiilamo, and Lallukka, 2021), and they might have long-lasting effects across the life course even if stopped. Nevertheless, sociodemographic and behavioural inequalities in healthy working life expectancy have received limited attention and little is known about the factors that shape this relevant measure.

In this study, the aim is to estimate healthy and unhealthy working and non-working (inactive) life expectancy at age 50, considering differences by race/ethnicity, education levels, and smoking behaviour. The study aims to shed light on the disparities in the duration of healthy working years across different behavioural and socioeconomic groups in the U.S. using a large follow-up. In doing so, we link individuals' health trajectories with their working life courses, and provide insights into life course inequalities which are crucial for policymakers aiming at extending the length of working life.

2. Data and method

2.1. Sample

The study uses data from the RAND version of the Health and Retirement Study (HRS), an ongoing nationally representative longitudinal survey of health characteristics of U.S. men and women aged 50 and older, with oversampling of minority ethnic groups (Juster, and Suzman, 1995). Participants have been interviewed approximately every two years from 1992 to 2020. RAND HRS version is a user-friendly longitudinal data file, which is cleaned and compiled by the RAND Corporation (Bugliari et al. 2020; Juster, and Suzman, 1995). Because the health measure of interest (i.e., limitation in five activity of daily living, more details in the subsection of measurements) was not available at the first wave of the survey, the initial sample included 38,354 individuals, interviewed between 1993/1994 (wave 2) and 2020 (wave 15) aged 50 years and older. Refreshment samples at each wave were also included. After excluding 2,318 individuals (6.0%) due to missing information on labor force, race/ethnicity, education, and smoking behaviour, the final sample included 36,036 individuals (53.2% women and 46.8% men).

2.2. Measurements

Employment is measured based on self-reported labor force state and distinguished between two states: working and inactive. Inactive respondents are those who report to be retired, out of the labor force, or unemployed. Health was measured according to limitation in five activity of daily living (ADL): bathing, eating, dressing, walking across a room, and getting in or out of bed. An individual is defined healthy (unhealthy) if he/she report none (at least one) limitation.

According to the available information on the HRS database, four race/ethnic groups are considered: Non-Hispanic White, Non-Hispanic Black, Hispanic, and Others (i.e., American Indian/Alaskan Native, Asian/Pacific Islander, or something else). Educational level is measured using the highest degree and dichotomized into higher educated (i.e. college or university degree) and lower educated (i.e. less than high-school, high-school graduate, and general equivalency degree). Finally, smoking status is dichotomized into current smoker and current non-smoker.

2.3. Analysis

The combination of two employment states and two health states allowed us to identify four living states, i.e. working healthy (state 1), working unhealthy (state 2), not working/inactive and healthy (state 3), not working/inactive and unhealthy (state 4). We used multistate Markov survival models including death as absorbing state (state 5), and consequently 16 possible transitions. Data from multiple waves were pooled into a single dataset for analysis. The age-specific transition rates were modelled through multinomial logistic regression, using age as covariates. Educational level and smoking (time-varying) are included in the models as covariates, and the model is estimated separately for subsamples defined by gender and race/ethnicity. This implicitly interacts all covariates with gender and race/ethnicity. Transition rates are subsequently applied to a synthetic cohort in order to summarize them into duration: Total Life Expectancy (TLE); Healthy Working Life Expectancy (HWLE) - expected average number of remaining years of life in workforce and without physical limitation; Unhealthy Working Life Expectancy (UWLE) - expected average number of remaining years of life in workforce and with physical limitation; Healthy Inactive life expectancy (Inact-H) - years of life in not workforce and without physical limitation; Unhealthy Inactive life expectancy (Inact-U) - years of life in not workforce and with physical limitation.

All the analyses were conducted using R software version 4.2.3.

3. Preliminary findings

As expected, the findings of the study reveal disparities in HWLE based on gender, race/ethnicity, education, and smoking status. In Table 1 we present detailed information regarding life expectancy estimates at age 50, such as TLE, HWLE, UWLE, Inact-H, and Inact-U life expectancy. These estimates are categorized by gender, race/ethnicity, education, and smoking behaviour.

Overall, HWLE is greater in men than in women and among non-smokers compared to smokers. Additionally, approximately 95.0% of the remaining working life is expected to be without limitations in ADL. Remarkably, HWLE varies significantly across educational levels and among different racial and ethnic groups. Individuals with lower educational attainment, when compared to their higher-educated counterparts, report approximately 1.2 to 1.5 years shorter HWLEs. Overall, at age 50, non-smoking men with higher education can expect around 12.2 years of working life without limitations, whereas lower-educated men have 10.7 years. Similarly, for women, it is 11.3 years for those with higher education and 9.9 years for lower-educated women. Among smokers, there is a roughly 2-years gap for men and a 1.5-year gap for women.

Among non-smoking men, the shortest and longest HWLEs are observed among Blacks and Hispanics, respectively, with Whites and other racial/ethnic groups falling in between. For instance, among the higher educated, HWLE is 11.5 years for Black men, around 12.0

years for White and other racial/ethnic groups, and 12.7 years for Hispanic men. Among smoker men, Whites and Hispanics report the longest HWLEs, approximately 10.0 years in the higher-educated group, while it is lower among Blacks and other ethnicities, at around 9.0 years for the same educational level group. In women, HWLE at age 50 is approximately 10.5 years for non-smoking White, Black, and Hispanic women, and about 11.6 years for other racial/ethnic groups. Among White, Black, and Hispanic smoker women, HWLE ranges from 9.0 to 10.0 years, whereas it is less than 8.0 years in the other ethnic group. In both genders, the largest difference in HWLE between smokers and non-smokers, referred to as the smoking differential, is observed among the "other ethnicity" group, with a difference of 2.9 years in men, 4.0 years in higher-educated women, and 3.6 years in lower-educated women. For White, Black, and Hispanic men, the smoking differential ranges from 1.8 to 2.6 years, while in White and Black women, it is lower, at 1.4 and 1.7 years, respectively, and even lower, at 0.7 years, among Hispanic women.

Significant variations in HWLE are also noted when considering race/ethnicity, gender, and smoking behaviour in the context of education. In higher-educated White, Black, and other ethnic women, HWLE is over one year longer than in the lower-educated group. In males, educational disparities are less pronounced among Black and other ethnicity groups, with differences of 0.4 and 0.8 years, respectively. For women, smoking-related differences are slightly larger in the higher-educated Black and other ethnicity groups compared to their lower-educated counterparts, at 1.8 vs. 1.6 years (Black) and 4.0 vs. 3.6 years (other ethnicity groups), respectively. Among lower-educated men, smoking differences are slightly larger in the higher-educated group, with differences of 1.9 vs. 1.7 years in White, 2.4 vs. 2.2 years in Black, and 2.7 vs. 2.6 years in Hispanic individuals. Overall, the most significant educational gradients are observed among White men, at 1.5 years, and Hispanic women, at 1.8 years. In addition, educational differences in HWLE are consistent between smokers and non-smokers.

Disparities in HWLE are shown in Figures 1 and 2, which display age-specific HWLEs (in years) between ages 50 and 80, categorized by gender, race/ethnicity, and smoking behaviour, among higher and lower educated individuals, respectively. In addition, figures show that while variations in HWLE by gender, race/ethnicity, education, and smoking behaviour diminish at older ages, they remain remarkable until approximately age 65.

Table 1. Total Life Expectancy (TLE), Healthy Working Life Expectancy (HWLE), Unhealthy Working Life Expectancy (UWLE), Healthy inactive life expectancy (Inact-H), and Unhealthy inactive life expectancy (Inact-U) estimates at age 50, by gender, race/ethnicity, education, and smoking behaviour, between 1992 and 2020.

	Non-smoker					Smokers				
	TLE	HWLE	UWLE	Inact-H	Inact-U	TLE	HWLE	UWLE	Inact-H	Inact-U
Total Males										
High education	28.1	12.2	0.4	13.2	2.3	22.4	10.1	0.4	9.5	2.4
Low education	25.7	10.7	0.6	11.3	3.2	20.5	8.8	0.5	8.0	3.2
White Males										
High education	28.6	12.3	0.4	13.7	2.3	22.6	10.4	0.4	9.5	2.3
Low education	26.5	10.7	0.6	12.2	3.1	20.8	8.9	0.6	8.3	3.0
Black Males										
High education	25.3	11.5	0.4	10.8	2.7	21.7	9.1	0.3	9.3	3.0
Low education	22.5	10.1	0.4	8.9	3.2	19.3	7.9	0.3	7.5	3.5
Hispanic Males										
High education	27.8	12.7	0.7	11.6	2.9	24.8	10.0	0.5	10.9	3.4
Low education	25.6	12.2	0.8	9.1	3.6	22.6	9.6	0.5	8.4	4.1
Other ethnicity Males										
High education	26.0	12.0	0.3	11.3	2.4	21.5	9.1	0.7	9.8	1.9
Low education	24.1	11.2	0.4	8.7	3.8	19.7	8.3	1.0	7.5	3.0
Total Females										
High education	31.3	11.3	0.4	15.9	3.8	25.7	9.7	0.5	11.9	3.7
Low education	28.9	9.9	0.5	13.8	4.7	23.6	8.5	0.6	10.1	4.5
White Females										
High education	32.1	11.2	0.4	16.9	3.6	26.1	9.8	0.4	12.5	3.5
Low education	29.8	10.0	0.5	15.1	4.2	24.1	8.6	0.5	11.0	4.0
Black Females										
High education	28.1	11.1	0.6	12.2	4.2	24.1	9.4	0.6	10.0	4.1
Low education	26.0	9.6	0.6	10.0	5.8	22.3	8.0	0.6	8.1	5.6
Hispanic Females										
High education	31.4	11.5	0.8	15.2	4.0	30.4	10.7	0.8	13.6	5.3
Low education	27.7	9.6	0.9	11.3	5.9	27.2	8.9	0.8	9.8	7.6
Other ethnicity Females										
High education	29.8	12.4	0.5	12.7	4.2	22.2	8.5	0.7	9.5	3.6
Low education	27.9	10.8	0.4	11.6	5.1	20.5	7.2	0.6	8.5	4.2

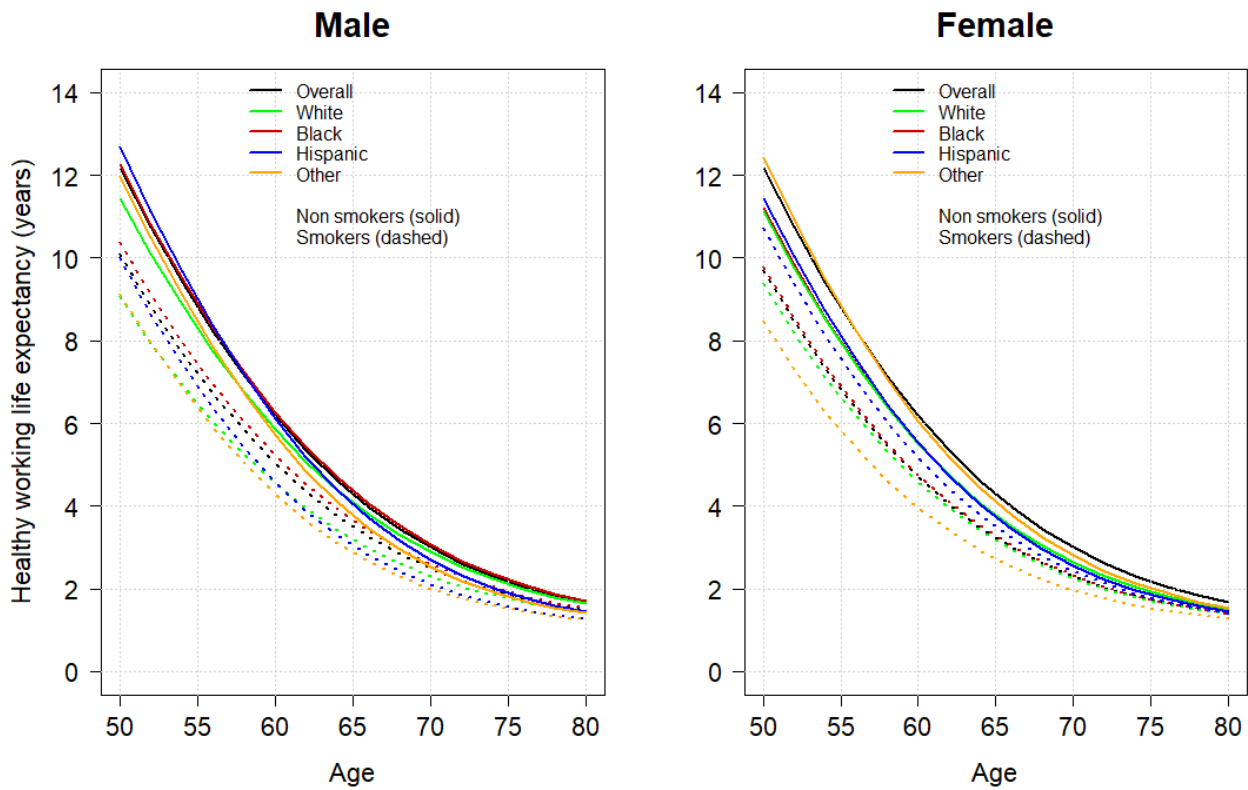


Figure 1. Healthy Working Life Expectancy (HWLE, in years) over ages, by gender, race/ethnicity, and smoking behaviour among higher educated individuals, between 1992 and 2020.

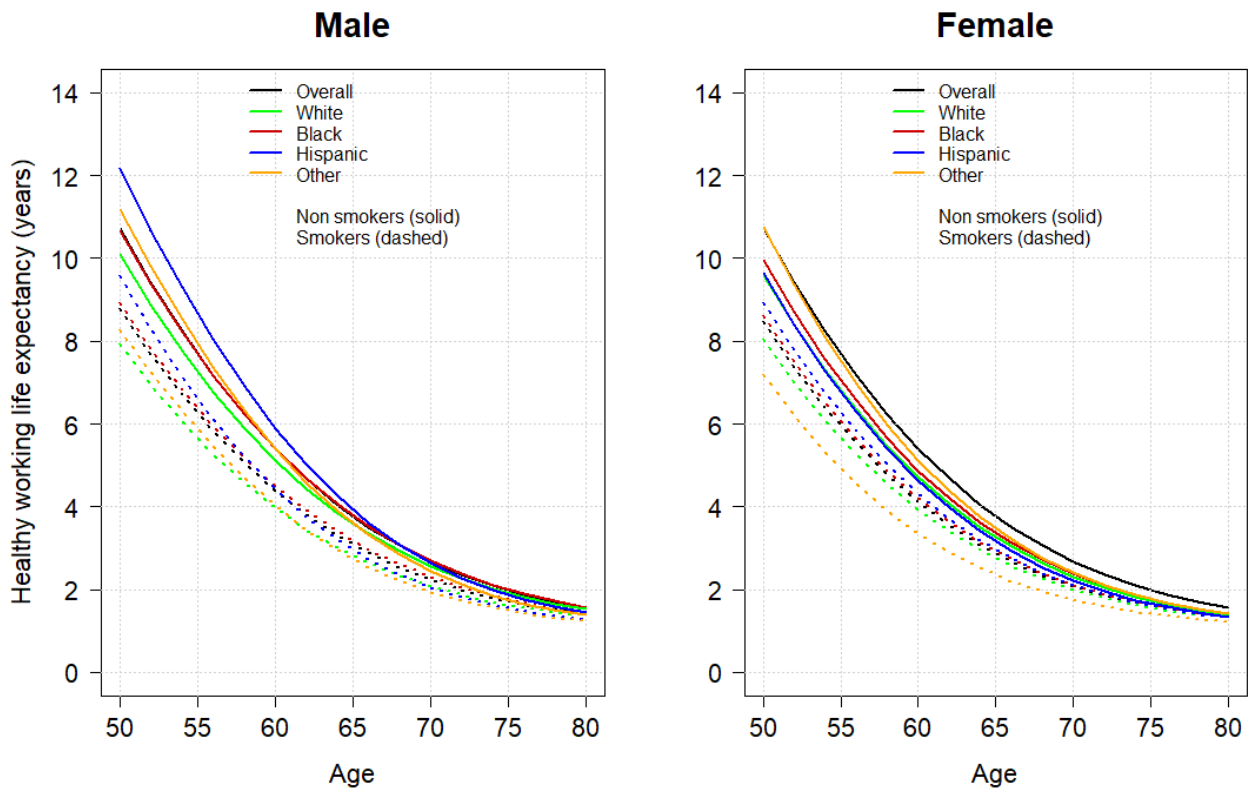


Figure 2. Healthy Working Life Expectancy (HWLE) over ages, by gender, race/ethnicity, and smoking behaviour among lower educated individuals, between 1992 and 2020.

Furthermore, Inact-H life expectancy is notably lower among both male and female smokers, approximately 4.0 years less when compared to non-smokers (see Table 1). In particular, roughly 80.0% of the total years within the inactive period are spent in a healthy state for both genders.

Interestingly, variation in the smoking-related differences in Inact-H life expectancy across different racial and ethnic groups are also present. Among White individuals, this difference is most marked, standing at around 4.0 years. In contrast, among Hispanic individuals, it is considerably lower, such as less than one year for women and less than two years for men. Finally, the educational gradient in Inact-H life expectancy remains consistent, irrespective of smoking behaviour. This means that the difference in Inact-H life expectancy based on education level is similar among both smokers and non-smokers.

4. Conclusion

Our research has uncovered a significant association between smoking and a shortened span of productive and healthy working years. Smoking was found to decrease healthy working life expectancy by more than two years. Our results underscore the presence of disparities among different educational and racial/ethnic groups, with an educational gradient in healthy working life expectancy of more than one year. While individuals at the age of 50 can typically expect more than 11.0 years of healthy working life expectancy, women and Black individuals, on average, have approx. 10.0 years.

Addressing socioeconomic inequalities in healthy working life expectancy and promoting non-smoking habits are crucial for the sustainability of the workforce. These findings provide added insights given the expected increase in the statutory retirement age in numerous countries, emphasizing the urgent need to address issues in high-risk occupational sectors.

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