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Evaluating The Risk of Cognitive Decline from Socio-Demographic, Behavioral, and Social Factors

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ABSTRACT

Cognitive decline is a growing concern in the US and other aging populations. Cognitive decline begins with typical age-related changes and can advance to subjective cognitive impairment, mild cognitive impairment, and eventually lead to more serious conditions like Alzheimer's disease and other forms of dementia. Using data from the 2023 Behavioral Risk Factor Surveillance System (BRFSS), which is weighted to be nationally representative, this study assessed the prevalence of difficulties with thinking or memory that were happening more often or were getting worse over the past 12 months and associated socio-demographic, behavioral, and social risk factors among adults aged 45 and older in the US. We hypothesized that: [1] sex differences in cognitive decline would be mitigated when accounting for these other factors and [2] physical inactivity would be associated with more prevalent difficulty in thinking or memory that occurs more often or gets worse over the past 12 months. Three central findings emerged from our study. First, after adjusting for socio-demographic, behavioral, and health-related risk factors, the odds of experiencing difficulties with thinking or memory that were happening more often or were getting worse over the past 12 months were higher for males than for females (adjusted odds ratio [aOR] = 1.04; 95% confidence interval [CI]: 1.00 to 1.08). Second, the odds of experiencing difficulties with thinking or memory that were happening more often or were getting worse over the past 12 months were lower for individuals earning $100,000 or more per year compared to those earning between $50,000 and <$100,000 per year (aOR = 0.80; 95% CI: 0.75 to 0.85). Third, physical inactivity was also associated with higher odds of difficulty with thinking or memory (aOR = 1.28; 95% CI: 1.22 to 1.35). These results emphasize the importance of addressing social and behavioral risk factors to potentially delay or reduce the onset of cognitive decline among the elderly.

INTRODUCTION

Cognitive decline is a growing concern as people age (1). It is defined as difficulties in decision-making, memory, and judgment, and it ranges from mild to severe forms (2). In the elderly, cognitive decline can progress in severity from normal age-related changes to subjective cognitive impairment, then to mild cognitive impairment (MCI), and finally to serious conditions, including Alzheimer's disease and many other types of dementia, Parkinson's disease, and Huntington's disease (3). The estimated prevalence of MCI was 22% and dementia affects about 10% of older adults, based on nationally representative data

from 2016 in the US (5). These estimates highlight age as a significant risk factor (5). About two-thirds of Americans face some level of cognitive decline, with the average onset occurring at 83 years for women and 79 years for men (6).

Research indicates that women may undergo an expedited rate of cognitive decline compared to men, though the significance of sex in this context remains unclear (7). Racial and ethnic disparities exist as well; severe cognitive decline is more prevalent among non-Hispanic Black adults, while MCI is seen more in Hispanic adults compared to non-Hispanic White adults (5). Education plays a crucial role in cognitive decline, with higher educational attainment being linked to a lower likelihood of cognitive impairment in later years of life. In this study, the lifetime risk of dementia for men with at least an associate's degree was 20% and 35% for men with lower than a high school education. Additionally, for women, the lifetime risk was 32% for those with at least an associate's degree and 42% for those with below a high school education (6). Furthermore, higher socioeconomic status (SES) correlated with stronger cognitive performance and a slower rate cognitive decline (8,9).

Cognitive decline is associated with substantial financial burden (10). The estimated annual per-patient cost of Alzheimer's disease and related dementias (ADRD) was $43,900, accounting for out-of-pocket, formal homecare spending, nursing home spending, and caregiving time valued at foregone wages (11). Although cognitive abilities generally decline with age, increased age is not necessarily associated with lower cognitive function in practical, real-world settings (12). Individuals with MCI have a higher mortality rate compared to cognitively healthy peers, at 38.4% and 17.3%, respectively, following an average follow-up of 5.8 years (13).

However, it is still uncertain whether observed differences in worsening difficulties with thinking and memory between males and females persist after controlling for socio-demographic, health, and behavioral characteristics such as hypertension and obesity. Obesity and hypertension are recognized as modifiable ADRD risk factors as they have been shown to influence the likelihood of cognitive decline during adulthood and dementia in later years (14). Our study aims to address this gap by utilizing nationally representative data to evaluate the risk of worsening difficulties with thinking and memory in men and women, while accounting for associated comorbidities and modifiable risk factors. We hypothesized that: [1] the risk of worsening difficulties with thinking and memory would be approximately equal between males and females when considering other socio-demographic, behavioral, and social risk factors, and [2] physical inactivity would correlate to higher rates of worsening difficulties with thinking and memory.

MATERIALS AND METHODS

We utilized data from the 2023 Behavioral Risk Factor Surveillance System (BRFSS) survey, which included 131,456 respondents. BRFSS, administered by the Centers for Disease Control and Prevention (CDC), aims to collect information on health-related behaviors, various health conditions, and the use of preventive services (15). BRFSS employs a sampling design that includes samples from both landline and

cell phone users. Landline numbers were selected using disproportionate stratified sampling (DSS), which prioritizes high-density census blocks of known household telephone numbers where these areas are sampled at higher rates. Cell phone numbers are randomly generated from area code and prefix combinations, allowing for equal probability of selection. Additionally, since 2013, the BRFSS sampling design has also applied geographic stratification to focus on specific geographical regions and collect data on smaller areas. The survey is weighted to be nationally representative, allowing its results to reflect the entire US population.

Our main outcome of interest was worsening cognitive decline based on the survey question, "During the past 12 months, have you experienced confusion or memory loss that is happening more often or is getting worse?" (15). Covariates included age (in five-year age groups), sex, race/ethnicity, household income, and low education (i.e., less than some college education (16)). Other covariates were hearing loss, diabetes, current smoking, and depression. Additionally, covariates also included physical inactivity, midlife hypertension, and midlife obesity. In our study midlife was been defined as individuals between the ages of 45 and 64 in accordance with Nianogo et al. (16). Furthermore, the survey question used to investigate physical inactivity was "During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?" (15) Lastly, our study defines hearing loss based on the survey question "Are you deaf or do you have serious difficulty hearing? (15). Appendix Table 1 provides details of survey questions for the covariates.

In this study, we focused on ≥45-year-olds. We first assessed the prevalence of the socio-demographic, behavioral, and health characteristics in the sample population. Second, we determined the weighted prevalence of worsening cognitive decline by age (in five-year age groups). Third, we calculated the weighted prevalence of worsening cognitive decline by other socio-demographic, behavioral, and medical characteristics to identify potential increased risks. Fourth, to determine the association of these possible risk factors together with greater difficulty thinking or memory, we fit a weighted logistic regression model. The primary outcome of interest was more frequent difficulties with thinking or memory that were happening more often or were getting worse over the past 12 months. Covariates included sex, age, race and ethnicity, household income, low education, hearing loss, diabetes, current smoking status, depression, physical inactivity, midlife hypertension, and midlife obesity. We conducted all analyses using R version 4.5.0 and set the type I error rate to $\alpha=0.05$.

RESULTS

Characteristics of Sample. The total study sample consisted of 131,456 participants, of whom 72,650 (55%) were aged 65 years or older. Male participants comprised 45% of the total sample. By race and ethnicity, the majority of participants were non-Hispanic White (78%), followed by Hispanic (7.7%), non-Hispanic Black (7.1%), and non-Hispanic Other/Multiracial (7.1%). Hearing loss was reported in 12% of participants, while the prevalence of diabetes was 19%. By educational attainment, 5.6% of participants had low educational attainment (i.e., less than some college education). Current smoking was

reported by 11% of participants, while the prevalence of depression was 19%. Also, 28% of respondents reported physical inactivity, and the prevalence of midlife hypertension was 19%. Finally, 21% of participants had midlife obesity.

Prevalence of Worsening Difficulties with thinking or memory by Age Group. The prevalence of worsening difficulties with thinking and memory between ages 45-49 and 70-74 varied between 15.2% (95% CI: 14.7%-15.7%) and 17.1% (95% CI: 16.5%-17.7%; Figure 1). The prevalence increased to 18.0% among 75-79-year-olds (95% CI: 17.4%-18.6%) and 20.7% among ≥80-year-olds (95% CI: 20.1%-21.3%).

The prevalence of rising difficulties in thinking or memory was 16.2% (95% CI: 15.5%, 17.0%) among males and 18.2% (95% CI: 17.5%, 18.8%) among females. By race/ethnicity, the prevalence was 17.0% (95% CI: 16.5%, 17.4%) among non-Hispanic Whites, 17.5% (95% CI: 15.5%, 19.6%) among Hispanics, 17.3% (95% CI: 15.8%, 18.8%) among non-Hispanic Blacks, and 18.6% (95% CI: 16.7%, 20.5%) among non-Hispanic Other/Multiracials. The prevalence among those with hearing loss was 31.9% (95% CI: 30.2%, 33.7%) compared to 15.5% (95% CI: 15.0%, 16.0%) among those without hearing loss.

The prevalence of worsening difficulties in thinking or memory was 22.5% (95% CI: 21.3%, 23.7%) among individuals with diabetes, whereas the prevalence was 15.9% (95% CI: 15.3%, 16.4%) for those without diabetes. For those with low educational attainment, the prevalence was 24.9% (95% CI: 22.4%, 27.4%), while for those with high education (i.e., at least some college), the prevalence was 16.3% (95% CI: 15.9%, 16.8%). The prevalence was 23.6% (95% CI: 22.2%, 25.1%) for current smokers compared to 16.4% (95% CI: 15.9%, 16.9%) for non-smokers. The prevalence was 38.6% (95% CI: 37.1%, 40.2%) among those with depression compared to 12.4% (95% CI: 12.0%, 12.9%) among those without depression.

The prevalence of increased difficulties relating to memory or thinking was 23.3% (95% CI: 22.2%, 24.4%) among those who were physically inactive compared to 14.7% (95% CI: 14.2%, 15.2%) among those who were physically active. Among those with midlife hypertension, the prevalence was 20.5% (95% CI: 19.5%, 21.5%) compared to 16.2% (95% CI: 15.6%, 16.8%) among those without midlife hypertension. Finally, among those with midlife obesity, the prevalence was 19.1% (95% CI: 18.0%, 20.1%) compared to 16.4% (95% CI: 15.8%, 17.1%) among those without midlife obesity.

Regression Results. The odds of worsening cognitive decline were marginally higher in males than females (p=0.048, Table 2). Compared to adults younger than 65 years old, those aged 65 years and older had a 1.21 times higher risk of worsening difficulties in thinking or memory (95% CI: 1.14–1.27). The odds of worsening difficulties in memory or thinking decreased with household income level. Compared to those who earned $50,000 to <$100,000 per year, the odds of increased chalelenges in memory or thinking were 1.53 times higher for those who earned $0 to $25,000 (95% CI: 1.44-1.62), 1.19 times higher for those who earned $25,000 to <$50,000 per year (95% CI: 1.13-1.25) and 0.79 times higher for people who earned $100,000 or higher per year (95% CI: 0.75-0.83).

We also observed significantly higher odds of worsening difficulties in thinking or memory among those who experienced hearing loss, diabetes, current smoking status, depression, physical inactivity, midlife hypertension, but not midlife obesity. For example, the odds were 1.15 times higher for those with diabetes compared to those without (95% CI: 1.10-1.21). Similarly, the odds were 1.10 times higher for current smokers compared to non-current smokers (95% CI: 1.04-1.16). Additionally, individuals with depression faced a 3.57 times higher risk of worsening cognitive decline compared to those without depression (95% CI: 3.42-3.72). Finally, the odds were 1.27 times among those who were physically inactive compared to those who were physically active (95% CI: 1.21-1.32). However, the odds of increased challenges in thinking or memory were not significantly different between adults with and without midlife obesity (p=0.3; Table 2).

DISCUSSION

Three central findings emerged from this nationally representative study on cognitive impairment and its association with socio-demographic, behavioral, and health-related risk factors. First, when these factors were considered, no statistically significant difference in the risk of worsening difficulties in thinking or memory between males and females was observed. Second, we noted that income can function as a protective element against worsening difficulties in thinking or memory. Third, physical activity may also protect against worsening cognitive decline.

Our findings align with existing research, which has consistently concluded higher SES can function as a protective element against cognitive decline (8,9). Our nationally representative study found the prevalence of worsening cognitive impairment was lower for adults with higher educational attainment and income. Hale et al. found the risk of dementia was lower among individuals with at least an associate's degree, compared to those with less than a high school education: 21 and 35 percent, respectively (6). Similarly, our study found the risk of worsening cognitive decline was higher among those with low education and high education. Additionally, Krueger et al. found higher income and maternal educational attainment were linked to improved cognitive performance and a slower rate of cognitive decline (8). Similarly, we found the likelihood of worsening cognitive decline decreased with higher income when compared to adults earning between $50,000 and <$100,000 per year.

Our findings are also consistent with existing research on modifiable risk factors. First, Sabia et al. discovered smoking significantly contributed to the risk of cognitive decline (17). In particular, this longitudinal study of N= (7236) current and non-current smokers found current smokers experienced a faster rate of cognitive decline than non-current smokers. Similarly, our study found that the likelihood of worsening difficulty in thinking or memory was notably greater in current smokers compared to those who have never smoked.

Second, we concluded individuals with midlife hypertension had a significantly higher risk of worsening difficulty in thinking or memory than their counterparts without midlife hypertension. This result is concordant with the results of Gottesman et al. that individuals with midlife hypertension had a more

significant decline in cognitive impairment than those without midlife hypertension over 20 years (18). Third, Nguyen et al. found midlife obesity was a risk factor for cognitive dysfunction and higher dementia risk (19). However, we did not ascertain any significant association between midlife obesity and worsening difficulty with thinking or memory. Our findings support those of Yan et al., who found physical inactivity led to a wide range of adverse health outcomes, including a higher rate of cognitive decline and dementia (20). We discovered that physically inactive adults had a significantly higher risk of worsening thinking or memory difficulties.

Moreover, our findings also align with previous research on other health-related factors. Lin et al. found that among older adults, hearing loss was associated with a faster rate of cognitive decline compared to individuals without hearing loss (21). We discovered that individuals with hearing loss had twice the odds of worsening thinking or memory difficulties compared to those without hearing loss. Furthermore, Zilliox et al. found that individuals with both Type 1 and Type 2 diabetes were associated with reduced cognitive performance and predisposed to cognitive decline (22). Likewise, our study supports their findings; individuals with diabetes had a significantly higher risk of worsening difficulties in thinking or memory. Also, Perini et al. found that depression among elderly adults was a strong predictor of dementia and severe cognitive decline (23). Similarly, we found individuals who experience depression have a risk of worsening difficulties in memory ot thinking nearly four times higher compared to individuals who did not experience depression.

In their pooled cohort study, Levine et al. found women experienced substantially quicker declines over age in global cognition and executive function but approximately equal declines in memory as men (7). Conversely, our study found the risk of worsening confusion and memory loss was slightly higher in males than in females.

However, some of our findings contrasted with previous research, including findings by Manly et al., who found that the prevalence of MCI was higher among Hispanic adults compared to non-Hispanic White adults (5). Conversely, our study found that Hispanic adults had lower odds of worsening memory or thinking difficulties. Additionally, Wright et al. concluded that, considering age and education level, Black adults were more likely to be diagnosed with MCI and dementia compared to White adults (24). In contrast, our study found equal risk of worsening challenges in thinking or memory between non-Hispanic Black and White adults once we accounted for other socio-demographic, behavioral, and social risk factors.

The US population continues to become older, particularly with the Baby Boomer generation entering a time of older adulthood (5). As stated by Manly et al., due to an increased number of adults aged 65 years and older, the prevalence of MCI and dementia is projected to rise significantly in the coming decades (5). Our study found that factors including hypertension, obesity, smoking, physical inactivity, and diabetes increase the risk of poor cognitive outcomes later in life. An adult's midlife serves as a period of intervention, as individuals can modify their habits regarding various risk factors to prevent or at least delay the onset of cognitive decline in the future (25). By focusing on these risk factors through lifestyle changes and early preventative treatments, elderly adults may experience more years without cognitive

impairment. One key area to focus on is exercise and physical activity, which can help prevent or delay cognitive decline while also supporting overall mental and physical health (26). This focus aligns with a Healthy People 2030 objective from the National Center for Health Statistics (CDC) that aims to increase the number of adults engaging in regular aerobic activity. Expanding support services, enhancing health education, and increasing investment in healthy aging initiatives can help adults maintain cognitive health and improve quality of life as they age.

Our study has several strengths. First, it utilizes data from BRFSS, which is weighted to be nationally representative. Second, BRFSS uses a consistent and structured survey methodology with validated questions administered across all states, enhancing the reliability of responses. However, we note several limitations. First, BRFSS focuses on memory decline. Other studies also assessed executive function and global cognition. Excluding these domains may not provide the complete picture of cognitive health and lead to an underestimate of cognitive impairment. Secondly, BRFSS data relies on respondent self-report; thus, recall bias may be a concern. Edmonds et al. found a disparity between informant-reported cognitive decline and self-reported decline, suggesting the self-reports from BRFSS may underestimate actual cognitive decline (27). Finally, BRFSS assesses worsening thinking or memory over the past year through respondent self-report rather than clinical assessment over time.

Our nationally representative study found there was no statistically significant difference in the risk of worsening memory or thinking challenges between males and females. To better understand the various risk factors associated with cognitive decline, a longitudinal study could be conducted to examine how worsening difficulties in thinking or memory progresses over time in relation to presumed risk factors. Initiatives aimed at promoting healthy aging, particularly those targeting modifiable risk factors, could help reduce the prevalence of worsening cognitive decline. Implementing these initiatives during midlife may help delay or reduce the onset of cognitive decline among the elderly.

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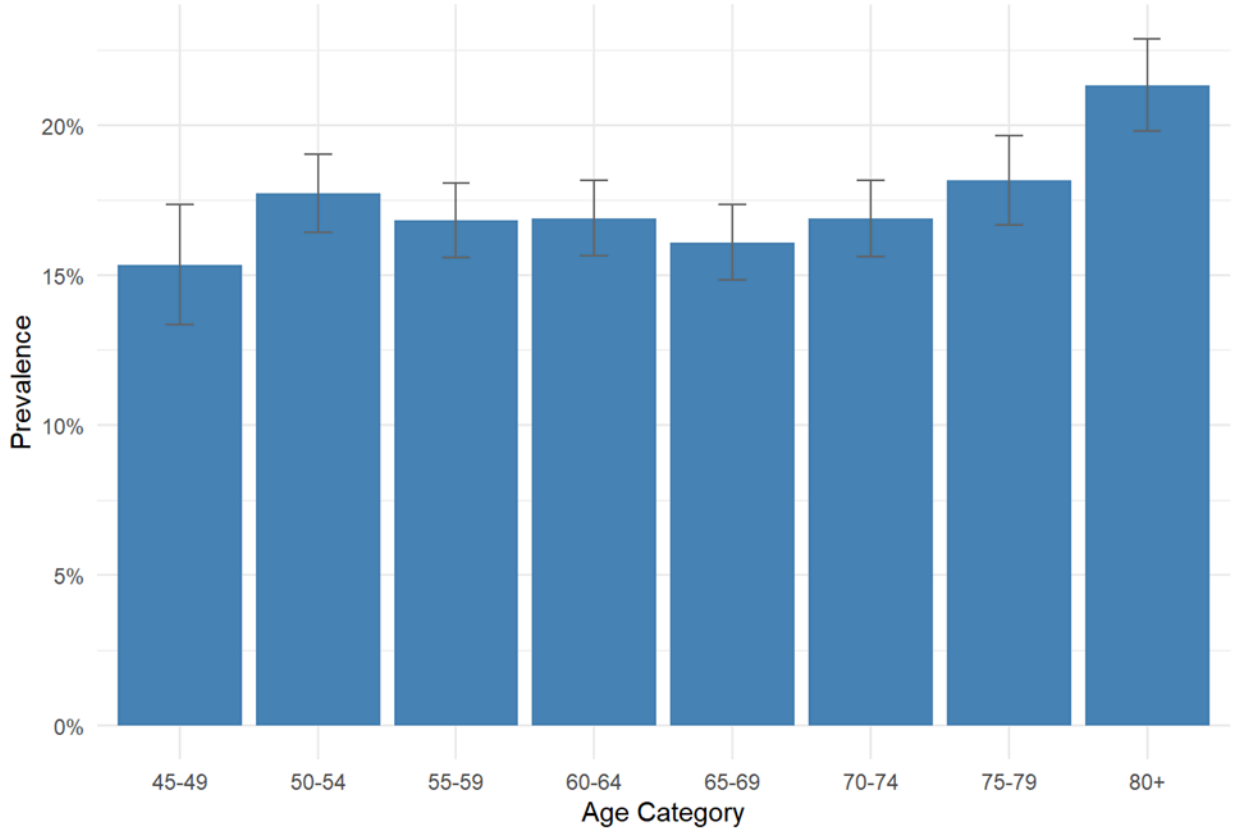
FIGURES AND TITLES/CAPTIONS



Note: Vertical line represents 95% confidence interval.

Figure 1. Prevalence of Worsening Cognitive Decline by Age Group

Bar graph shows weighted prevalence (%) ± 95% confidence intervals, calculated using 2023 Behavioral Risk Factor Surveillance System (BRFSS) data. Estimates were weighted to be nationally representative using BRFSS-calculated survey weights.

Table 1. Summary of Participant Characteristics

Characteristic	N = 131,456[1]
Age 65 years and older	72,650 (55%)
Male	58,935 (45%)
Race/ethnicity	
Non-Hispanic White	100,864 (78%)
Hispanic	9,881 (7.7%)
Non-Hispanic Black	9,156 (7.1%)
Non-Hispanic Other/Multiracial	9,105 (7.1%)
Unknown	2,450
Hearing loss	15,873 (12%)

Diabetes	24,797 (19%)
Unknown	188
Low education	7,281 (5.6%)
Unknown	329
Current smoking	14,322 (11%)
Unknown	901
Depression	24,857 (19%)
Unknown	525
Physical inactivity	36,498 (28%)
Unknown	334

Midlife hypertension	24,683 (19%)
Unknown	446
Midlife obesity	22,224 (21%)
Unknown	27,470

[1] n (%)

Table 2. Prevalence of Worsening Cognitive Decline by Characteristic

Characteristic	Value	Prevalence	95% CI
Age 65 Years and Older	No	16.8%	(16.0%, 17.5%)
	Yes	17.9%	(17.2%, 18.6%)
Sex	Female	18.2%	(17.5%, 18.8%)
	Male	16.2%	(15.5%, 17.0%)
Race/ethnicity	Non-Hispanic White	17.0%	(16.5%, 17.4%)
	Hispanic	17.5%	(15.5%, 19.6%)
	Non-Hispanic Black	17.3%	(15.8%, 18.8%)

	Non-Hispanic Other/Multiracial	18.6%	(16.7%, 20.5%)
Hearing loss	No	15.5%	(15.0%, 16.0%)
	Yes	31.9%	(30.2%, 33.7%)
Diabetes	No	15.9%	(15.3%, 16.4%)
	Yes	22.5%	(21.3%, 23.7%)
Low education	No	16.3%	(15.9%, 16.8%)
	Yes	24.9%	(22.4%, 27.4%)
Current smoking	No	16.4%	(15.9%, 16.9%)
	Yes	23.6%	(22.2%, 25.1%)

Depression	No	12.4%	(12.0%, 12.9%)
	Yes	38.6%	(37.1%, 40.2%)
Physical inactivity	No	14.7%	(14.2%, 15.2%)
	Yes	23.3%	(22.2%, 24.4%)
Midlife hypertension	No	16.2%	(15.6%, 16.8%)
	Yes	20.5%	(19.5%, 21.5%)
Midlife obesity	No	16.4%	(15.8%, 17.1%)
	Yes	19.1%	(18.0%, 20.1%)

Abbreviations: CI = Confidence Interval

Table 3. Regression Results

Characteristic	OR	95% CI	p-value
Sex			
Female	—	—	
Male	1.04	1.00, 1.08	0.048
Age 65 years and older			
No	—	—	
Yes	1.21	1.14, 1.27	<0.001
Race and ethnicity			

Non-Hispanic White	—	—	
Hispanic	0.84	0.78, 0.90	<0.001
Non-Hispanic Black	1.01	0.94, 1.09	0.7
Non-Hispanic Other/Multiracial	1.12	1.05, 1.20	0.001
Household income			
$50,000 to <$100,000	—	—	
0 to <$25,000	1.53	1.44, 1.62	<0.001
$25,000 to <$50,000	1.19	1.13, 1.25	<0.001
$100,000 and higher	0.79	0.75, 0.83	<0.001

Low education	1.12	1.03, 1.21	0.008
Hearing loss	2.03	1.93, 2.15	<0.001
Diabetes	1.15	1.10, 1.21	<0.001
Current smoking	1.10	1.04, 1.16	<0.001
Depression	3.56	3.42, 3.72	<0.001
Physical inactivity	1.27	1.21, 1.32	<0.001
Midlife hypertension	1.29	1.23, 1.36	<0.001
Midlife obesity	1.03	0.98, 1.09	0.3

Abbreviations: CI = Confidence Interval, OR = Odds Ratio

Appendix Table 1: Survey Questions

Covariate	Survey Question	Original Levels	Levels in Analysis
Age	What is your age?	Single Years of Age	45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80+
Sex	Sex of Respondent	Male, Female	Male, Female
Race/Ethnicity	Are you Hispanic, Latino/a, or Spanish origin?	Mexican, Mexican American, Chicano/a, Puerto Rican, Cuban, Another Hispanic, Latino/a, or Spanish origin, No, Don't know / Not sure, Refused	Hispanic
Race/Ethnicity	Which one or more of the following would you say is your race?	White, Black or African American, American Indian or Alaska Native, Asian, Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, Other Asian, Pacific Islander, Native Hawaiian, Guamanian or Chamorro, Samoan, Other Pacific Islander, Other, No additional choices,	Non-Hispanic White Non-Hispanic Black Non-Hispanic Other/Multiracial

		Don't know / Not sure, Refused	
Hearing Loss	Are you deaf or do you have serious difficulty hearing?	Yes, No, Don't Know/Not Sure, Refused	Yes (Respondents who answered Yes to survey question)
Diabetes	(Ever told) (you had) diabetes?	Yes, Yes, but female told only during pregnancy, No, No, pre-diabetes or borderline diabetes, Don't Know/Not Sure, Refused	Yes (No: If female is diagnosed with diabetes during pregnancy)
Low Education	What is the highest grade or year of school you completed?	Never attended school or only Kindergarten, Grades 1 through 8 (Elementary), Grade 9 through 11 (Some High School, College 1 year to 3 years (Some college or technical school), College 4 years or more (College graduate), Refused	Yes (i.e., those with fewer than some college or technical education (1 year to 3 years))
Current Smoking	Do you now smoke cigarettes every day, some days, or not at all?	Every day, Some days, Not at all, Don't know / Not sure, Refused	Yes (Everyday or day or someday smoker)
Depression	(Ever told) (you had) a depressive disorder (including depression, major depression, dysthymia, or minor depression)?	Yes, No, Don't Know/Not Sure, Refused	Yes (Respondents who answered Yes to the survey question)
Physical Inactivity	During the past month, other than your regular	Yes, No, Don't know/Not Sure,	No (Respondents who answered No to

	job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?	Refused	the survey question)
Midlife Hypertension	Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure?	Yes, Yes, but female told only during pregnancy, No, Told borderline high or pre-hypertensive or elevated blood pressure, Don't know/Not Sure, Refused	Yes (Respondents who answered Yes to the survey question and are between the age groups 5-9 (40-64)). (No: if female is told to have high blood pressure only during pregnancy)
Midlife Obesity	Four-categories of Body Mass Index (BMI)	Underweight Notes: _BMI5 < 1850 (_BMI5 has 2 implied decimal places) Normal Weight Notes: 1850 <= _BMI5 < 2500 Overweight Notes: 2500 <= _BMI5 < 3000 Obese Notes: 3000 <= _BMI5 < 9999 Don't know/Refused/ Missing Notes: _BMI5 = 9999	Obese (Respondants who answered Obese to survey question and are between age groups 5-9 (40-64)).

Appendix Table 2. Summary of Participant Characteristics: Complete Versus Missing Cases

Characteristic	Complete Case N = 100,424[1]	Missing N = 31,032[1]
Age 65 years and older	46,390 (46%)	26,260 (85%)
Sex		
Female	53,807 (54%)	18,714 (60%)
Male	46,617 (46%)	12,318 (40%)
Race/ethnicity		
Non-Hispanic White	77,967 (78%)	22,897 (80%)

Hispanic	8,085 (8.1%)	1,796 (6.3%)
Non-Hispanic Black	6,873 (6.8%)	2,283 (8.0%)
Non-Hispanic Other/Multiracial	7,499 (7.5%)	1,606 (5.6%)
Hearing Loss	11,071 (11%)	4,802 (15%)
Diabetes	16,079 (16%)	8,718 (28%)
Low Education	5,204 (5.2%)	2,077 (6.8%)
Current Smoking	12,204 (12%)	2,118 (7.0%)
Depression	18,959 (19%)	5,898 (19%)
Physical Inactivity	24,962 (25%)	11,536 (38%)
Midlife Hypertension	22,758 (23%)	1,925 (6.3%)

Midlife Obesity	21,564 (21%)	660 (19%)

[1] n (%)

Appendix Table 3. Multiple Imputation Regression Results

Characteristic	Odds Ratio	95% CI
(Intercept)	0.10	0.09–0.11
Male (Ref: No)	1.01	0.93–1.09
Age 65 years and Older (Ref: No)	1.13	1.02–1.25
Race and ethnicity (Ref: Non-Hispanic White)		

Hispanic	0.88	0.76–1.01
Non-Hispanic Black	1.01	0.91–1.14
Non-Hispanic Other/Multiracial	1.18	1.02–1.35
Household Income		
Linear	0.82	0.76–0.88
Quadratic	0.66	0.61–0.71
Cubic	1.06	0.98–1.15
Low Education	1.18	1.03–1.36
Deaf	2.17	1.97–2.39

Diabetes	1.16	1.06–1.26
Current Smoking	1.12	1.01–1.25
Depression	3.86	3.55–4.20
Physical Inactivity	1.25	1.16–1.35
Midlife Hypertension	1.23	1.11–1.37
Midlife Obesity	1.04	0.94–1.16

Abbreviations: CI = Confidence Interval