The Fatal Conceit? Cognitive Misperception and Mortality among Older Adults in the United States and England

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Abstract

Despite a large body of literature on cognitive ability and health, less is known about the health consequences of biased cognitive perception. Using harmonized and nationally representative longitudinal surveys from the United States and England, we document the growing gap between actual and perceived cognitive ability that appears to increase with age, and construct a standardized measure of cognitive misperception. Linking this novel measure with mortality and disability, we model the cognitive misperception – health gradient. Results show that being in the upper quartile of cognitive misperception (i.e., showing heightened overconfidence in cognition) leads to higher mortality rates within 1 year, 3 years, and 5 years. Conditional on survival, being overconfident in cognition also greatly increases the risks of incident disability and frailty, especially for older adults receiving less family support. We identify two possible pathways inducing poorer outcomes: the first stemming from increased risk taking and financial vulnerability; the second associated with suboptimal use of preventive services and declines in health-promoting behaviors. Given the large and profound impacts of cognitive misperception on older adults' health and well-being, more family and social supports are needed to increase the timely awareness of cognitive decline.

Keywords: Aging; Cognitive Misperception; Overconfidence; Disability; Mortality; Preventive Care; Health Behavior

1. Introduction

Cognitive functioning is critical to health and well-being (Winblad et al. 2016; Chen 2019; Livingston et al. 2020). It influences individuals' ability to process information and to make thoughtful decisions. As population ages, deterioration in cognition, ranging from age-related normal cognitive aging to neurological pathologies, may substantially impact individuals, families, and societies (Liverman, Blazer, and Yaffe 2015; Alzheimer's Disease International 2021). The growing complexity of decision making amid declining health and financial literacy further adds to the vulnerability of older adults (Korniotis and Kumar 2011; Agarwal and Mazumder 2013; Campbell 2016; Finke, Howe, and Huston 2017), who have been increasingly exposed to financial exploitation (e.g., misconduct, fraud) (Hsu and Willis 2013; Egan, Matvos, and Seru 2019; Kim, Maurer, and Mitchell 2021), choices over health insurance plans (Abaluck and Gruber 2011; Bishop, Ketcham, and Kuminoff 2018), clinical decision-making (Fried, Street Jr, and Cohen 2020), and choices over timing of retirement and pension claim (Keane and Thorp 2016). Emerging evidence has linked cognitive decline with poor decision-making, health and financial losses and vulnerability (Widera et al. 2011; Shin 2021; Nicholas et al. 2021).

Despite the growing body of literature on cognitive ability and decision-making (Smith, McArdle, and Willis 2010; Feil, Zhu, and Sultzer 2012; Agarwal and Mazumder 2013), less is known about the impacts and potential consequences of biases in perceived cognitive ability (Roberts, Clare, and Woods 2009). Older adults often overestimate their cognitive abilities, especially for individuals with deteriorated cognitive functioning (Rickenbach, Agrigoroaei, and Lachman 2015; Haavisto 2017). The enlarged discrepancies between actual and perceived cognition statuses may pose profound challenges to wellbeing of the aging population, imposing tremendous family and societal burden.

Cognitive misperception often leads to impaired health and financial decision-making. For example, recent research indicates that the effects of cognition on financial decisions differ notably between actual and perceived cognition. Simultaneously controlling for actual and perceived cognition, the former positively elevates financial wealth, while the latter negatively impacts decisions and well-being (Shin 2021). Other studies document persisting confidence in financial decision-making abilities while financial literacy declines (Finke, Howe, and Huston 2017; Grežo

2020). Some work shows that wealthier older adults with higher initial levels of cognitive ability are more likely to underestimate their cognitive decline and incur financial losses (Mazzonna and Peracchi 2020; Kim, Maurer, and Mitchell 2021), and these decision-makers tend to not seek external help (Von Gaudecker 2015). Cognitive misperception may also harm health-related decision-making, such as through overrating control over health changes, being unaware of or ineffectively preventing chronic diseases, delaying doctor visit, and choosing unhealthy lifestyle (Schwarzer and Fuchs 1996; Radcliffe and Klein 2002; Brewer et al. 2007; Brnstrm and Brandberg 2010; Jessen et al. 2014; Rabin et al. 2015; Centers for Disease Control and Prevention 2019).

While growing evidence begins to link cognitive misperception to various outcomes, we still lack understanding of how the divergence of actual and perceived cognition may vary across subgroups or over the lifespan; how their divergence may vary across countries that tend to place varying levels of cognitive demands on elders; how their divergence may relate to certain health or health-related outcomes and reinforce their health disparities; and how the impact on health and health-related outcomes is associated with the magnitude of the divergence.

Using harmonized and nationally representative longitudinal surveys from the United States and England, this paper first documents their common diverging pattern of perceived and actual cognition over age. We then construct a standardized measure of cognitive misperception and classify populations into four groups ranging from conservative to overconfident. Using both the U.S. and England samples, we document the stylized facts that cognitive overconfidence often concentrates on groups with more disadvantaged sociodemographic characteristics, in particular older adults with lower education, lower cognitive skills, lower income, living without partners, or those who are ethnic/racial minorities.

The analysis then focuses on examining two severe consequences of overestimating cognitive abilities that tend to have on high quality of measures in population surveys, i.e., mortality and disability. Our models estimate that being in the upper quartile of cognitive misperception (i.e., showing overconfidence in cognition) can lead to large increases in mortality rates within 1 year, 3 years, and 5 years in both the United States and England compared to a reference group with no/limited cognitive biases. Conditional on survival, being in the upper quartile of cognitive

misperception also largely increases the risks of incident disability and frailty. These identified effects are more salient for people living alone and receiving less family support. Testing potential mechanisms that may drive effects on mortality and disability, we show that being overconfident in cognition is associated with a wide range of subsequently missed preventive care use and less healthy behaviors; besides, we show that it is associated with more risk-taking attitude and poorer financial health compared to the reference group.

We also provide novel evidence on the gradient relationship between cognitive misperception and health outcomes. Specifically, relative to the 25th-50th percentiles of cognitive misperception (i.e., the reference group), being in the 50th-75th percentiles of cognitive misperception (i.e., showing optimism in cognition) predicts somewhat higher mortality rates and incident disability rates, though imprecisely estimated. In contrast, being in the lower quartile of cognitive misperception (i.e., conservatism in cognition) is associated with reduced mortality rates, especially in the U.S. sample.

This study may add to the literature in three key aspects. First, we offer a standardized measure of cognitive misperception and classify populations by the degree of misperception, which are validated in two countries with similar pattern that can be further generalized to the global scale, via the harmonized HRS family studies. We originally document the enlarging cognitive overconfidence with age and differences across subgroups and countries. Second, we distinguish the effect of underestimating cognitive decline from the cognitive decline itself and quantify the additional health costs in terms of the elevated disability and mortality rates. Third, we are the first to link cognitive misperception with mortality and disability outcomes, and additional tests are performed on preventive care utilization, healthy behaviors, risk taking and financial vulnerability to enrich our understanding of the range of health consequences of cognitive misperception and potential channels.

The remainder of this paper is organized as follows. Section 2 introduces data, measures and empirical model. Section 3 presents the baseline results and effect heterogeneity, and discusses the potential mechanisms. Section 4 concludes and discusses potential policy implications.

2. Data and Methods

2.1 The HRS and ELSA

Data are obtained from two comparable cohort studies conducted in the United States and England, including Health and Retirement Study (HRS) and English Longitudinal Study of Aging (ELSA).

The HRS is a nationally representative longitudinal survey of Americans aged 50 and older. The survey is fielded biannually from 1992 to 2020, which collects comprehensive information on demographics, health status, health care utilization, functional limitation, cognition, income, wealth and other important domains. The sample size for each round is about 20,000. The ELSA is a comparable version of HRS that surveys a representative sample of more than 10,000 people aged 50 and older in England. The survey elicits similar information as the HRS and is conducted every two years from 2002 to 2019.

We use harmonized data from the RAND HRS files and ELSA files. Data and variables are constructed in a harmonized way to facilitate comparability. To obtain consistent time frames and age profiles, we confine our samples to older adults aged 60 and older who are surveyed in either nine waves (2002-2018) of HRS or nine waves (2002-2019) of ELSA. The sample selection process is illustrated in Figure 1.

[Figure 1 about here]

2.2 Subjective and Objective Cognition

Methods of cognitive assessments are highly consistent between the HRS and ELSA. In specific, subjective cognition is measured by self-rated memory, where the respondents are asked to rate their memory on a five-point Likert scale as either “Excellent” (1), “Very Good” (2), “Good” (3)

"Fair" (4), or "Poor" (5), at the time of interview. We reverse-code the measure so that higher scores indicate better subjective cognition from poor (0) to excellent (4)[1].

Objective cognition is assessed by two tests of working memory. In the survey, a word recall list of 10 words were read to the respondent once, and the respondent is asked to recall as many words as possible immediately (immediate word recall, 0-10) and again after a delay of about 5 minutes (delayed word recall, 0-10). The tests are similarly performed in the HRS and ELSA (Langa et al. 2020). We count the total number of words that are recalled correctly in the two tests as a summary score of memory performance, ranging from 0-20.

Notably, subjective and objective cognition shows divergent patterns in our data. Figure 2 presents the trajectories of subjective and objective cognition across ages in HRS and ELSA, where we calculate the percentage of cognition each age cohort has relative to the average level at age 60. Although the objective cognition declines markedly with age, the subjective cognition remains quite stable, leading to increasingly enlarged gaps between self-perceived and objectively assessed cognition. The diverging patterns are similar between two countries, especially after age 70, suggesting potential misperception older adults might have about their cognition.

[Figure 2 about here]

2.3 Cognitive Misperception

To make valid comparison between subjective and objective cognition, we standardized the cognitive scores following a z-score type calculation using the mean and standard deviation at age 60 as benchmark. The calculating equations are specified as follows,

$$Z_Sub_i = \frac{SubC_i - \widehat{\overline{SubC_{60}}}}{\hat{\sigma}[SubC_{60}]}$$

[1] It should be noted that, although the subjective cognition is asked every wave from 2002 to 2018 in HRS, the measure is only available from 2002 (wave 1) to 2008 (wave 4) and from 2014 (wave 7) to 2019 (wave 9) in ELSA.

$$Z_Obj_i = \frac{ObjC_i - \widehat{\overline{ObjC_{60}}}}{\hat{\sigma}[ObjC_{60}]}$$

where $SubC_i$ (subjective cognition) and $ObjC_i$ (objective cognition) are the cognitive scores of individual i has at the time of measurement. $\widehat{\overline{SubC_{60}}}$ and $\widehat{\overline{ObjC_{60}}}$ are the sample mean of cognition for cohorts of age 60; and $\hat{\sigma}[SubC_{60}]$ and $\hat{\sigma}[ObjC_{60}]$ are the standard deviation of cognition for cohorts of age 60. Accordingly, Z_Sub_i and Z_Obj_i respectively capture the number of standard deviations by which the values of individual subjective and objective cognitive scores are above or below the average levels measured at age 60[2].

Figure 3 displays the trajectories of subjective and objective cognition over age relative to the average levels at age 60 using standardized scores. The divergent trends between these two measures are even more evident after standardization, where we find salient gaps especially among older ages.

[Figure 3 about here]

To formally quantify the cognitive gaps at the individual level, we derive it as the difference between the standardized subjective (Z_Sub_i) and objective cognition (Z_Obj_i),

$$CogGap_i = Z_Sub_i - Z_Obj_i$$

where a positive cognitive misperception exists when $CogGap_i > 0$, indicating an individual tends to overestimate his/her cognition; whereas a negative cognitive misperception exists when $CogGap_i < 0$, indicating an individual tends to underestimate his/her cognition.

The distributions of cognitive misperception are presented in Figure 4. To better conceptualize the cognitive misperception, we stratify sample based on the quartiles of cognitive gaps. Specifically, the second quartile is defined as reference group because the cognitive gap in this group is very small and the average level is close to 0 ($CogGap_i \approx 0$). Besides, the first quartile is defined as

[2] Using 60 as the benchmark can increase the comparability between the two datasets with different age profiles. Besides, since 60 is the youngest cohort in our sample with the best cognitive abilities, using it as the benchmark can help us better characterize the declining trends of cognition over age.

"Conservative", as the respondents tend to underestimate their cognition ($CogGap_i < 0$); and the third quartile is defined as "Optimistic" as the respondents tend to overestimate their cognition ($CogGap_i > 0$). Lastly, we define the fourth quartile as "Overconfident" as the respondents greatly overestimate their cognitive performance ($CogGap_i \gg 0$).

[Figure 4 about here]

Figure 5 further illustrates the distributions of subjective and objective cognition across four groups. We find that the cognitive misperception is particularly salient in overconfident group. Although objective cognition centers around poor or fair (lower tail) of the distribution, most of the respondents perceive their cognition as good, very good or excellent. In comparison, the average level of cognitive misperception is minimal in the reference group, where the distributions of subjective and objective cognition largely overlap with each other. The patterns are fairly consistent between the two datasets.

[Figure 5 about here]

2.4 Disability and Mortality

Disability. Disability is assessed using activities of daily living (ADL), instrumental activities of daily living (IADL), and frailty, which are demonstrated comparable across the US and England (Choi et al. 2022). Activities of daily living (ADL) assesses whether individuals have any difficulties with completing the daily tasks of bathing, dressing, eating, getting in/out of the bed and walking across a room (0/1). Instrumental activities of daily living (ADL) assesses whether individuals have any difficulties with completing the daily tasks of using the phone, managing money, taking medications, shopping for groceries, and preparing hot meals (0/1). ADL and IADL are available at each wave from 2002 to 2018 in HRS, and from 2002 to 2019 in ELSA. Besides, we make use of the functional measures taken in the enhanced face-to-face interviews of HRS and ELSA, and construct frailty index based on gait speed, grip strength, exhaustion, physical activities, and weight loss. Individuals with the highest quartile of frailty index are defined as being "frail" (0/1). Detailed construction methods and validation of frailty index can be found elsewhere (Wu

et al. 2018). For each individual, valid frailty measure is available every other wave from 2006 to 2018 in HRS and from 2008 to 2016 in ELSA.

To ensure the temporality of the outcomes, we focus on incident ADL, IADL disability and frailty. Specifically, for each wave, we assess whether individuals with nondisabled status in the current wave transits to disabled in the next wave. This largely reduces the possibility of reverse causality, and facilitate causal interpretation of the results.

Mortality. Mortality data in the HRS are taken from exit interviews or partner's core interviews, and detailed death information are available from 2002 to 2018. In ELSA, the mortality data are obtained from end-of-life interviews, and death information are only available from 2002 (wave 1) to 2012 (wave 6). For each wave, we examined 1-year mortality, 3-year mortality, and 5-year mortality from the time of interview[3].

2.5 Empirical Model

Linear probability model is used to estimate the effects of cognitive misperception on disability and mortality. The regression model is specified as follows,

$$Y_{it} = \alpha + \beta_1 Conserv_{it} + \beta_2 Optim_{it} + \beta_3 Overconf_{it} + \gamma X_i + \delta Z_{it} + \epsilon_{it}$$

where Y_{it} represents binary outcomes including mortality and incident disability. Mortality measures whether individual i decease in 1 year, 3 year, and 5 year from the time of interview at wave t; and incident disability measures whether individual's disability status transits from nondisabled to disabled between waves t and $t+1$. The $Conserv_{it}$, $Optim_{it}$, $Overconf_{it}$ are the main variables of interests, where $Conserv_{it}$ takes value one if individual i is classified as *conservative* at wave t ($CogGap_{it} < 0$) and zero otherwise, $Optim_{it}$ takes value one if individual i is classified as *optimistic* at wave t ($CogGap_{it} > 0$) and zero otherwise, and $Overconf_{it}$ takes value one if individual i is classified as *overconfident* at wave t ($CogGap_{it} \gg 0$) and zero

[3] We ensure enough follow-up periods for the mortality outcomes. For example, for 5-year mortality, since the latest death information is in 2018, we only use the interviews that are taken before 2013 to ensure there are at least 5 years of follow-up periods.

otherwise. The omitted reference group contains individuals who have minimal cognitive misperception and are classified as *reference* at wave t ($CogGap_{it} \approx 0$). X_i is a vector of time-invariant covariates including sex, race/ethnicity, and education. Z_{it} represents a comprehensive set of time-varying covariates including age, marital status, income, retirement status, insurance coverage, depressive symptoms, number of chronic diseases, and number of children. β_1, β_2, and β_3 are parameters of interest, which respectively capture the effects of being cognitively conservative, optimistic, or overconfident on the probability of outcomes relative to being neutral.[4]

3. Results

3.1 Descriptive Statistics

A total of 23,760 persons (106,046 person-waves) and 12,701 persons (40,853 person-waves) age 60 and older are respectively identified from the HRS and ELSA (Figure 1). The average age (SD) of the samples is 72.0 (8.4) for HRS and 71.1 (7.8) for ELSA.

Older adults on average tend to overestimate their cognitive performance, with level of cognitive misperception being 0.2 in HRS and 0.4 in ELSA. The misperception is especially salient in the overconfident group, which is above 2.0 in both samples. In particular, while the overconfident samples tend to perform badly in their cognitive tests, almost none of them perceive their cognition as "poor". Instead, the majority of samples believe they have "very good" or "excellent" cognition (61.8% in HRS and 52.3% in ELSA), demonstrating a great amount of misperception and overestimation of cognitive performance.

Moreover, we find that adults who are older, male, non-white, less-educated, retired, and those who have lower income, less private insurance coverage and not living with partners are more likely to overestimate their cognitive performance.

[Table 1 about here]

[4] The results are fairly robust to the further control of survey year fixed effects.

[Table 2 about here]

As for health outcomes, summary statistics suggest that the disability and mortality rates are higher for people with cognitive misperception, and are extremely high among overconfident samples (Table 1 and Table 2). Figure 6 further visualizes the pattern in the raw data, where we observe clear and marked "jumps" in mortality and disability rates from optimistic samples to overconfident samples.

[Figure 6 about here]

3.2 Cognitive Misperception and Mortality

Figure 7 presents the regression results showing the impacts of cognitive misperception on mortality. We find that being cognitively overconfident (in the 75^{th}-100^{th} of cognitive misperception) have huge positive effects on mortality. In particular, we find that cognitive overconfidence respectively leads to 1.2 percentage points (pp) (or 53%), 3.5 pp (or 42%), and 5.3 pp (or 34%) increase in the probability of mortality in 1 year, 3 years, and 5 years among HRS samples. Similar patterns are also observed in ELSA, where the overconfident group have 0.5 pp (or 43%), 0.8 pp (or 35%), and 1.6 pp (35%) higher mortality rates compared to the reference group. Moreover, there is a gradient relationship between cognitive misperception and mortality. Relative to the reference group, being optimistic in cognition predicts somewhat higher mortality rates. In contrast, being in the lower quartile of cognitive misperception (conservative) is associated with reduced mortality rates, especially in the U.S. sample.

[Figure 7 about here]

3.3 Cognitive Misperception and Disability

The patterns are highly consistent for disability. Specifically, we find strong and significant impact of cognitive overconfidence, but small impacts of being conservative and optimistic on disability

(Figure 8). Relative to the reference group, cognitive overconfidence results in 1.8 pp (or 19%), 2.5 pp (or 28%), and 3.2 pp (or 18%) higher probability of incident ADL disability, IADL disability and frailty among HRS samples. As for ELSA samples, the effect sizes of overconfidence are also large (1.8 pp or 17% for ADL; 1.8pp or 25% for IADL; and 3.2 pp or 20% for frailty), though the estimates are only significant at 5% level for incident ADL and IADL disability.[5]

[Figure 8 about here]

3.4 Heterogeneous Effects

The descriptive patterns motivate us to further test the heterogeneous effects of overconfidence among older adults with different levels of vulnerability. As older adults with inadequate family support and interaction are less likely to be aware their actual cognitive performance (see the distributional evidence in Appendix Figure A1 and A2), we hypothesize that the impact of overconfidence can be more salient among people living alone and with less supports from spouse. To do so, we estimate the effects of overconfidence respectively for subsamples stratified by living arrangement and access to spousal support.

As shown in Figure 9, relative to people who live with others, the effects of overconfidence on mortality and disability are consistently larger among people living alone. The differences in effect sizes are more evident in HRS than ELSA. Notably, overconfidence can result in twice as large increase in 1-year mortality (2.1pp vs. 0.9pp), 3-year mortality (5.1pp vs. 2.9pp), 5-year mortality (7.7pp vs 4.3pp), incident ADL (2.7pp vs. 1.5pp), and incident IADL (3.6 pp vs. 2.1 pp) for people of older ages than younger ages in the HRS sample.

[Figure 9 about here]

Similarly, compared to those with spousal support, the effect of overconfidence are larger for people without access to spousal support (Figure 10). These findings hence overall suggests that

[5] Given the large effect size and particularly wide confidence intervals, the insignificance of the effects for incident frailty may result from the limited sample size.

family interaction and spousal support may help to alleviate or buffer against the negative impact of overconfidence.

[Figure 10 about here]

3.5 Potential Mechanisms

The analysis above demonstrates strong and consistent effects of cognitive misperception on mortality and disability. Since subjective and objective cognition and their interactions are pivotal for decision-making, we hypothesize that cognitive misperception may greatly influence individuals' health investment and decisions and their abilities to perform healthy behaviors, thereby resulting in bad health outcomes. Additionally, as emerging evidence highlights the possible linkage between cognitive (mis)perception and financial well-being, we hypothesize that individuals who are cognitively overconfident are more likely to be risk-taking and have poorer financial health, which may limit their potential for health investments. To explore the underlying mechanisms, we estimate the impacts of cognitive misperception on preventive care utilization, health behaviors, risk taking and financial health; all of which are critical for individuals' health development.

The results for preventive care utilization are presented in Figure 11. We find that cognitive overconfidence leads to large and significant reduction in preventive care utilization. In the US samples, people who are overconfident in cognition have 3.5 pp (or 4.8%), 3.3 pp (or 4.4%), 3.3 pp (3.8%) or 3.3 pp (or 5.2%) lower probability of utilizing mammogram, prostate test, cholesterol test, and dental services. By contrast, the effects are small and insignificant for conservative and optimistic groups. We also find some supporting evidence in the ELSA, where the cognitive overconfidence leads to 2.1 pp (or 2.1%) decrease in mammogram use.

[Figure 11 about here]

The patterns are similar for health behaviors. Figure 12 indicates that the effects of cognitive misperception are largest and most salient among overconfident group. It can lead to 2.3 pp (or

4.7%), 3.5 pp (or 6.5%) 2.7 pp (or 3.3%) reduction in moderate physical activities, light physical activities and smoking cessation, while 1.6 pp (16 %) increase in smoking among US older adults. Besides, the effects of overconfidence are even larger in England, with the effect size being 5.0 pp (or 8.4%), 3.7 pp (or 4.8%), 5.1 pp (6.0%), and 3.5 pp (34 %) for moderate and light physical activities, smoking cessation, and smoking. Moreover, we find some gradient relationship between cognitive misperception and health behaviors, which is also consistent with the findings of disability and mortality. These results suggest that the decrease in preventive care utilization and healthy behaviors can be potential mechanisms through which the cognitive misperception and overconfidence negatively affect disability and mortality.

[Figure 12 about here]

As for financial outcomes, we examine respondents' financial health and risk attitudes. Specifically, three key aspects of financial health for older adults are examined, including emergency funds adequacy, retirement adequacy and financial solvency. Emergency funds adequacy is measured by respondent's liquidity ratio, which is the ratio of total cash equivalents and monthly gross income. The variable is defined as 1 if the liquidity ratio ≥ 3 (the cash-equivalent is enough to cover roughly three months of expenses) and 0 otherwise. Retirement adequacy is measured by respondent's capital accumulation ratio, the ratio of household's total investment assets and household's net worth. The variable is defined as 1 if the capital accumulation ratio ≥ 0.25 and 0 otherwise. Financial solvency is measure by respondent's debt-to-asset ratio, the ratio of respondent's liabilities and total assets. The variable is defined as 1 if the debt-to-asset ratio ≤ 0.70 (i.e., financial solvent), and 0 otherwise. As shown in Figure 13, being cognitively overconfident has significant negative impact on these outcomes. In the US, it is associated with 2.9 pp (7.5%), 3.6 pp (8.1%), 0.5 pp (0.6%) lower likelihood of emergency funds adequacy, retirement adequacy, and financial solvency. In the England, overconfidence is associated with 3.8 pp (6.5%) decline in emergency funds adequacy, 1.9 pp (7,9%) decline in retirement adequacy. These results overall support our hypothesis that cognitive overconfidence may lead to poorer financial health.

On the other hand, we examine the effect of cognitive misperception on respondent's risk attitude (Figure 13). In the survey, respondents were asked to rate themselves from 0 (not at all willing to take risks) to 10 (very willing to take risks). The variable is defined as 1 if the respondent is inclined to be risk taking (the fourth quartile) and 0 otherwise. In the US, we find a clear gradient relationship between cognitive misperception and risk attitudes. Relative to the reference group, people who are more conservative in cognition are indeed more risk averse. By contrast, those who are more cognitively optimistic and overconfident are more likely to be risk taking, and the effect is the larger for overconfident group. In the England, the gradient seems to be less evident, probably due to the limited sample size for this measure. Nevertheless, we still observe similar patterns for these groups, which indicates the common trends/relationships between cognitive misperception and risk attitudes.

[Figure 13 about here]

Furthermore, we test the mechanisms across subsamples to see whether the patterns of health decision-making are consistent with the results of disability and mortality. Specifically, we predict that the effects of overconfidence should be larger among people living alone and without spouse so as to induce bigger impacts on disability and mortality. Indeed, the results presented in Figure A3 (stratified by living arrangement) and A4 (stratified by access to spousal support) to some extent support our prediction. The effects of overconfidence on mechanism variables are relatively larger among people of greater vulnerability, especially for financial health. The consistent findings in entire samples and subsamples among two countries, therefore, shed light on the important roles of health decision-making and behaviors in forming the link between cognitive misperception and disability and mortality.

4. Discussion and Conclusions

Using nationally representative samples in the United States and England, we document the alarmingly divergent trajectories of actual and perceived cognition as population ages. Moreover, we construct a standardized measure to quantify the cognitive misperception and classify

populations by the degree of misperception. We show that being overconfident in cognition greatly increase mortality and incident disability in both countries, and the impacts are more salient for people living alone and receiving less family support. Besides, we demonstrate that the impacts of cognitive misperception can be potentially explained by their negative influences on health decision-making, such as preventive care utilization and health behaviors, as well as more risk taking and financial vulnerability.

Several limitations need to be addressed in future studies. First, while the temporal linkage between cognitive misperception and subsequent disability and mortality can alleviate some of the concern over reverse causality, the causal interpretation of the results may not be reached due to the observational nature of the study. Future studies may leverage quasi-experimental design to understand how the changes in cognitive misperception may affect health decision-making, and consequently impact major health outcomes. Second, our mechanism testing may benefit from further investigations on other potential channels and factors. For example, cognitive misperception may affect individuals' decisions of health insurance enrollment, choices of care providers, and their abilities to seek high-value health services. Administrative data may be linked to the survey to facilitate the investigation. Third, our current analysis demonstrates largely consistent relationship between cognitive misperception and subsequent disability and mortality for the U.S. and UK. Cross-national comparisons with more countries involved may help generalize our findings. Fourth, our findings of differential effects by availability of family support prompt us to explore the role of supportive in-home programs in various contexts as well as their interactions with forms of multi-generational family support. Finally, future work will examine the nature of cognitive misperception. Our current measure hinges on the memory metric, while it remains to be understood improvements over what other aspects of self-assessments may have great potential to reshape health and well-being.

Despite these limitations, our study highlights the profound impacts of cognitive misperception and overconfidence on health and health decision-making. Our findings stress the importance of promoting regular assessment of cognitive abilities among older adults to improve the accuracy of their perceived cognitive abilities and encourage them to seek help and advice for decision-making.

This is in line with the U.S. Healthy People 2030 blueprint that calls for increased memory diagnosis and awareness, encouraging older adults to discuss their memory issues with their health care professionals. As cognitive overconfidence may motivate inappropriate use of heuristics in decision making, lowering information processing accuracy, interventions aimed at moderating overconfidence among older adults who underestimate their deteriorated cognition may promote their delegation of important decisions to those who trust (Besedeš et al. 2012; Hsu and Willis 2013; Kim, Maurer, and Mitchell 2021). Our findings also suggest that older adults overly optimistic about their declining cognitive functioning may bear grave health consequences in the following years. More support from families, communities, and the healthcare system should be provided, with a special focus on the disadvantaged populations.

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Figure 1. Flow chart of sample selection process

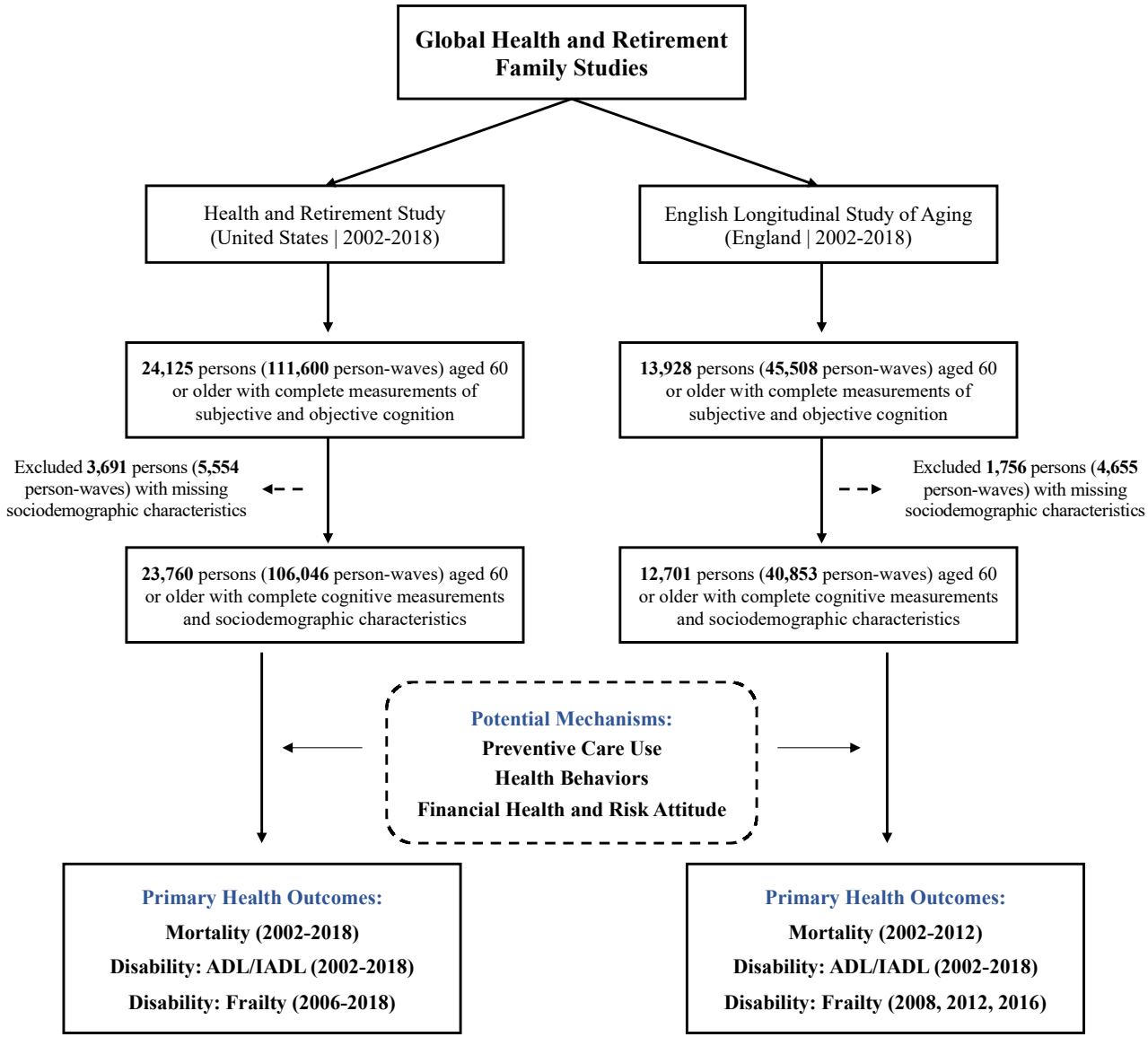
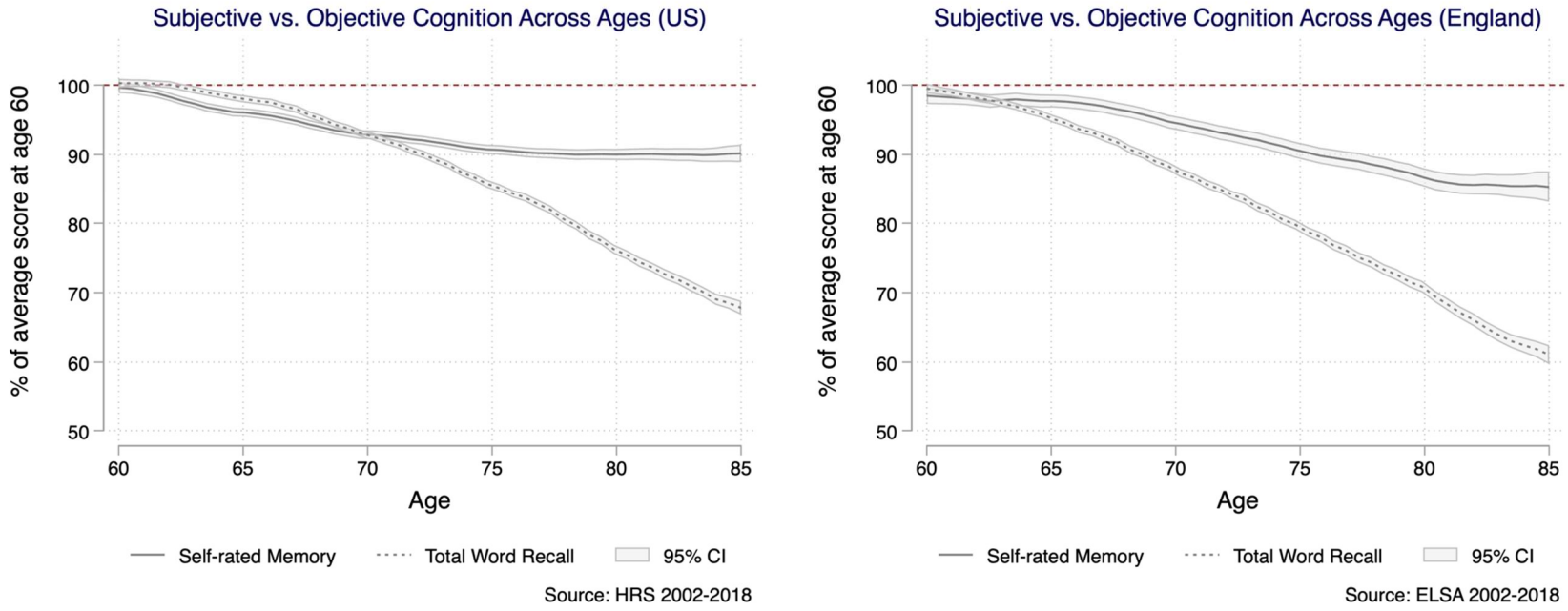
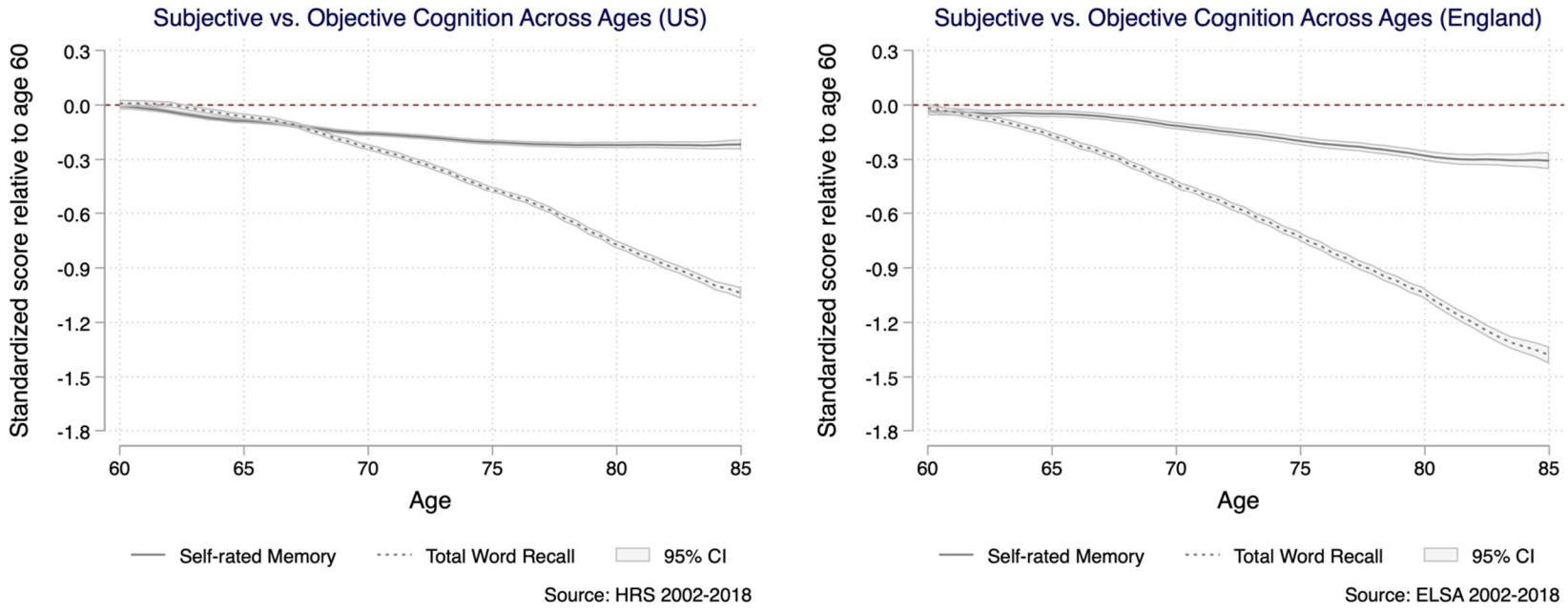


Figure 2. Trajectories of subjective and objective cognition across age



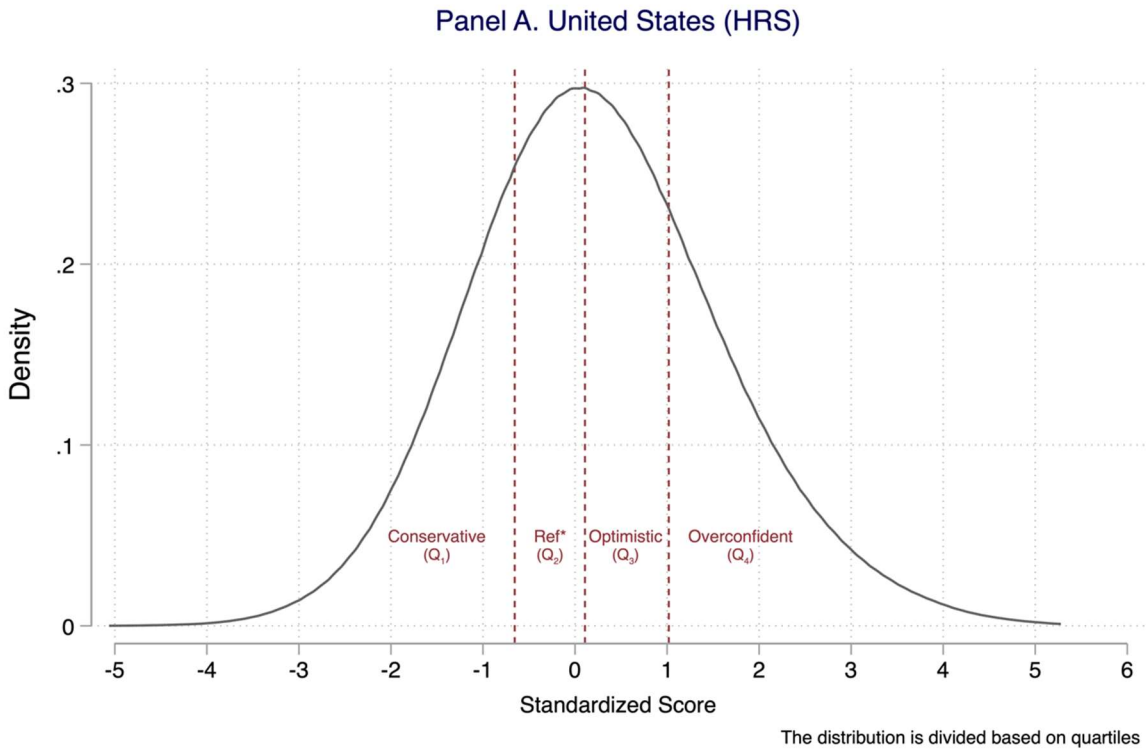
Notes: The figure represents the trajectories of subjective and objective cognition over age relative to the average level at age 60. For each age cohort (age as the time of interview), we calculate the percentage of cognitive levels people on average have relative to the average levels at age 60. The data are pooled over the study periods. The lines are fitted using local moving average.

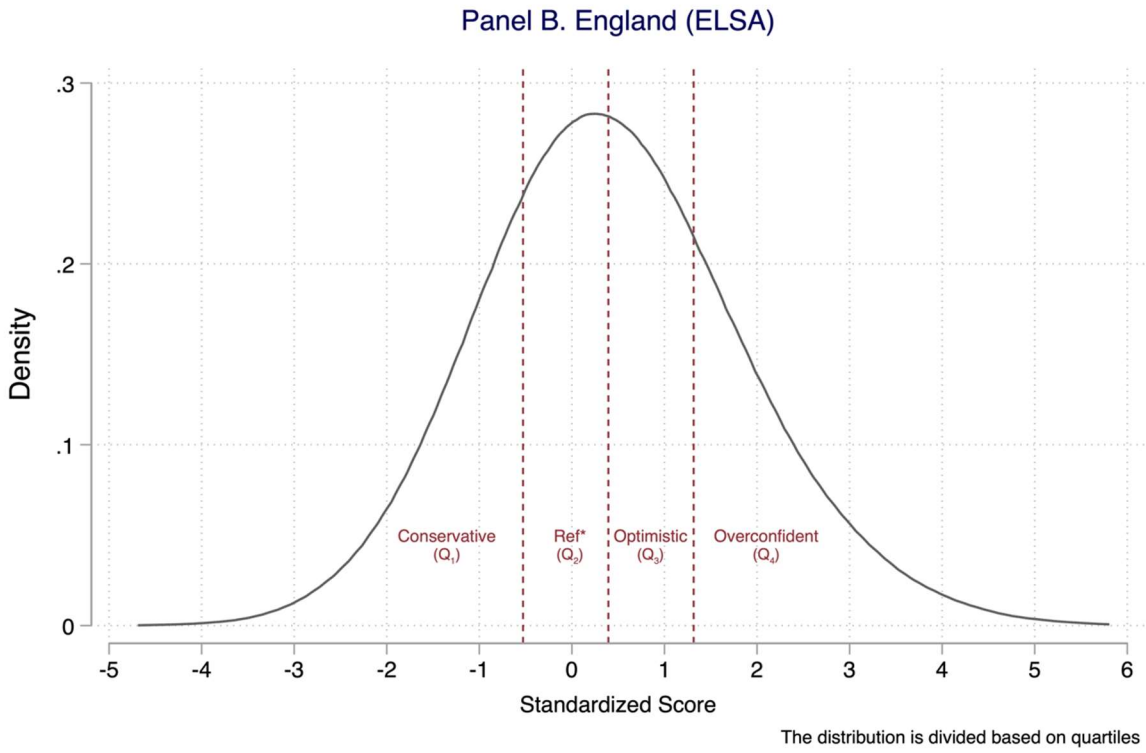
Figure 3. Trajectories of standardized subjective and objective cognition across age



Notes: The figure represents the trajectories of subjective and objective cognition over age using the standardized scores. The cognitive scores are standardized using the mean and SD measured at age 60; and for each age cohort (age as the time of interview), we calculate the average levels of standardized cognitive scores. The data are pooled over the study periods. The lines are fitted using local moving average.

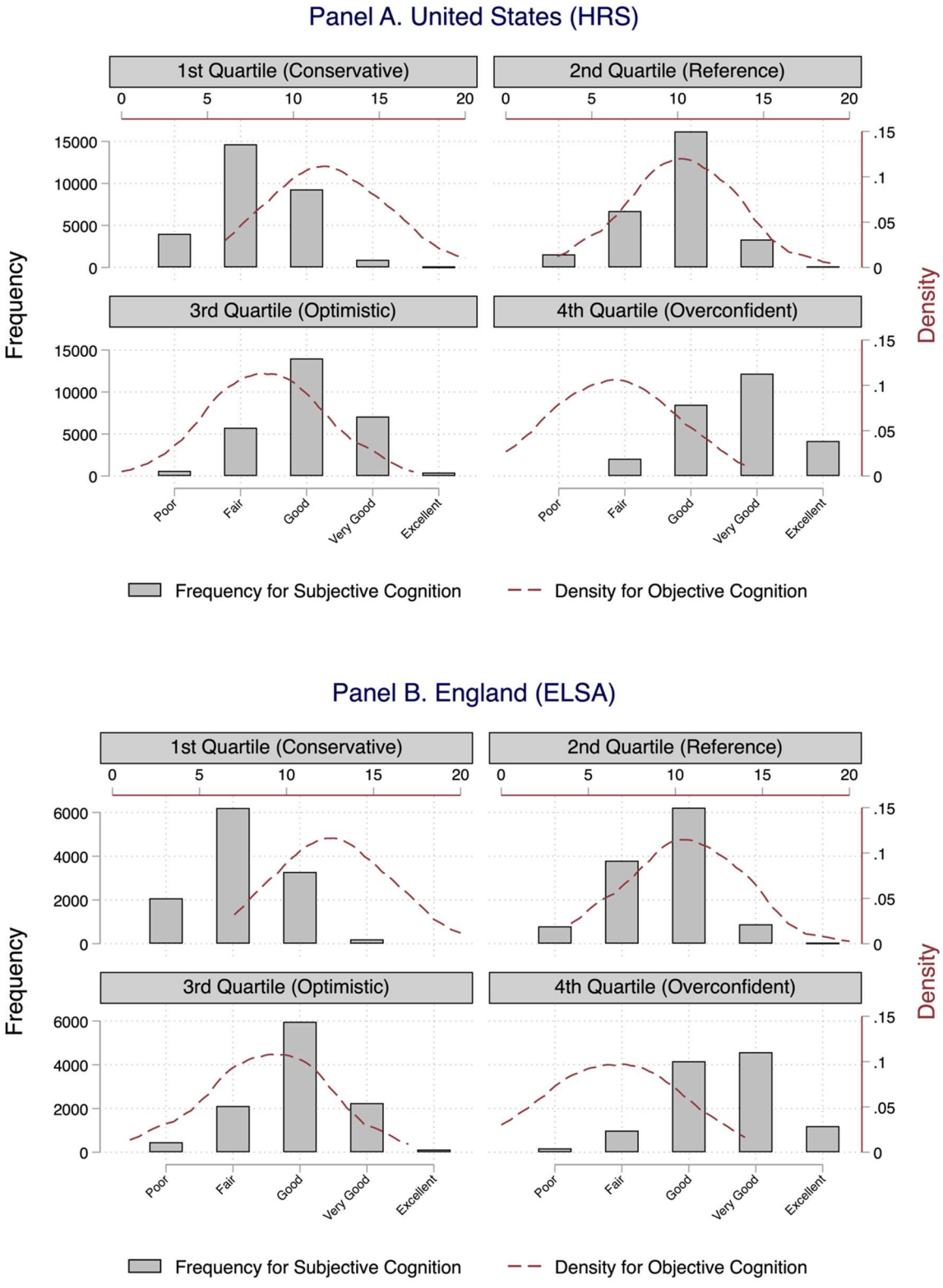
Figure 4. Distributions of standardized cognitive misperception between subjective and objective cognition





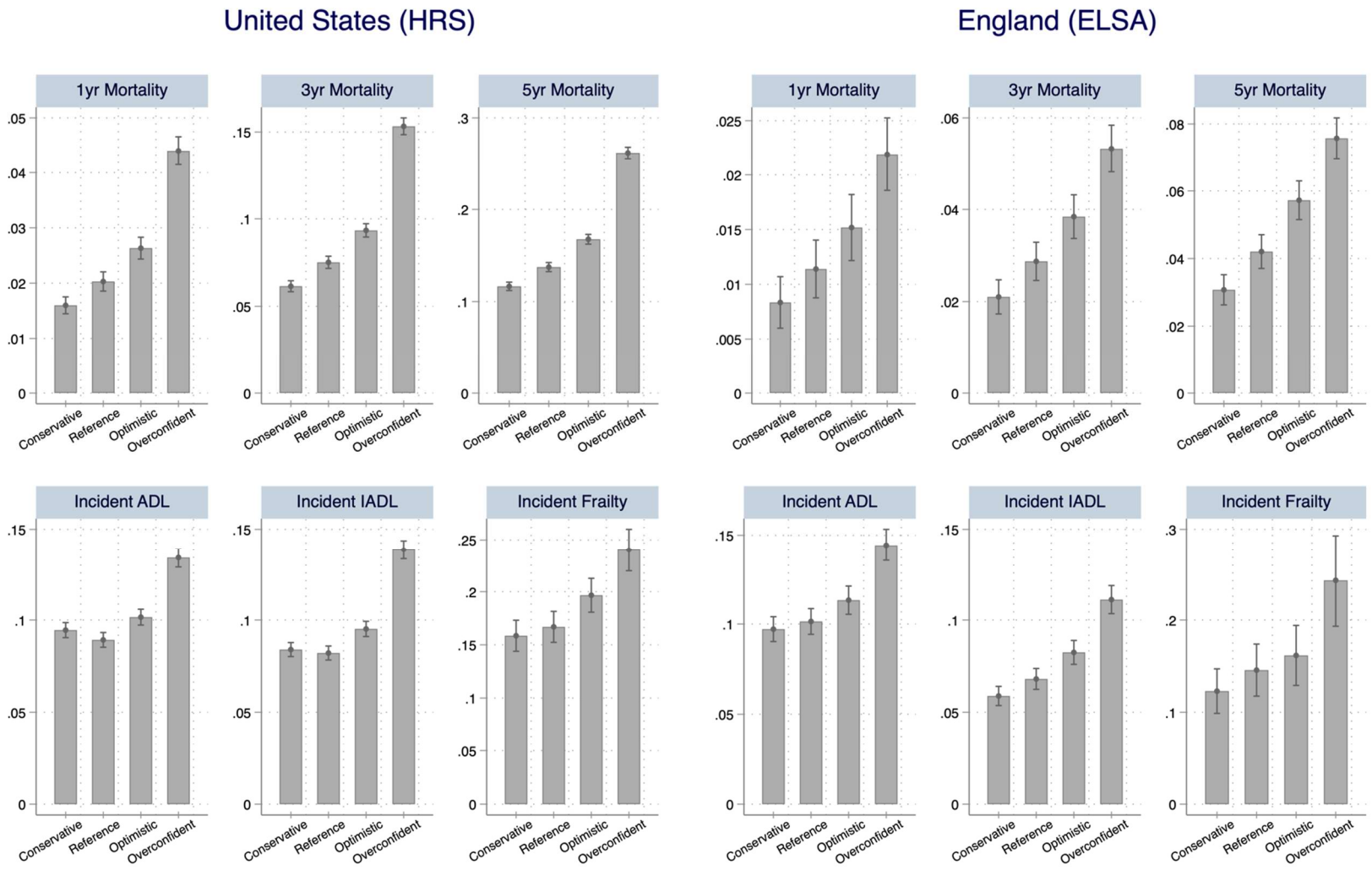
Notes: This figure plots the kernel densities of standardized cognitive misperception between subjective and objective cognition for HRS (Panel A) and ELSA (Panel B). Positive score indicates overestimation of cognitive performance, while negative scores indicating underestimation. Based on the quartiles of cognitive misperception, we use vertical dotted lines (in red) to stratify the distributions into four sections, including conservative (1^{st} quartile), reference (2^{nd} quartile), optimistic (3^{rd} quartile) and overconfident (4^{th} quartile). The classification is performed respectively for the two datasets.

Figure 5. Distributions of subjective and objective cognition by quartiles of cognitive misperception



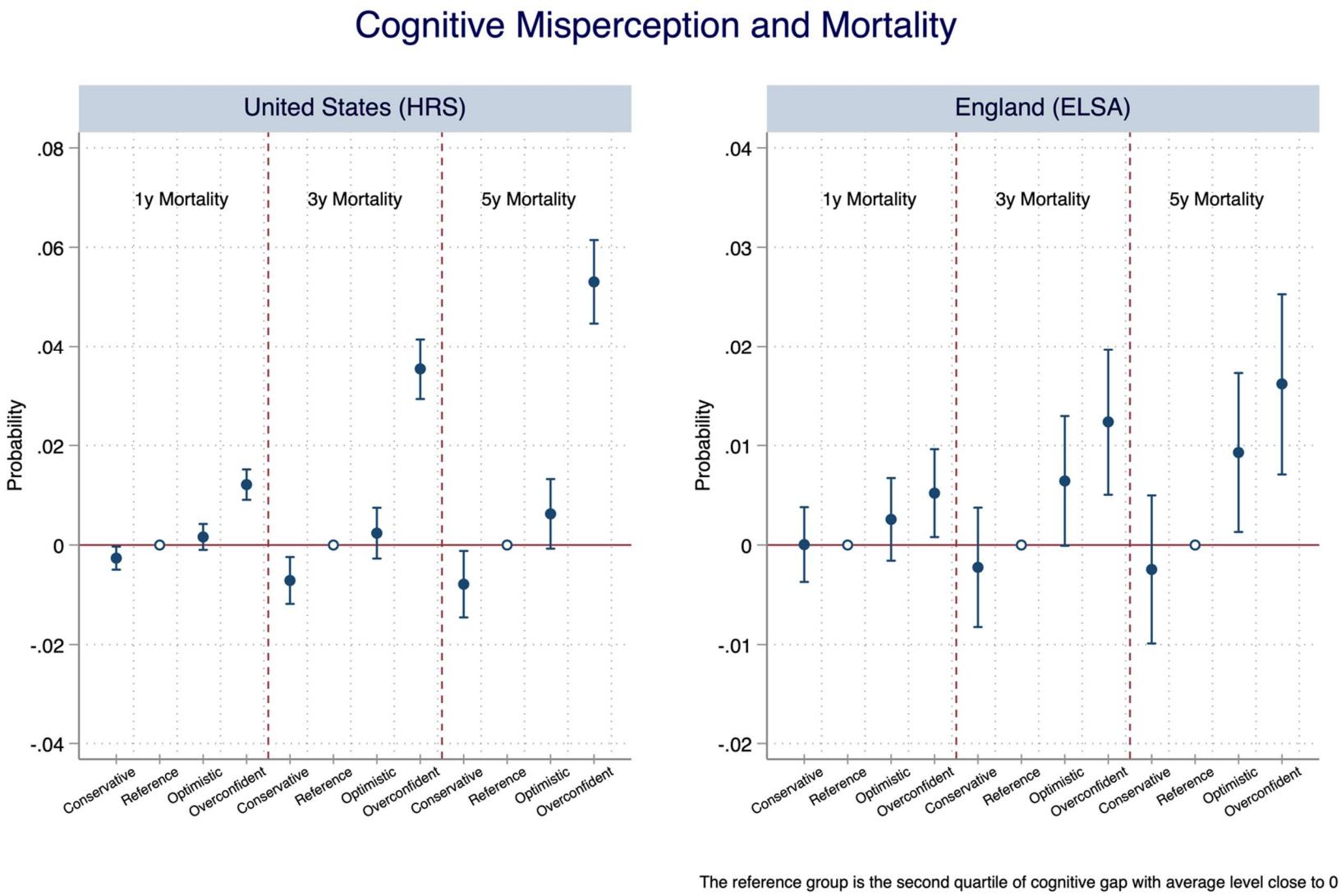
Notes: This figure plots the distributions of subjective and objective cognition by the quartiles of cognitive misperception, where Panel A shows the distributions for HRS samples while Panel B shows those for ELSA samples. Based on the quartiles of cognitive misperception, we stratify the distributions into four groups, including conservative (1^{st} quartile), reference (2^{nd} quartile), optimistic (3^{rd} quartile) and overconfident (4^{th} quartile). The classification is performed respectively for the two datasets. The red curves denote the kernel density of objective cognition in each group, and the gray bars show the distribution of subjective cognition in frequency.

Figure 6. Mortality and disability by quartiles of cognitive misperception



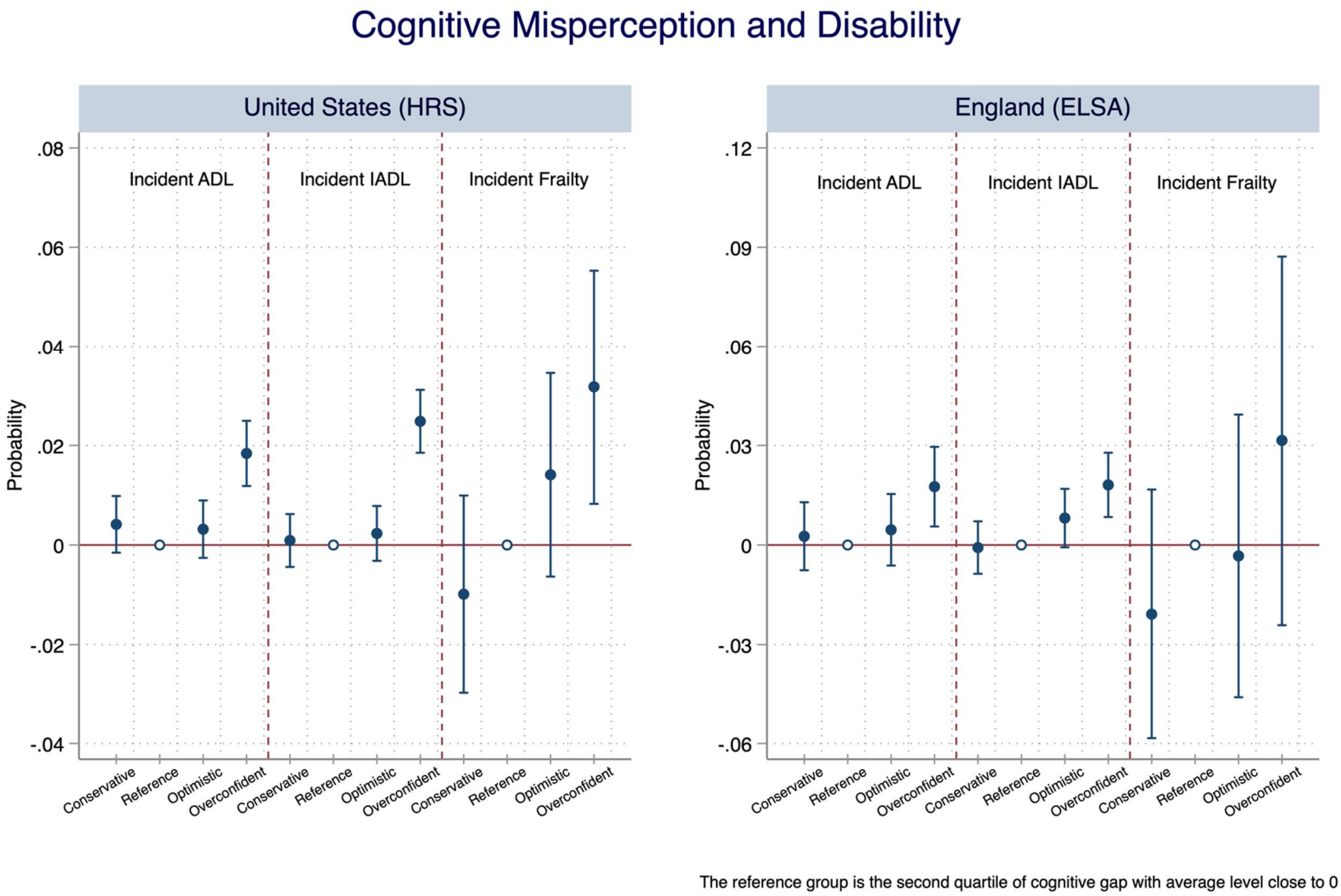
Notes: This figure illustrates the mortality and disability by quartiles of cognitive misperception for HRS and ELSA samples. The gray bars show the average level of mortality/disability in each group, with vertical lines denoting 95% confidence intervals. Abbreviations: ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living.

Figure 7. Cognitive misperception and mortality



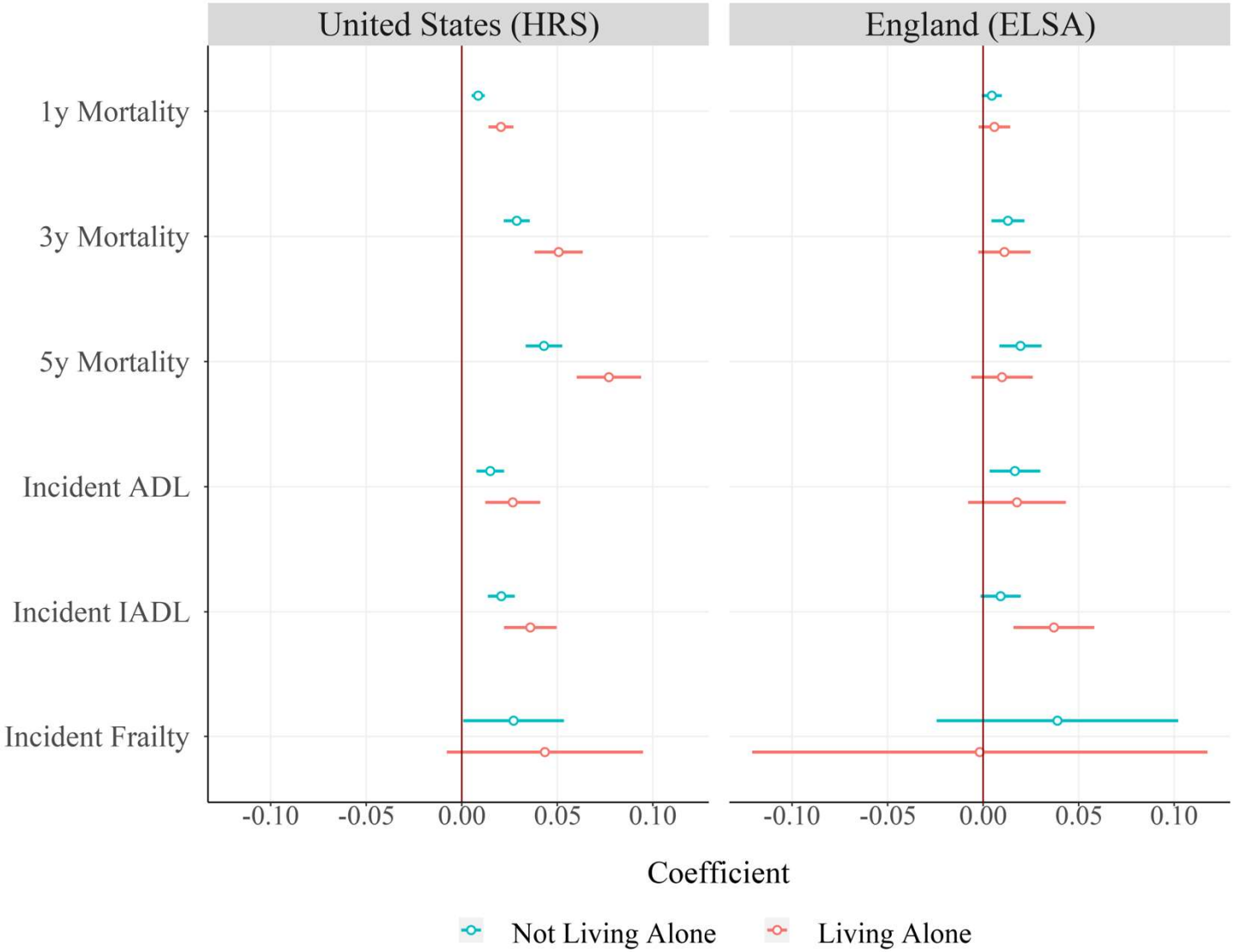
Notes: This figure illustrates the regression results quantifying the impacts of cognitive misperception on mortality for HRS and ELSA samples. The reference group is the second quartile of cognitive gap with average level of misperception close to 0. Blue circles represent the coefficient estimates for the group with notable misperception, either conservative, optimistic, or overconfident, relative to the reference, and the vertical lines represent 95% confidence interval. The regression models control for time-invariant characteristics including sex, race/ethnicity, and education, as well as time-varying characteristics including age, marital status, income, retirement status, insurance coverage, depressive symptoms, number of chronic diseases, and number of children. Standard errors are robust and clustered at the individual level. Full regression estimates are presented in Appendix Table A1.

Figure 8. Cognitive misperception and disability



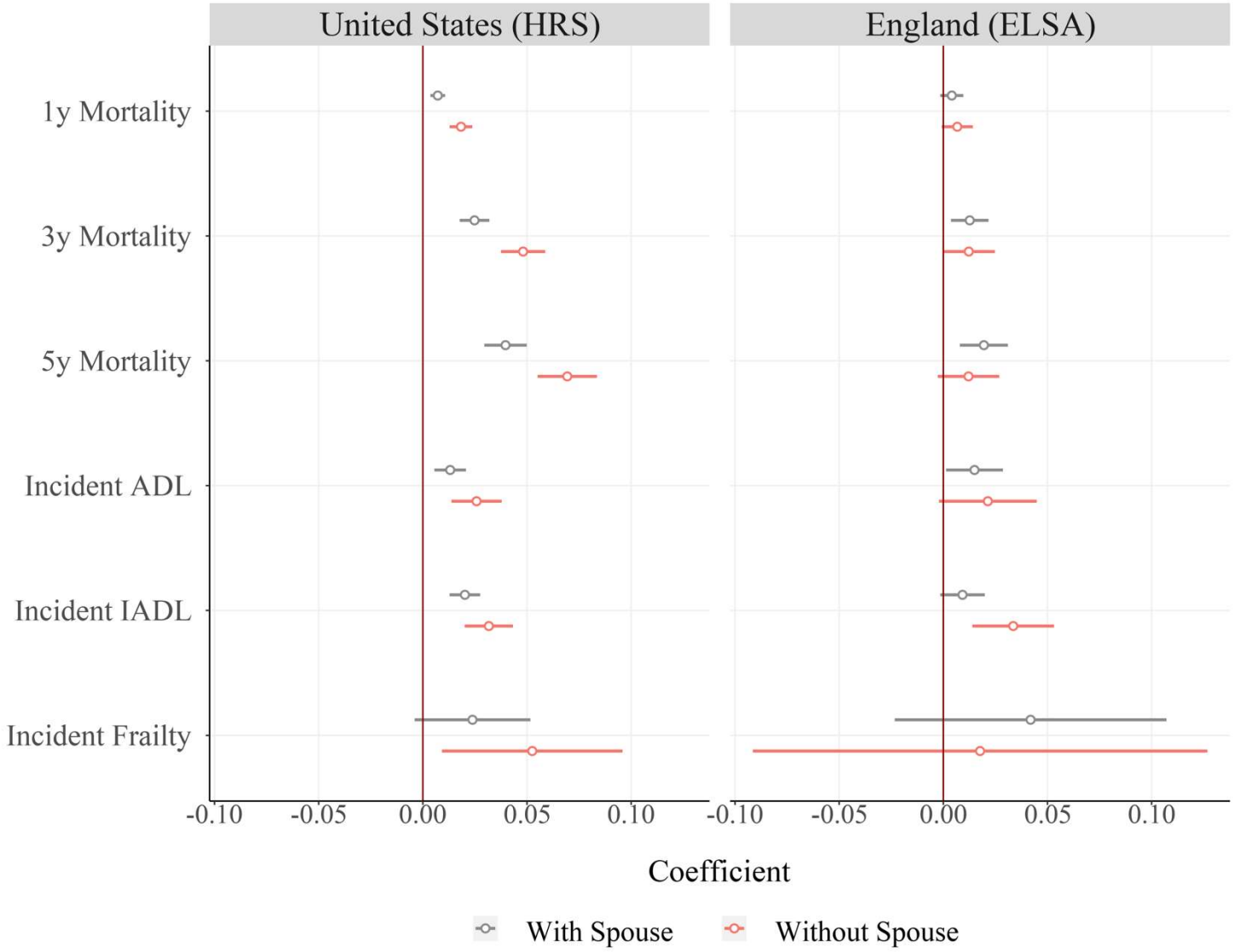
Notes: This figure illustrates the regression results quantifying the impacts of cognitive misperception on disability for HRS and ELSA samples. The reference group is the second quartile of cognitive gap with average level of misperception close to 0. Blue circles represent the coefficient estimates for the group with notable misperception, either conservative, optimistic, or overconfident, relative to the reference, and the vertical lines represent 95% confidence interval. Incident disability is a binary outcome equals to one if an individual's disability status changes from nondisabled to disabled between wave t and $t + 1$. The regression models control for time-invariant characteristics including sex, race/ethnicity, and education, as well as time-varying characteristics including age, marital status, income, retirement status, insurance coverage, depressive symptoms, number of chronic diseases, and number of children. Standard errors are robust and clustered at the individual level. Abbreviations: ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living. Full regression estimates are presented in Appendix Table A2.

Figure 9. Effects of cognitive overconfidence on mortality and disability by living arrangement



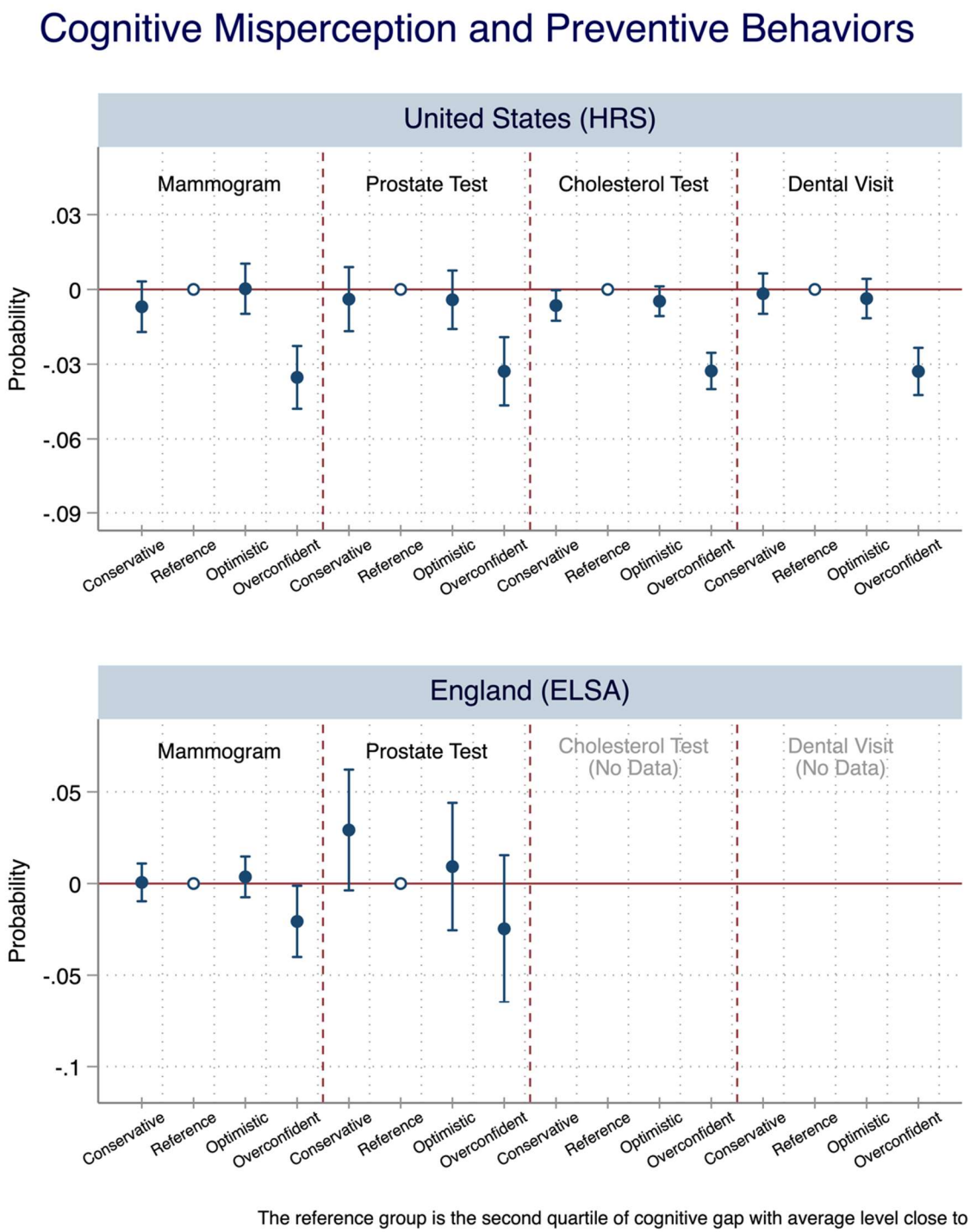
Notes: This figure illustrates the regression results quantifying the impacts of cognitive overconfidence (being in the 4th quartile of misperception) on mortality and disability for HRS and ELSA samples, stratified by living arrangement. The reference group is the second quartile of cognitive gap with average level of misperception close to 0. Circles represent the coefficient estimates for overconfidence relative to the reference, and the vertical lines represent 95% confidence interval. Blue circles and lines represent the estimates for older adults age who do not live alone; whereas red circles and lines represent the estimates for older adults living alone. Incident disability is a binary outcome equals to one if an individual's disability status changes from nondisabled to disabled between wave t and $t+1$. The regression models control for time-invariant characteristics including sex, race/ethnicity, and education, as well as time-varying characteristics including age, marital status, income, retirement status, insurance coverage, depressive symptoms, number of chronic diseases, and number of children. Standard errors are robust and clustered at the individual level. Abbreviations: ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living. Full regression estimates are available upon request.

Figure 10. Effects of cognitive overconfidence on mortality and disability by access to spousal support



Notes: This figure illustrates the regression results quantifying the impacts of cognitive overconfidence (being in the 4th quartile of misperception) on mortality and disability for HRS and ELSA samples, stratified by access to spousal support. The reference group is the second quartile of cognitive gap with average level of misperception close to 0. Circles represent the coefficient estimates for overconfidence relative to the reference, and the vertical lines represent 95% confidence interval. Gray circles and lines represent the estimates for older adults with spouse; whereas red circles and lines represent the estimates for older adults without spouse. Incident disability is a binary outcome equals to one if an individual's disability status changes from nondisabled to disabled between wave t and $t + 1$. The regression models control for time-invariant characteristics including sex, race/ethnicity, and education, as well as time-varying characteristics including age, marital status, income, retirement status, insurance coverage, depressive symptoms, number of chronic diseases, and number of children. Abbreviations: ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living. Standard errors are robust and clustered at the individual level. Full regression estimates are available upon request.

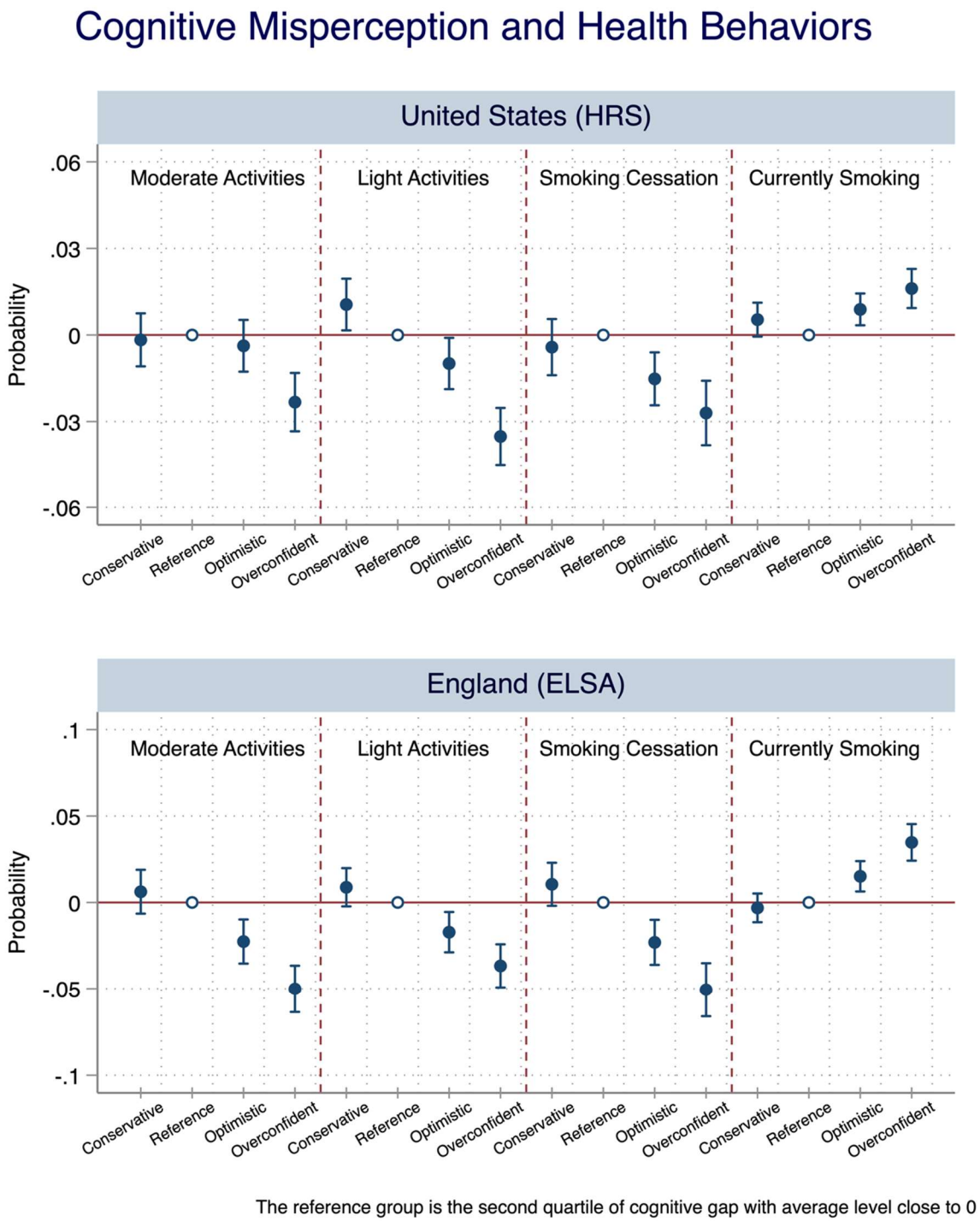
Figure 11. Mechanism testing: cognitive misperception and preventive care utilization



Notes: This figure illustrates the regression results quantifying the impacts of cognitive misperception on preventive care utilization for HRS and ELSA samples. The reference group is the second quartile of cognitive gap with average level of misperception close to 0. Blue circles represent the coefficient estimates for the group with notable misperception, either conservative, optimistic, or overconfident, relative to the reference, and the vertical lines represent 95%

confidence interval. Mammogram is a binary outcome denoting whether the participant had a mammogram to screen for breast cancer (females), and prostate test is a binary outcome denoting whether the participant had a PSA blood test to screen for prostate cancer (males) during the survey period. Cholesterol test and dental visit respectively denote whether the respondent had a blood test for cholesterol and had dental visit during the survey period. These two variables are only available in HRS. All the regression models control for time-invariant characteristics including sex, race/ethnicity, and education, as well as time-varying characteristics including age, marital status, income, retirement status, insurance coverage, depressive symptoms, number of chronic diseases, and number of children. Standard errors are robust and clustered at the individual level. Full regression estimates are presented in Appendix Table A3.

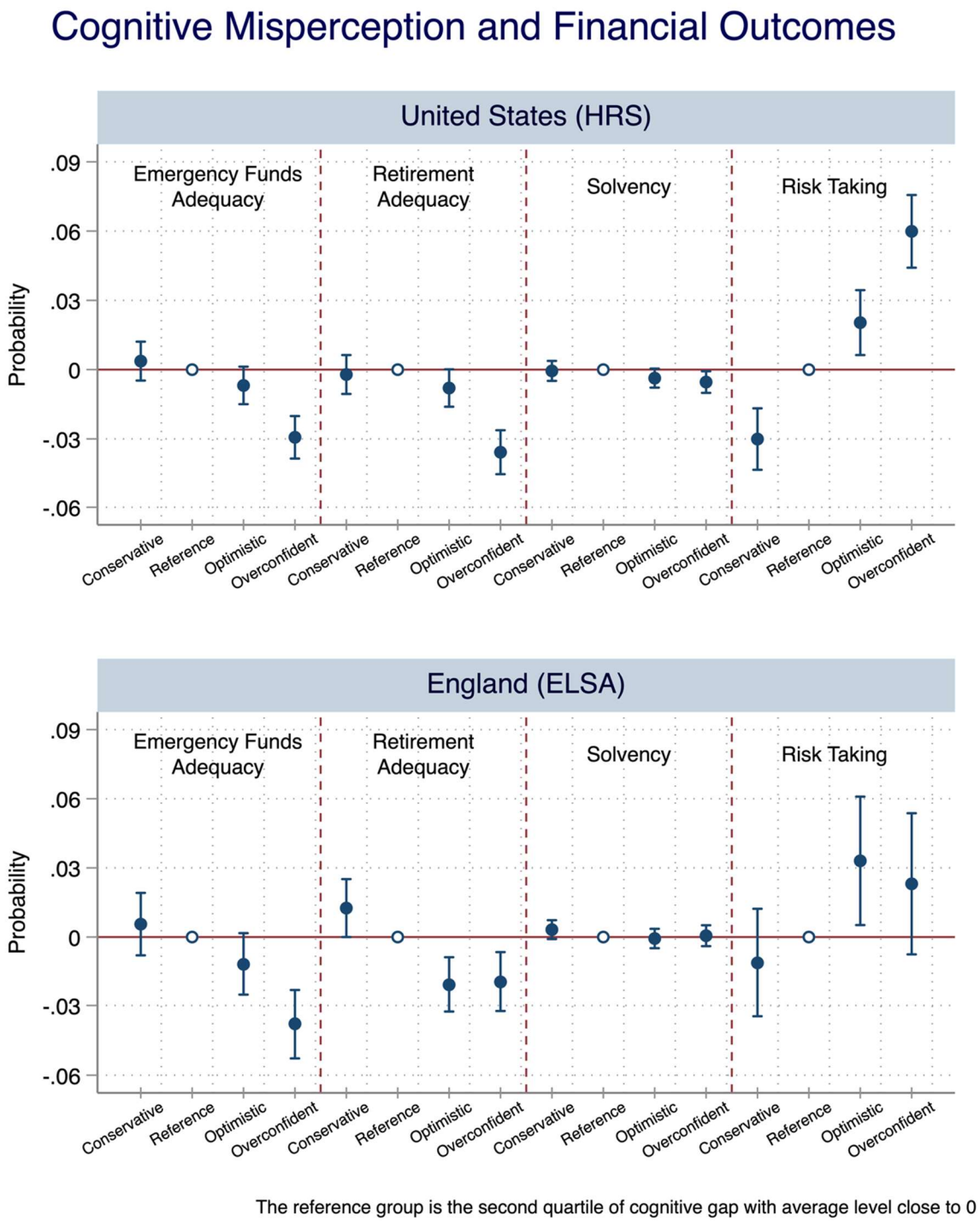
Figure 12. Mechanism testing: cognitive misperception and health behaviors



Notes: This figure illustrates the regression results quantifying the impacts of cognitive misperception on health behaviors for HRS and ELSA samples. The reference group is the second quartile of cognitive gap with average level of misperception close to 0. Blue circles represent the coefficient estimates for the group with notable misperception, either conservative, optimistic, or overconfident, relative to the reference, and the vertical lines represent 95% confidence interval.

Moderate activities and light activities are binary variables indicating whether individuals do moderate (e.g., stretching exercises) or light activities (e.g., vacuuming) more than once a week. Smoking cessation denotes whether participants who have ever smoked have quitted smoking by the time of interview. Currently smoking denotes whether participants are still smoking at the time of interview. All the regression models control for time-invariant characteristics including sex, race/ethnicity, and education, as well as time-varying characteristics including age, marital status, income, retirement status, insurance coverage, depressive symptoms, number of chronic diseases, and number of children. Standard errors are robust and clustered at the individual level. Full regression estimates are presented in Appendix Table A4.

Figure 13. Mechanism testing: cognitive misperception and financial health and risk attitude



Notes: This figure illustrates the regression results quantifying the impacts of cognitive misperception on financial outcomes for HRS and ELSA samples. The reference group is the second quartile of cognitive gap with average level of misperception close to 0. Blue circles represent the coefficient estimates for the group with notable misperception, either conservative, optimistic, or overconfident, relative to the reference, and the vertical lines represent 95%

confidence interval. Three aspects of financial health are examined, including emergency funds adequacy, retirement adequacy and financial solvency. Emergency funds adequacy is measured by respondent's liquidity ratio, which is the ratio of total cash equivalents and monthly gross income. The variable is defined as 1 if the liquidity ratio ≥ 3 (the cash-equivalent is enough to cover roughly three months of expenses) and 0 otherwise. Retirement adequacy is measured by respondent's capital accumulation ratio, the ratio of household's total investment assets and household's net worth. The variable is defined as 1 if the capital accumulation ratio ≥ 0.25 and 0 otherwise. Financial solvency is measure by respondent's debt-to-asset ratio, the ratio of respondent's liabilities and total assets. The variable is defined as 1 if the debt-to-asset ratio ≤ 0.70 (i.e., financial solvent), and 0 otherwise. On the other hand, we examine the effect of cognitive misperception on respondent's risk attitude. Respondents were asked to rate themselves from 0 (not at all willing to take risks) to 10 (very willing to take risks). The variable is defined as 1 if the respondent is very risk taking (the fourth quartile) and 0 otherwise. All the regression models control for time-invariant characteristics including sex, race/ethnicity, and education, as well as time-varying characteristics including age, marital status, income, retirement status, insurance coverage, depressive symptoms, number of chronic diseases, and number of children. Standard errors are robust and clustered at the individual level. Full regression estimates are presented in Appendix Table A5.

Table 1. Descriptive statistics for the HRS sample

Variable	HRS Sample (United States)					*p*-value
	All (N=106,046)	Conservative (N=27,702)	Reference (N=26,753)	Optimistic (N=26,584)	Overconfident (N=25,007)	
Panel A. Cognitive Measures						
Cognitive misperception, mean (SD)	0.2 (1.3)	-1.3 (0.6)	-0.2 (0.2)	0.6 (0.3)	2.0 (0.7)	<0.001
Subjective cognition						
Poor, No. (%)	5664 (5.3)	3736 (13.5)	1406 (5.3)	522 (2)	0 (0)	<0.001
Fair, No. (%)	27539 (26)	14049 (50.7)	6333 (23.7)	5343 (20.1)	1814 (7.3)	
Good, No. (%)	45856 (43.2)	8996 (32.5)	15693 (58.7)	13422 (50.5)	7745 (31)	
Very good, No. (%)	22526 (21.2)	885 (3.2)	3228 (12.1)	6891 (25.9)	11522 (46.1)	
Excellent, No. (%)	4461 (4.2)	36 (.1)	93 (.3)	406 (1.5)	3926 (15.7)	
Objective cognition	9.4 (3.5)	12.1 (2.9)	10.3 (2.7)	8.5 (2.8)	6.4 (3.0)	<0.001
Panel B. Demographic Characteristics						
Age, mean (SD)	72.0 (8.4)	69.9 (7.2)	71.1 (7.8)	72.5 (8.4)	74.9 (9.3)	<0.001
Female, No. (%)	62308 (58.8)	17946 (64.8)	16299 (60.9)	14841 (55.8)	13222 (52.9)	<0.001
Race/ethnicity						
Non-Hispanic White, No. (%)	76982 (72.6)	20226 (73)	20017 (74.8)	19273 (72.5)	17466 (69.8)	<0.001
Non-Hispanic Black, No. (%)	16113 (15.2)	3920 (14.2)	3684 (13.8)	4031 (15.2)	4478 (17.9)	
Hispanics, No. (%)	10556 (10)	2937 (10.6)	2501 (9.3)	2704 (10.2)	2414 (9.7)	
Others, No. (%)	2395 (2.3)	619 (2.2)	551 (2.1)	576 (2.2)	649 (2.6)	
Educational attainment						
Less than high school, No. (%)	22172 (20.9)	5057 (18.3)	4812 (18)	5643 (21.2)	6660 (26.6)	<0.001
High school diploma, No. (%)	37850 (35.7)	9971 (36)	9696 (36.2)	9547 (35.9)	8636 (34.5)	
Some college or above, No. (%)	46024 (43.4)	12674 (45.8)	12245 (45.8)	11394 (42.9)	9711 (38.8)	
Married/partnered, mean (SD)	64182 (60.5)	17603 (63.5)	16783 (62.7)	16243 (61.1)	13553 (54.2)	<0.001
Income level						

Low, No. (%)	36643 (34.6)	8659 (31.3)	8299 (31)	9312 (35)	10373 (41.5)	<0.001
Middle, No. (%)	38896 (36.7)	10399 (37.5)	10078 (37.7)	9825 (37)	8594 (34.4)	
High, No. (%)	30507 (28.8)	8644 (31.2)	8376 (31.3)	7447 (28)	6040 (24.2)	
Retirement, No. (%)	68882 (65)	17170 (62)	16834 (62.9)	17489 (65.8)	17389 (69.5)	<0.001
Medicare enrollment, No. (%)	82339 (77.6)	20192 (72.9)	20343 (76)	21065 (79.2)	20739 (82.9)	<0.001
Medicaid enrollment, No. (%)	9736 (9.2)	2266 (8.2)	2059 (7.7)	2450 (9.2)	2961 (11.8)	<0.001
VA enrollment, No. (%)	6923 (6.5)	1706 (6.2)	1742 (6.5)	1844 (6.9)	1631 (6.5)	0.004
Covered by private health insurance, No. (%)	58004 (54.7)	15851 (57.2)	15375 (57.5)	14393 (54.1)	12385 (49.5)	<0.001
Covered by employer-based health insurance, No. (%)	38465 (36.3)	10749 (38.8)	10305 (38.5)	9469 (35.6)	7942 (31.8)	<0.001
Covered by other health insurance, No. (%)	20292 (19.1)	5338 (19.3)	5268 (19.7)	5093 (19.2)	4593 (18.4)	0.002
Depressive symptoms, mean (SD)	1.4 (1.9)	1.6 (2.1)	1.3 (1.9)	1.4 (1.9)	1.4 (1.8)	<0.001
Number of chronic Diseases, mean (SD)	2.4 (1.5)	2.4 (1.5)	2.3 (1.4)	2.4 (1.4)	2.4 (1.4)	<0.001
Number of children, mean (SD)	3.3 (2.1)	3.3 (2.0)	3.2 (2.1)	3.3 (2.1)	3.3 (2.2)	0.074
Panel C. Primary Health Outcomes						
1-year mortality, No. (%)	2448 (2.5)	381 (1.5)	476 (2)	611 (2.5)	980 (4.2)	<0.001
3-year mortality, No. (%)	7840 (9.2)	1311 (6)	1572 (7.4)	1920 (9)	3037 (14.9)	<0.001
5-year mortality, No. (%)	12130 (16.6)	2128 (11.5)	2457 (13.5)	3008 (16.4)	4537 (25.5)	<0.001
Any ADL disability, No. (%)	18257 (17.2)	4586 (16.6)	4124 (15.4)	4420 (16.6)	5127 (20.5)	<0.001
Incident ADL disability, No. (%)	7337 (10.1)	1797 (9.4)	1645 (8.7)	1822 (9.9)	2073 (13)	<0.001
Any IADL disability, No. (%)	15850 (14.9)	3857 (13.9)	3383 (12.6)	3918 (14.7)	4692 (18.8)	<0.001
Incident IADL disability, No. (%)	7124 (9.6)	1632 (8.3)	1572 (8.1)	1745 (9.3)	2175 (13.3)	<0.001
Frailty, No. (%)	5669 (24.6)	1194 (20.6)	1287 (21.4)	1470 (24.4)	1718 (32.8)	<0.001
Incident frailty, No. (%)	1621 (18.4)	371 (15.9)	413 (16.7)	454 (19.4)	383 (23.2)	<0.001

Notes: ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living.

Table 2. Descriptive statistics for the ELSA sample

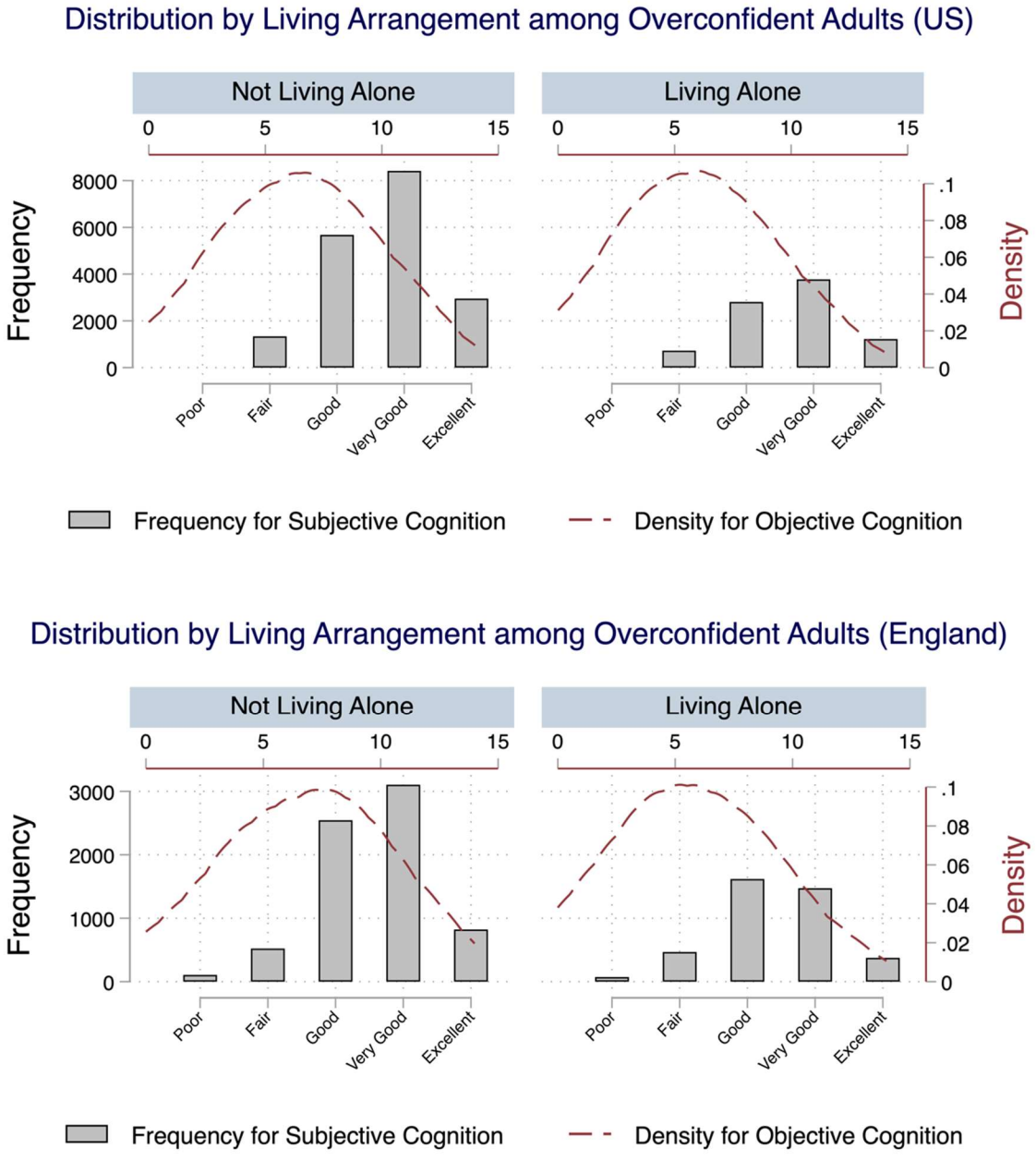
Variable	ELSA Sample (England)					*p*-value
	All (N=40,853)	Conservative (N=10,606)	Reference (N=10,500)	Optimistic (N=9,772)	Overconfident (N=9,975)	
Panel A. Cognitive Measures						
Cognitive misperception, mean (SD)	0.4 (1.4)	-1.2 (0.6)	-0.0 (0.3)	0.8 (0.3)	2.2 (0.8)	<0.001
Subjective cognition						
Poor, No. (%)	3122 (7.6)	1858 (17.5)	721 (6.9)	404 (4.1)	139 (1.4)	<0.001
Fair, No. (%)	11703 (28.6)	5564 (52.5)	3392 (32.3)	1880 (19.2)	867 (8.7)	
Good, No. (%)	17621 (43.1)	2993 (28.2)	5549 (52.8)	5327 (54.5)	3752 (37.6)	
Very good, No. (%)	7180 (17.6)	191 (1.8)	815 (7.8)	2045 (20.9)	4129 (41.4)	
Excellent, No. (%)	1227 (3)	0 (0)	23 (.2)	116 (1.2)	1088 (10.9)	
Objective cognition	9.7 (3.7)	12.7 (2.7)	10.5 (2.8)	8.9 (3.0)	6.4 (3.2)	<0.001
Panel B. Demographic Characteristics						
Age, mean (SD)	71.1 (7.8)	68.9 (6.8)	70.3 (7.4)	71.5 (7.8)	73.9 (8.4)	<0.001
Female, No. (%)	21795 (53.3)	6039 (56.9)	5634 (53.7)	5005 (51.2)	5117 (51.3)	<0.001
Non-white, No. (%)	982 (2.4)	209 (2)	226 (2.2)	240 (2.5)	307 (3.1)	<0.001
Educational attainment						
Less than high school, No. (%)	18177 (44.5)	3426 (32.3)	4293 (40.9)	4566 (46.7)	5892 (59.1)	<0.001
High school diploma, No. (%)	7762 (19)	2369 (22.3)	2121 (20.2)	1789 (18.3)	1483 (14.9)	
Some college or above, No. (%)	14914 (36.5)	4811 (45.4)	4086 (38.9)	3417 (35)	2600 (26.1)	
Married/partnered, mean (SD)	26966 (66)	7433 (70.1)	7220 (68.8)	6487 (66.4)	5826 (58.4)	<0.001
Income level						
Low, No. (%)	15166 (37.1)	3075 (29)	3571 (34)	3755 (38.4)	4765 (47.8)	<0.001
Middle, No. (%)	13412 (32.8)	3583 (33.8)	3533 (33.6)	3204 (32.8)	3092 (31)	
High, No. (%)	12275 (30)	3948 (37.2)	3396 (32.3)	2813 (28.8)	2118 (21.2)	
Retirement, No. (%)	30389 (74.4)	7503 (70.7)	7651 (72.9)	7395 (75.7)	7840 (78.6)	<0.001

Covered by private health insurance, No. (%)	4548 (11.1)	1395 (13.2)	1254 (11.9)	1030 (10.5)	869 (8.7)	<0.001
Depressive symptoms, mean (SD)	1.5 (1.9)	1.5 (1.9)	1.4 (1.9)	1.4 (1.9)	1.5 (1.9)	<0.001
Number of chronic Diseases, mean (SD)	1.6 (1.2)	1.6 (1.2)	1.6 (1.2)	1.5 (1.2)	1.6 (1.2)	0.118
Number of children, mean (SD)	2.2 (1.5)	2.2 (1.5)	2.2 (1.5)	2.2 (1.5)	2.2 (1.6)	0.054
Panel C. Primary Health Outcomes						
1-year mortality, No. (%)	330 (1.4)	45 (.9)	60 (1.1)	85 (1.5)	140 (2.1)	<0.001
3-year mortality, No. (%)	833 (3.6)	107 (2.1)	156 (2.8)	218 (3.9)	352 (5.3)	<0.001
5-year mortality, No. (%)	1214 (5.3)	160 (3.1)	229 (4.2)	320 (5.7)	505 (7.6)	<0.001
Any ADL disability, No. (%)	8392 (20.5)	2005 (18.9)	2084 (19.8)	1959 (20.1)	2344 (23.5)	<0.001
Incident ADL disability, No. (%)	2623 (11.1)	613 (9.6)	619 (10.1)	628 (11.1)	763 (14.2)	<0.001
Any IADL disability, No. (%)	5218 (12.8)	1075 (10.1)	1207 (11.5)	1250 (12.8)	1686 (16.9)	<0.001
Incident IADL disability, No. (%)	2060 (7.9)	418 (5.9)	468 (6.9)	515 (8.3)	659 (11.2)	<0.001
Frailty, No. (%)	1838 (25.9)	475 (20.6)	468 (24)	451 (27.3)	444 (37.5)	<0.001
Incident frailty, No. (%)	290 (15.4)	75 (11.9)	81 (15.1)	75 (16.6)	59 (22.8)	0.001

Notes: ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living.

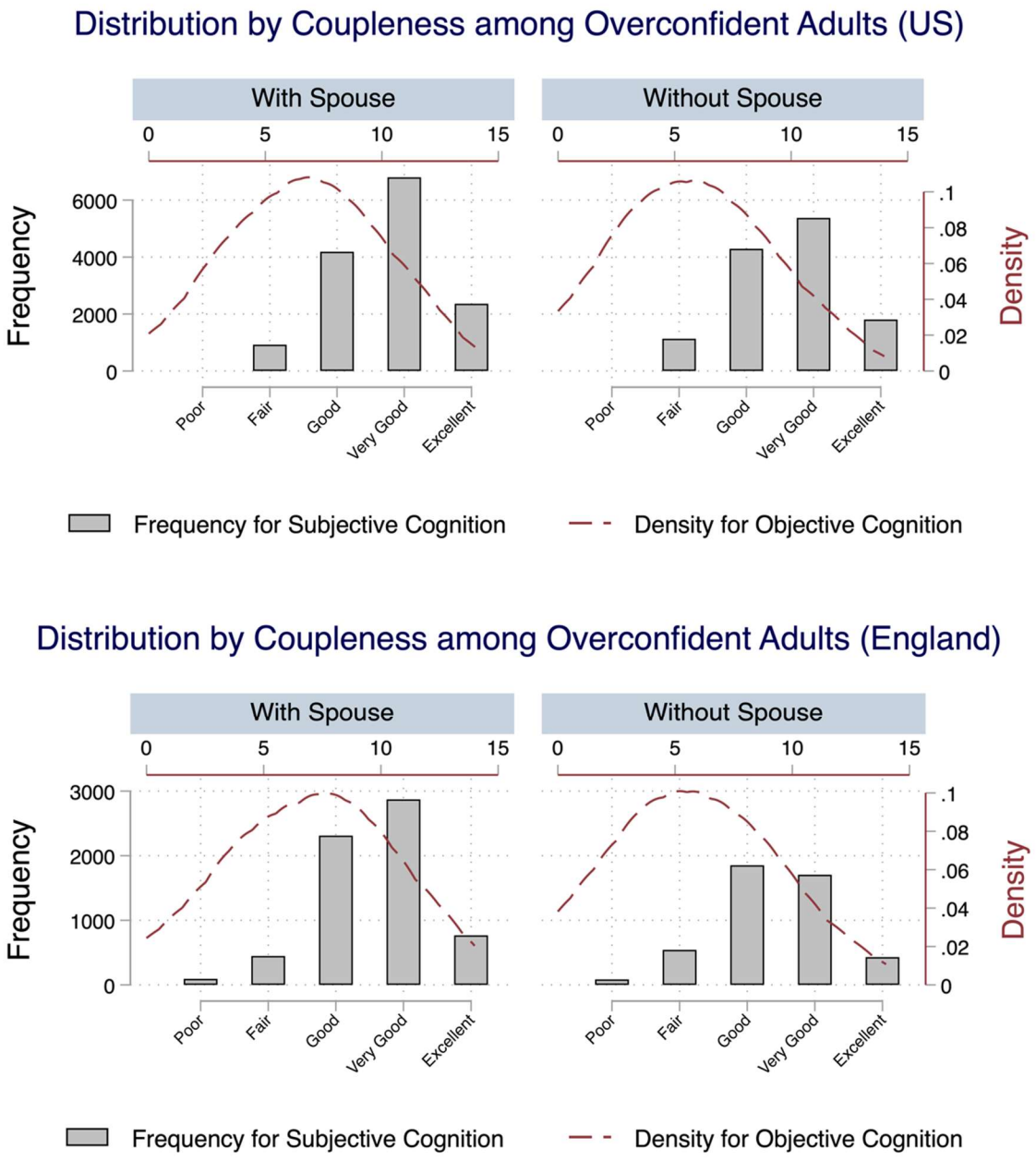
Appendix

Figure A1. Distributions of subjective and objective cognition by living arrangement



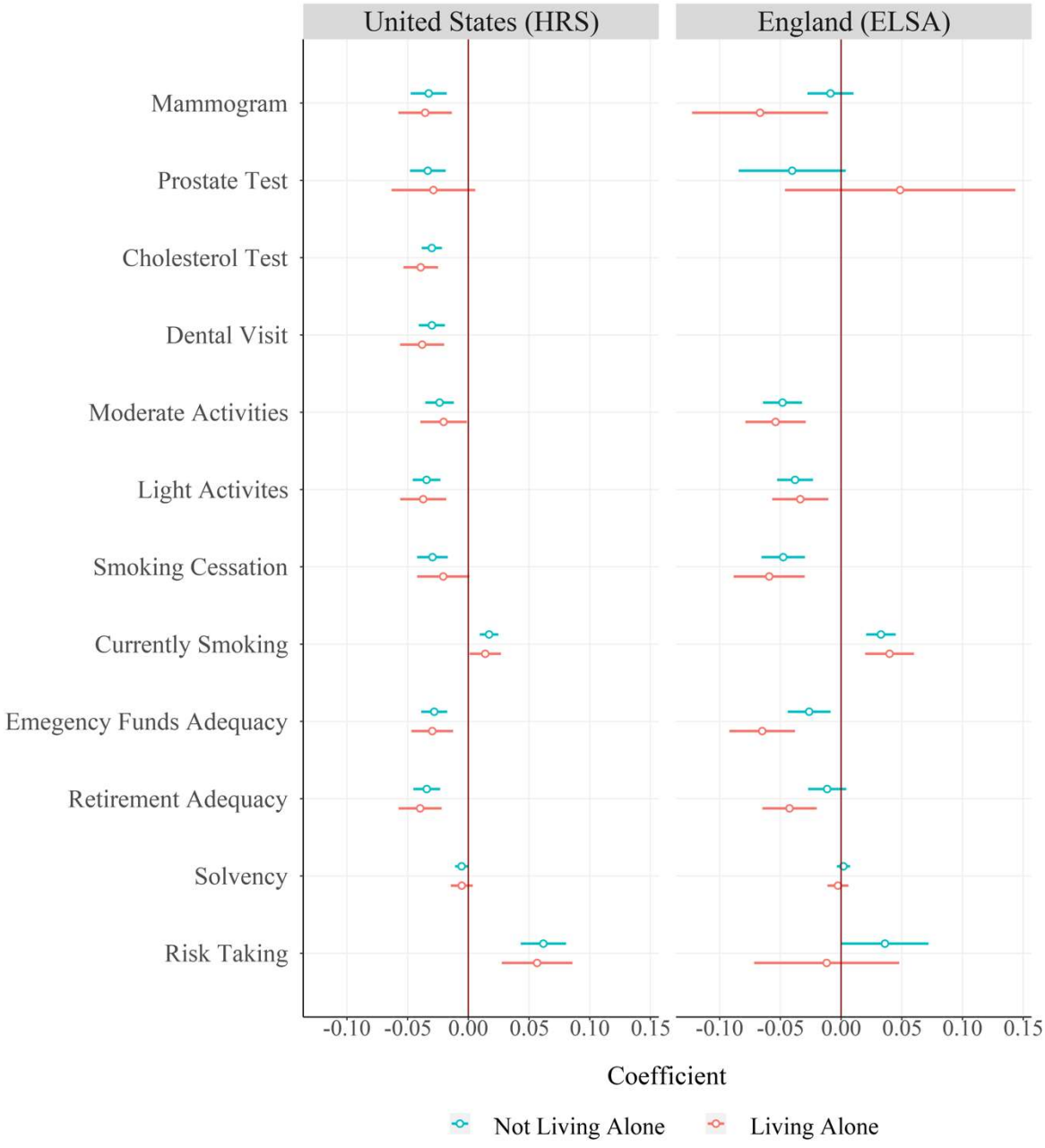
Notes: This figure plots the distributions of subjective and objective cognition by living arrangement, where Panel A shows the distributions for HRS samples while Panel B shows those for ELSA samples. The red curves denote the kernel density of objective cognition in each group, and the gray bars show the distribution of subjective cognition in frequency.

Figure A2. Distributions of subjective and objective cognition by access to spousal support



Notes: This figure plots the distributions of subjective and objective cognition by access to spousal support, where Panel A shows the distributions for HRS samples while Panel B shows those for ELSA samples. The red curves denote the kernel density of objective cognition in each group, and the gray bars show the distribution of subjective cognition in frequency.

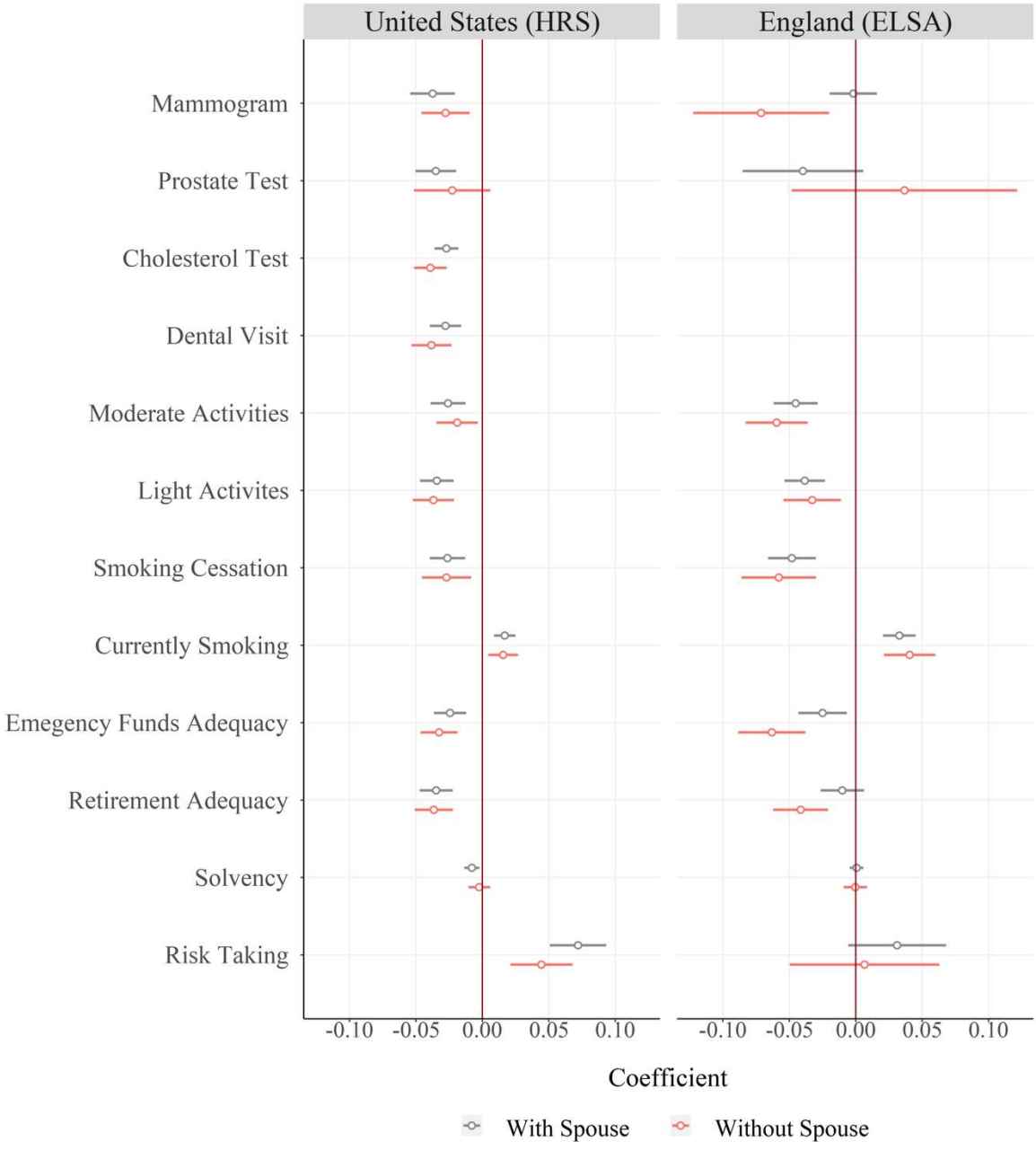
Figure A3. Mechanism testing: effects of cognitive overconfidence on preventive care utilization and health behaviors by living arrangement



Notes: This figure illustrates the regression results quantifying the impacts of cognitive overconfidence on preventive care utilization and health behaviors for HRS and ELSA samples, stratified by living arrangement. The reference group is the second quartile of cognitive gap with average level of misperception close to 0. Circles represent the coefficient estimates for overconfidence relative to the reference, and the vertical lines represent 95% confidence interval. Blue circles and lines represent the estimates for older adults who do not live alone; whereas red circles and lines represent the estimates for older adults living alone. Mammogram is a binary outcome denoting whether the participant had a mammogram to screen for breast cancer (females),

and prostate test is a binary outcome denoting whether the participant had a PSA blood test to screen for prostate cancer (males) during the survey period. Cholesterol test and dental visit respectively denotes whether the respondent had a blood test for cholesterol and had dental visit during the survey period. These two variables are only available in HRS. Moderate activities and light activities are binary variables indicating whether individuals do moderate (e.g., stretching exercises) or light activities (e.g., vacuuming) more than once a week. Smoking cessation denotes whether participants who have ever smoked have quitted smoking by the time of interview. Currently smoking denotes whether participants are still smoking at the time of interview. Three aspects of financial health are examined, including emergency funds adequacy, retirement adequacy and financial solvency. Emergency funds adequacy is measured by respondent's liquidity ratio, which is the ratio of total cash equivalents and monthly gross income. The variable is defined as 1 if the liquidity ratio ≥ 3 (the cash-equivalent is enough to cover roughly three months of expenses) and 0 otherwise. Retirement adequacy is measured by respondent's capital accumulation ratio, the ratio of household's total investment assets and household's net worth. The variable is defined as 1 if the capital accumulation ratio ≥ 0.25 and 0 otherwise. Financial solvency is measure by respondent's debt-to-asset ratio, the ratio of respondent's liabilities and total assets. The variable is defined as 1 if the debt-to-asset ratio ≤ 0.70 (i.e., financial solvent), and 0 otherwise. On the other hand, we examine the effect of cognitive misperception on respondent's risk attitude. Respondents were asked to rate themselves from 0 (not at all willing to take risks) to 10 (very willing to take risks). The variable is defined as 1 if the respondent is very risk taking (the fourth quartile) and 0 otherwise. All the regression models control for time-invariant characteristics including sex, race/ethnicity, and education, as well as time-varying characteristics including age, marital status, income, retirement status, insurance coverage, depressive symptoms, number of chronic diseases, and number of children. Standard errors are robust and clustered at the individual level. Full regression estimates are available upon request.

Figure A4. Mechanism testing: effects of cognitive overconfidence on preventive care utilization and health behaviors by co-residence status with the partner



Notes: This figure illustrates the regression results quantifying the impacts of cognitive misperception on preventive utilization and health behaviors for HRS and ELSA samples, stratified by co-residence status. The reference group is the second quartile of cognitive gap with average level of misperception close to 0. Circles represent the coefficient estimates for overconfidence relative to the reference, and the vertical lines represent 95% confidence interval. Gray circles and lines represent the estimates for older adults living with a partner; whereas red circles and lines represent the estimates for older adults not living with a partner. Mammogram is a binary outcome denoting whether the participant had a mammogram to screen for breast cancer

(females), and prostate test is a binary outcome denoting whether the participant had a PSA blood test to screen for prostate cancer (males) during the survey period. Cholesterol test and dental visit respectively denotes whether the respondent had a blood test for cholesterol and had dental visit during the survey period. These two variables are only available in HRS. Moderate activities and light activities are binary variables indicating whether individuals do moderate (e.g., stretching exercises) or light activities (e.g., vacuuming) more than once a week. Smoking cessation denotes whether participants who have ever smoked have quitted smoking by the time of interview. Currently smoking denotes whether participants are still smoking at the time of interview. Three aspects of financial health are examined, including emergency funds adequacy, retirement adequacy and financial solvency. Emergency funds adequacy is measured by respondent's liquidity ratio, which is the ratio of total cash equivalents and monthly gross income. The variable is defined as 1 if the liquidity ratio ≥ 3 (the cash-equivalent is enough to cover roughly three months of expenses) and 0 otherwise. Retirement adequacy is measured by respondent's capital accumulation ratio, the ratio of household's total investment assets and household's net worth. The variable is defined as 1 if the capital accumulation ratio ≥ 0.25 and 0 otherwise. Financial solvency is measure by respondent's debt-to-asset ratio, the ratio of respondent's liabilities and total assets. The variable is defined as 1 if the debt-to-asset ratio ≤ 0.70 (i.e., financial solvent), and 0 otherwise. On the other hand, we examine the effect of cognitive misperception on respondent's risk attitude. Respondents were asked to rate themselves from 0 (not at all willing to take risks) to 10 (very willing to take risks). The variable is defined as 1 if the respondent is very risk taking (the fourth quartile) and 0 otherwise. All the regression models control for time-invariant characteristics including sex, race/ethnicity, and education, as well as time-varying characteristics including age, marital status, income, retirement status, insurance coverage, depressive symptoms, number of chronic diseases, and number of children. Standard errors are robust and clustered at the individual level. Full regression estimates are available upon request.

Table A1. Effects of cognitive misperception on mortality

	(1)	(2)	(3)	(4)	(5)	(6)
	United States (HRS)			England (ELSA)		
VARIABLES	1yr Mortality	3yr Mortality	5yr Mortality	1yr Mortality	3yr Mortality	5yr Mortality
Conservative	-0.003*	-0.007**	-0.008*	0.000	-0.002	-0.002
	(0.001)	(0.002)	(0.003)	(0.002)	(0.003)	(0.004)
Optimistic	0.002	0.002	0.006	0.003	0.006	0.009*
	(0.001)	(0.003)	(0.004)	(0.002)	(0.003)	(0.004)
Overconfident	0.012***	0.035***	0.053***	0.005*	0.012***	0.016***
	(0.002)	(0.003)	(0.004)	(0.002)	(0.004)	(0.005)
Observations	96,499	84,842	72,906	22,908	22,908	22,908
R-squared	0.029	0.097	0.157	0.017	0.036	0.050
Effect of overconfidence (in %)	53.3	41.6	34.5	42.5	39.0	34.7

Notes: This table presents the regression results quantifying the impacts of cognitive misperception on mortality for HRS and ELSA samples. The reference group is the second quartile of cognitive gap with average level of misperception close to 0. The regression models control for time-invariant characteristics including sex, race/ethnicity, and education, as well as time-varying characteristics including age, marital status, income, retirement status, insurance coverage, depressive symptoms, number of chronic diseases, and number of children. Standard errors are robust and clustered at the individual level. Statistical significance: *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

Table A2. Effects of cognitive misperception on disability

	(1)	(2)	(3)	(4)	(5)	(6)
	United States (HRS)			England (ELSA)		
VARIABLES	Incident ADL	Incident IADL	Incident Frailty	Incident ADL	Incident IADL	Incident Frailty
Conservative	0.004	0.001	-0.010	0.003	-0.001	-0.021
	(0.003)	(0.003)	(0.010)	(0.005)	(0.004)	(0.019)
Optimistic	0.003	0.002	0.014	0.005	0.008	-0.003
	(0.003)	(0.003)	(0.010)	(0.005)	(0.004)	(0.022)
Overconfident	0.018***	0.025***	0.032**	0.018**	0.018***	0.032
	(0.003)	(0.003)	(0.012)	(0.006)	(0.005)	(0.028)
Observations	72,323	74,290	8,795	23,571	26,022	1,879
R-squared	0.070	0.079	0.123	0.073	0.084	0.140
Effect of overconfidence (in %)	19.3	27.7	17.9	16.7	24.7	20.0

Notes: This table presents the regression results quantifying the impacts of cognitive misperception on disability for HRS and ELSA samples. The reference group is the second quartile of cognitive gap with average level of misperception close to 0. Incident disability is a binary outcome equals to one if an individual's disability status changes from nondisabled to disabled between wave t and $t+1$. The regression models control for time-invariant characteristics including sex, race/ethnicity, and education, as well as time-varying characteristics including age, marital status, income, retirement status, insurance coverage, depressive symptoms, number of chronic diseases, and number of children. Standard errors are robust and clustered at the individual level. Abbreviations: ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living. Statistical significance: *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

Table A3. Mechanism testing: effects of cognitive misperception on preventive care utilization

	(1)	(2)	(2)	(3)	(5)	(6)
	United States (HRS)				England (ELSA)	
VARIABLES	Mammogram	Prostate Test	Cholesterol Test	Dental Visit	Mammogram	Prostate Test
Conservative	-0.007	-0.004	-0.006*	-0.002	0.001	0.029
	(0.005)	(0.007)	(0.003)	(0.004)	(0.005)	(0.017)
Optimistic	0.000	-0.004	-0.005	-0.004	0.004	0.009
	(0.005)	(0.006)	(0.003)	(0.004)	(0.006)	(0.018)
Overconfident	-0.035***	-0.033***	-0.033***	-0.033***	-0.021*	-0.025
	(0.006)	(0.007)	(0.004)	(0.005)	(0.010)	(0.020)
Observations	61,276	42,729	103,682	105,939	6,170	5,823
R-squared	0.072	0.061	0.065	0.175	0.017	0.061
Effect of overconfidence (in %)	-4.8	-4.4	-3.8	-5.2	-2.1	-5.5

Notes: This table presents the regression results quantifying the impacts of cognitive misperception on preventive care utilization for HRS and ELSA samples. The reference group is the second quartile of cognitive gap with average level of misperception close to 0. Mammogram is a binary outcome denoting whether the participant had a mammogram to screen for breast cancer (females), and prostate test is a binary outcome denoting whether the participant had a PSA blood test to screen for prostate cancer (males) during the survey period. Cholesterol test and dental visit respectively denotes whether the respondent had a blood test for cholesterol and had dental visit during the survey period. These two variables are only available in HRS. All the regression models control for time-invariant characteristics including sex, race/ethnicity, and education, as well as time-varying characteristics including age, marital status, income, retirement status, insurance coverage, depressive symptoms, number of chronic diseases, and number of children. Standard errors are robust and clustered at the individual level. Statistical significance: *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

Table A4. Mechanism testing: effects of cognitive misperception on health behaviors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	United States (HRS)				England (ELSA)			
VARIABLES	Moderate Activities	Light Activities	Smoking Cessation	Currently Smoking	Moderate Activities	Light Activities	Smoking Cessation	Currently Smoking
Conservative	-0.002	0.011*	-0.004	0.005	0.006	0.009	0.011	-0.003
	(0.005)	(0.005)	(0.005)	(0.003)	(0.006)	(0.006)	(0.006)	(0.004)
Optimistic	-0.004	-0.010*	-0.015**	0.009**	-0.023***	-0.017**	-0.023***	0.015***
	(0.005)	(0.005)	(0.005)	(0.003)	(0.007)	(0.006)	(0.007)	(0.004)
Overconfident	-0.023***	-0.035***	-0.027***	0.016***	-0.050***	-0.037***	-0.051***	0.035***
	(0.005)	(0.005)	(0.006)	(0.003)	(0.007)	(0.006)	(0.008)	(0.005)
Observations	93,434	93,475	59,666	105,409	40,847	40,850	26,141	40,773
R-squared	0.085	0.106	0.091	0.062	0.149	0.093	0.091	0.065
Effect of overconfidence (in %)	-4.7	-6.5	-3.3	15.9	-8.4	-4.8	-6.0	34.4

Notes: This table presents the regression results quantifying the impacts of cognitive misperception on preventive care utilization for HRS and ELSA samples. The reference group is the second quartile of cognitive gap with average level of misperception close to 0. Moderate activities and light activities are binary variables indicating whether individuals do moderate (e.g., stretching exercises) or light activities (e.g., vacuuming) more than once a week. Smoking cessation denotes whether participants who have ever smoked have quitted smoking by the time of interview. Currently smoking denotes whether participants are still smoking at the time of interview. All the regression models control for time-invariant characteristics including sex, race/ethnicity, and education, as well as time-varying characteristics including age, marital status, income, retirement status, insurance coverage, depressive symptoms, number of chronic diseases, and number of children. Standard errors are robust and clustered at the individual level. Statistical significance: *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

Table A5. Mechanism testing: effects of cognitive misperception on financial health and risk attitude

	(1)	(2)	(3)	(5)	(6)	(7)	(8)
	United States (HRS)			England (ELSA)			
VARIABLES	Emergency Funds Adequacy	Retirement Adequacy	Financial Solvency	Risk Taking	Emergency Funds Adequacy	Retirement Adequacy	Financial Solvency	Risk Taking
Conservative	0.004	-0.002	-0.001	-0.030***	0.006	0.013*	0.003	-0.011
	(0.004)	(0.004)	(0.002)	(0.007)	(0.007)	(0.006)	(0.002)	(0.012)
Optimistic	-0.007	-0.008	-0.004	0.020**	-0.012	-0.021***	-0.001	0.033*
	(0.004)	(0.004)	(0.002)	(0.007)	(0.007)	(0.006)	(0.002)	(0.014)
Overconfident	-0.029***	-0.036***	-0.005*	0.060***	-0.038***	-0.019**	0.001	0.023
	(0.005)	(0.005)	(0.002)	(0.008)	(0.008)	(0.007)	(0.002)	(0.016)
Observations	105,202	100,896	101,179	32,584	40,770	39,887	39,687	5,351
R-squared	0.133	0.223	0.041	0.032	0.044	0.066	0.032	0.019
Effect. overconfidence (%)	-7.5	-8.1	-0.57	20.9	-6.5	-7.9	0.06	16.5

Notes: This table presents the regression results quantifying the impacts of cognitive misperception on financial health and risk attitude for HRS and ELSA samples. The reference group is the second quartile of cognitive gap with average level of misperception close to 0. Emergency funds adequacy is measured by respondent's liquidity ratio, which is the ratio of total cash equivalents and monthly gross income. The variable is defined as 1 if the liquidity ratio ≥ 3 (the cash-equivalent is enough to cover roughly three months of expenses) and 0 otherwise. Retirement adequacy is measured by respondent's capital accumulation ratio, the ratio of household's total investment assets and household's net worth. The variable is defined as 1 if the capital accumulation ratio ≥ 0.25 and 0 otherwise. Financial solvency is measure by respondent's debt-to-asset ratio, the ratio of respondent's liabilities and total assets. The variable is defined as 1 if the debt-to-asset ratio ≤ 0.70 (i.e., financial solvent), and 0 otherwise. On the other hand, we examine the effect of cognitive misperception on respondent's risk attitude. Respondents were asked to rate themselves from 0 (not at all willing to take risks) to 10 (very willing to take risks). The variable is defined as 1 if the respondent is very risk taking (the fourth quartile) and 0 otherwise. All the regression models control for time-invariant characteristics including sex, race/ethnicity, and education, as well as time-varying characteristics including age, marital status, income, retirement status, insurance coverage, depressive symptoms, number of chronic diseases, and number of children. Standard errors are robust and clustered at the individual level. Statistical significance: *** $p<0.001$, ** $p<0.01$, * $p<0.05$.