

## SUPPLEMENTARY METHODS

### *Descriptions of covariates*

In NHANES, demographic and socioeconomic variables included race/ethnicity, classified into five categories (Mexican American, other hispanic, non-hispanic white, non-hispanic black, and other race), sex was classified as female or male, educational attainment categorized into three levels (below high school, completed high school, college or above), and the poverty-income ratio calculated as household income divided by the federal poverty threshold for the respective survey year, serving as a continuous socioeconomic status measure. Behavioral covariates comprised smoking status (never, former, current), alcohol consumption (yes/no based on any self-reported use), and physical activity classified using NHANES criteria into five categories: inactive, moderate only, vigorous only, or both moderate and vigorous. Health status indicators included comorbidities (categorized as yes for presence of  $\geq 1$  condition: hypertension, diabetes, chronic kidney disease, heart failure, stroke, liver disease, rheumatoid arthritis, or cancer; otherwise no) and antidepressant medication use (defined as  $\geq 7$  days of usage for any of eleven specific medications: bupropion, citalopram, desvenlafaxine, duloxetine, escitalopram, fluoxetine, imipramine, nortriptyline, paroxetine, sertraline, or venlafaxine, per NHANES pharmacological protocols). Cardiovascular risk was assessed using the triglyceride-glucose index, a validated surrogate marker for cardiovascular outcomes. Cognitive function was operationalized as self-reported memory deficits, defined by affirmative response to the question regarding being limited due to difficulty remembering or experiencing periods of confusion. Noise exposure metrics included: (1) recreational noise (2015-2016: “outside of a job, have you ever been exposed to very loud noise or music for  $\geq 10$  hours/week?”; 2017-2018: “Have you ever been exposed to very loud noise or music for  $\geq 10$  hours/week for  $\geq 3$  months?”), (2) firearm noise (2015-2018: “Have you ever used firearms for target shooting, hunting, occupational, or military service?”), and (3) occupational noise (consistent definition across 2015-2018: “have you ever had a job requiring exposure to loud sounds ( $\geq 4$  hours/day, several days/week)?”). Systemic Inflammation Response Index, calculated as:  $(\text{neutrophil count} \times \text{monocyte count})/\text{lymphocyte count}$ , using complete blood count data

In Health and Retirement Study and English Longitudinal Study of Ageing, sex was classified as female or male. Educational attainment was categorized into four groups: below high school, high school completion, college or above, and other educational backgrounds. Marital status classification comprised two categories: married or partnered, unmarried and others (never married/separated/divorced/widowed). Household income was stratified into tertiles representing high, medium, and low socioeconomic levels. Smoking status was dichotomized into ever smokers (encompassing both current and former smokers) versus never smokers. Alcohol consumption was similarly dichotomized into ever drinkers versus never drinkers. Hypertension and diabetes status were both classified through binary (yes/no) determinations based on established diagnostic criteria. The cognitive composite score was calculated by summing proportionally weighted deficits-half the number of unrecalled words from a 20-item memory test plus the full count of errors on a 4-item orientation assessment-then dividing this total by 14 to generate a normalized metric (range 0-1) where higher values indicate poorer cognitive function.