

# TRENDS IN MEMORY PROBLEMS AND RACE/ ETHNICITY IN THE NATIONAL HEALTH AND EXAMINATION SURVEY, 1999-2014

Alejandra Casillas, MD, MSHS<sup>1</sup>; Li-Jung Liang, PhD<sup>1</sup>;  
Stefanie Vassar, MS<sup>1</sup>; Arleen Brown, MD, PhD<sup>1</sup>

**Background:** Little data exist to describe serial population-level trends in cognitive impairment—especially among minority communities. Because memory problems are among the first warning signs of cognitive impairment, they provide a potential method for monitoring changes in cognitive health at the population level. This exploratory study aimed to: 1) estimate prevalence of memory problems among US residents by race/ethnicity, age category; and 2) examine whether racial/ethnic differences in subjective cognitive concerns (memory problems) varied across recent time periods.

**Design and Setting:** Serial cross-sectional analysis of self-reported data from the National Health and Examination Survey (NHANES), 1999-2014.

**Participants:** 20,585 participants aged  $\geq 45$  years during 1999-2014, who reported race/ethnicity as non-Hispanic White (NHW), non-Hispanic Black (NHB), and Latino/Hispanic.

**Measurements:** The outcome of interest was subjective cognitive concerns, identified as self-reported memory problems. The frequencies of memory problems were examined for each 4-year period, across racial/ethnic groups.

**Results:** In adjusted analyses, compared with older (aged  $\geq 65$  years) NHWs, disparities in subjective cognitive concerns were observed for older Latinos for most periods (range of AOR: 1.43 – 2.01,  $P < .05$ ). Additionally, Latinos without a high school education had significantly higher odds of reporting memory problems than NHW in multiple periods (range of AOR: 1.95 – 2.17,  $P < .005$ ), while Latino high school graduates did not. There were no significant

## INTRODUCTION

Cognitive impairment negatively affects quality of life and increases risk for morbidity and mortality.<sup>1</sup> Cognitive impairment alone is estimated to be the third most expensive condition treated in the United States.<sup>1-3</sup> In 2015, the US Department of Health and Human Services, in the *National Plan to Address Alzheimer's Disease*, called for “expanding data collection and surveillance efforts” to track the prevalence and impact of cognitive impairment.<sup>1</sup> Episodic memory difficulty is the first and most severely affected cognitive domain in dementias like Alzheimer's disease, and it is also a key early marker in early stages in other cognitive decline presentations, including mild cognitive impairment.<sup>1</sup>

changes in racial/ethnic differences in subjective cognitive concerns over time.

**Conclusions:** The prevalence of subjective cognitive concerns across time periods points to a need to engage patients—particularly older and less-educated Latinos—about warning signs for cognitive impairment. The impact of education on subjective cognitive concerns in older Latinos may be related to acculturation and warrant further investigation. *Ethn Dis.* 2019;29(3):525-534; doi:10.18865/ed.29.3.525

While the identification and classification of cognitive impairment (ranging from mild impairment to dementia) in national studies is a major challenge,<sup>4</sup> census statistics, community surveys, and claims data can provide some indication of the country's cognitive health.<sup>5</sup> However, the existing literature has several limitations. Few studies estimate the incidence of cognitive problems (starting with mild impairment) over time in older and middle-aged adults, and differences in case ascertainment and diagnostic criteria make it a challenge to compare such studies.<sup>2,6</sup> Further, most studies of cognition limit their samples to adults aged  $>60$  years because the prevalence of cognitive impairment increases significantly with age<sup>7,8</sup>; however, this cutoff may

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<sup>1</sup> General Internal Medicine & Health Services Research, University of California Los Angeles, CA

Address correspondence to Alejandra Casillas, MD, MSHS, General Internal Medicine & Health Services Research, University of California, Los Angeles; 1100 Glendon Ave #850; Los Angeles, CA 90024; acasillas@mednet.ucla.edu

diminish the ability to examine the emergence of early symptoms in middle-aged adults. Another gap in the current literature is that many studies are not nationally representative and do not have sufficient representation of minority race/ethnicity groups.<sup>4,9-18</sup>

Such limitations highlight the need for adjunctive surveillance tools for cognitive impairment that can be broadly applied at the population

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level. Memory problems, or subjective cognitive concerns, as described by the Centers for Disease Control (CDC), are “one of the first warning signs” of cognitive impairment and may be such an indicator.<sup>19-21</sup> The objectives of our exploratory study are to: 1) investigate racial/ethnic trends in subjective cognitive concerns (self-reported memory problems) from 1999-2014 in a

nationally representative sample of middle-aged and older adults; and 2) explore the contributions of demographic, socioeconomic, and health status variables to observed trends.

## METHODS

### Data Source

Conducted annually since 1999 by the CDC, the National Health and Examination Survey (NHANES) is a cross-sectional, multistage, stratified, clustered probability sample of the US civilian population for each time period.<sup>22</sup> The survey questionnaires are administered in the home, and all the procedures are extensively detailed by NHANES.<sup>22</sup> The SAS datasets used for our study were downloaded directly from the NHANES website.

Our analyses included NHANES participants aged  $\geq 45$  years, between 1999 and 2014, who reported their race/ethnicity as non-Hispanic White (NHW), non-Hispanic Black (NHB) and Hispanic/Latino. All NHANES procedures are in accordance with the ethical standards of the UCLA committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all participants included in the original survey. The UCLA institutional review board on human experimentation (IRB) approved the analyses for this study.

### Outcome and Covariates

The outcome of interest was subjective cognitive concerns (self-reported as memory problems by

NHANES participants). Participants were asked: “Are you limited in any way because of difficulty remembering or because you experienced periods of confusion?” (yes vs no; declined to answer or “don't know” were counted as missing). This self-report question has been used as a screen for memory problems in other study populations.<sup>19,23,24</sup>

The main variables were: race/ethnicity (non-Hispanic White, non-Hispanic Black and Hispanic/Latino); age group (categorized as middle-aged, aged 45-64 years; and older adults, aged  $\geq 65$  years);<sup>12</sup> and period (categorized in four-year intervals that included 1999-2002, 2003-2006, 2007-2010, and 2011-2014). Persons who reported a history of stroke were excluded in order to assess the burden of cognitive decline not directly related to acute injury to the brain. The pre-selected demographic covariates included sex, education level (did not graduate from high school, high school graduate or GED, education beyond high school), and income-poverty ratio (IPR; 0-1, 1.1-3,  $>3$ ). IPR (defined as family income divided by the federal poverty threshold) is established by the US Census Bureau Data at the time of each NHANES data collection.<sup>15</sup> The IPR values for these analyses were obtained from the original NHANES data without any further manipulation. The clinical covariates of interest were self-reported clinical diagnoses of the metabolic syndrome, that have been associated with cognitive impairment: dyslipidemia (none, untreated, treated), hypertension (none, untreated, treated) and diabetes mellitus (none, untreated, treated).<sup>4,25,26</sup>

**Table 1. Weighted demographic characteristics by race/ethnicity across periods<sup>a</sup>**

NHANES Period Cohort	1999-2002, N = 4761			2003-2006, N = 4666		
	NHW, N = 2606	NHB, N = 882	Latino, N = 1256	NHW, N = 2763	NHB, N = 960	Latino, N = 931
Race/Ethnicity						
Sex, n (%)						
Male, n (%)	1315 (47.0)	429 (43.3)	600 (45.0)	1401 (47.6)	462 (43.8)	452 (46.6)
Age group, n (%)						
45-64	1273 (64.7)	539 (73.4)	764 (74.3)	1332 (65.7)	625 (74.5)	533 (76.0)
≥ 65	1333 (35.3)	343 (26.6)	492 (25.7)	1431 (34.3)	335 (25.5)	398 (24.0)
Educational status, n (%)						
< High school	545 (17.7)	421 (43.4)	870 (55.7)	521 (13.5)	339 (31.9)	606 (51.3)
High school/GED	725 (26.8)	179 (21.4)	142 (17.8)	816 (29.3)	223 (23.7)	139 (17.1)
> High school	1336 (55.5)	282 (35.2)	244 (26.5)	1426 (57.1)	398 (44.4)	186 (31.6)
Income : poverty ratio, n (%)						
0 – 1.0	218 (7.27)	170 (19.6)	285 (23.1)	207 (5.23)	160 (16.4)	274 (22.5)
1.1 – 3.0	880 (28.2)	339 (36.3)	554 (42.7)	1099 (32.0)	406 (42.5)	403 (42.2)
> 3.0	1253 (55.6)	248 (30.9)	246 (23.3)	1298 (57.6)	351 (36.8)	196 (29.9)
Missing	255 (8.98)	125 (13.3)	171 (11.0)	159 (5.16)	43 (4.26)	58 (5.50)

NHANES Period Cohort	2007-2010, N = 6171			2011-2014, N = 4987		
	NHW, N = 3256	NHB, N = 1227	Latino, N = 1677	NHW, N = 2420	NHB, N = 1389	Latino, N = 1174
Race/ethnicity						
Sex, n (%)						
Male	1654 (47.9)	607 (43.8)	780 (47.9)	1150 (47.3)	683 (45.0)	567 (47.4)
Age group, n (%)						
45-64	1657 (66.6)	803 (75.2)	1168 (76.7)	1303 (65.8)	932 (74.3)	804 (76.4)
≥65	1599 (33.4)	424 (24.8)	509 (23.3)	1117 (34.2)	457 (25.7)	370 (23.6)
Educational status, n (%)						
Less than high school	659 (15.0)	416 (31.2)	934 (53.1)	375 (10.7)	353 (23.7)	593 (50.1)
High school/GED	873 (26.0)	299 (25.1)	259 (15.9)	558 (21.6)	393 (27.6)	212 (17.6)
Greater than high School	1724 (59.0)	512 (43.7)	484 (31.0)	1487 (67.7)	643 (48.7)	369 (32.3)
Income : poverty ratio, n (%)						
0 – 1.0	355 (6.17)	211 (17.3)	381 (22.3)	359 (7.79)	315 (23.8)	293 (24.4)
1.1 – 3.0	1236 (29.7)	511 (40.0)	683 (40.7)	877 (29.6)	505 (35.6)	458 (38.9)
> 3.0	1426 (57.3)	388 (33.0)	347 (22.2)	1044 (57.2)	431 (31.3)	272 (24.6)
Missing	239 (6.89)	117 (9.79)	266 (14.8)	140 (5.49)	138 (9.38)	151 (12.1)

NHW, non-Hispanic White; NHB, non-Hispanic Black.

a. Weighted percentages using appropriate National Health and Nutrition Examination Survey sample weights.

### Statistical Analysis

All statistical analyses were conducted using the SAS System for Windows 9.4 (Statistical Analysis Software, Cary, NC). The frequencies of sample characteristics and subjective cognitive concerns were generated for each 4-year period, specifically across racial/ethnic group. The goals of this study were to: 1) estimate proportions of NHANES participants with mem-

ory problems within each period by race/ethnicity and age category; and 2) examine whether the racial/ethnic disparities in these varied across the time periods. Generalized linear regression models with a *logit* link function were implemented using SAS PROC SURVEYLOGISTIC with appropriate sample weights accounting for unequal probabilities of selection, oversampling, and non-response to examine these aims.

### RESULTS

#### Descriptive Characteristics

Sample sizes in the four periods were: 4761 in 1999-2002, 4666 in 2003-2006, 6171 in 2007-2010, and 4987 in 2011-2014 (Table 1). In unadjusted, weighted analyses, NHW participants were more likely than NHB or Latino participants to have obtained education beyond high school and to have an IPR ≥3. Latino

participants were younger than the other two racial/ethnic groups; at least half had not graduated from high school; more than 22% had an IPR $\leq$ 1 across all NHANES time periods. Of note, about 25% of NHB and Latino participants in the most recent period (2011-2014) had an IPR $\leq$ 1.

### Unadjusted Racial/Ethnic Differences in Subjective Cognitive Concerns

Overall, among all participants, subjective cognitive concerns were more prevalent among NHB and Latino groups, compared with NHW participants, in all time periods (Figure 1). Middle-aged non-Hispanic Black participants had significantly greater percentages of subjective cognitive concerns in all time periods (except 2011-2014), compared

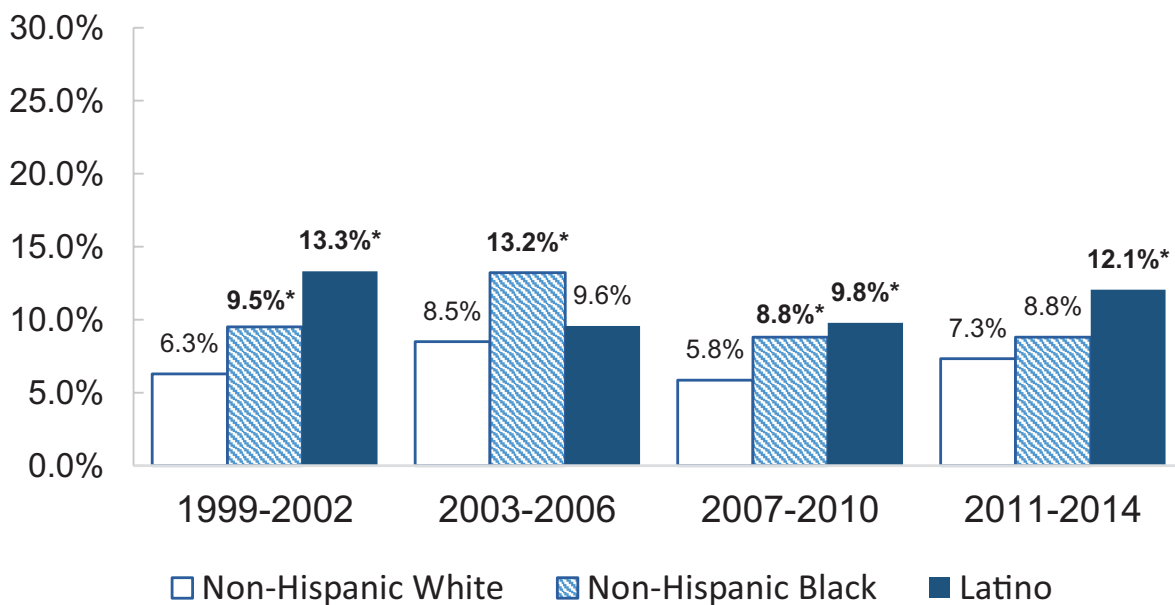
with non-Hispanic Whites (Figure 2). Latinos in the middle-aged (aged 45-64 years, Figure 2) and older adults (aged  $\geq$ 65 years, Figure 3) had significantly higher percentages of subjective cognitive concerns in all time periods (except 2003-2006), vs non-Hispanic Whites.

### Adjusted Racial/Ethnic Differences in Subjective Cognitive Concerns in Middle-Aged and Older Adult Groups

Figure 4 (panel A) shows that, among middle-aged adults, there were no significant differences in subjective cognitive concerns for either NHBs or Latinos compared with NHWs. Results from the adjusted analysis (not shown) also indicated that middle-aged participants who had not graduated from high school (AOR=1.75, 95%

CI: 1.34, 2.29) and those who were high school graduates (AOR=1.29, 95% CI: 1.02, 1.62) were more likely to report subjective cognitive concerns than middle-aged adults in the highest education category. Similarly, middle-aged adults with an IPR $\leq$ 1 had significantly higher odds of reporting subjective cognitive concerns compared with those with an IPR $>$ 3 (AOR=6.81, 95% CI: 5.08, 9.13). The presence of a treated cardio-metabolic condition was associated with higher odds of reporting subjective cognitive concerns for those without hypertension (AOR=1.27, 95% CI: 1.01, 1.58), without diabetes (AOR=1.52, 95% CI: 1.16, 1.98), and without dyslipidemia (AOR= 1.63, 95% CI: 1.30, 2.04).

As shown in Figure 4 (panel B), among those aged  $\geq$ 65 years, disparities in subjective cognitive concerns



**Figure 1. Unadjusted weighted percentages of subjective cognitive concerns for all participants aged  $\geq$  45 years, across racial groups and periods**

\* Significant difference in weighted percentages of subjective cognitive concerns (self-reported memory problems, ref: Non-Hispanic White) within time period

persisted among Latinos, who had significantly increased odds of reporting subjective cognitive concerns relative to NHWs in all time periods, except 2003-2006 (range of AOR: 1.43 – 2.01,  $P < .05$ ). In terms of covariates (not shown), higher odds of subjective cognitive concerns were associated with increasing age (AOR=1.08, 95% CI: 1.06, 1.10), female sex (AOR=1.30, 95% CI: 1.09, 1.55), not graduating from high school (AOR=1.50, 95% CI: 1.18, 1.91), and an IPR $\leq$ 1 (AOR=1.54, 95% CI: 1.14, 2.09). Older adults with untreated hypertension or diabetes had higher odds of subjective cognitive concerns compared with those without the conditions (AOR=1.77, 95% CI: 1.16, 2.70 for hypertension; AOR=1.65, 95% CI: 1.07, 2.56 for diabetes).

For both age groups, there were

no significant period differences in percentages with subjective cognitive concerns between the four-year intervals from 1999-2014.

### Subgroup Analysis

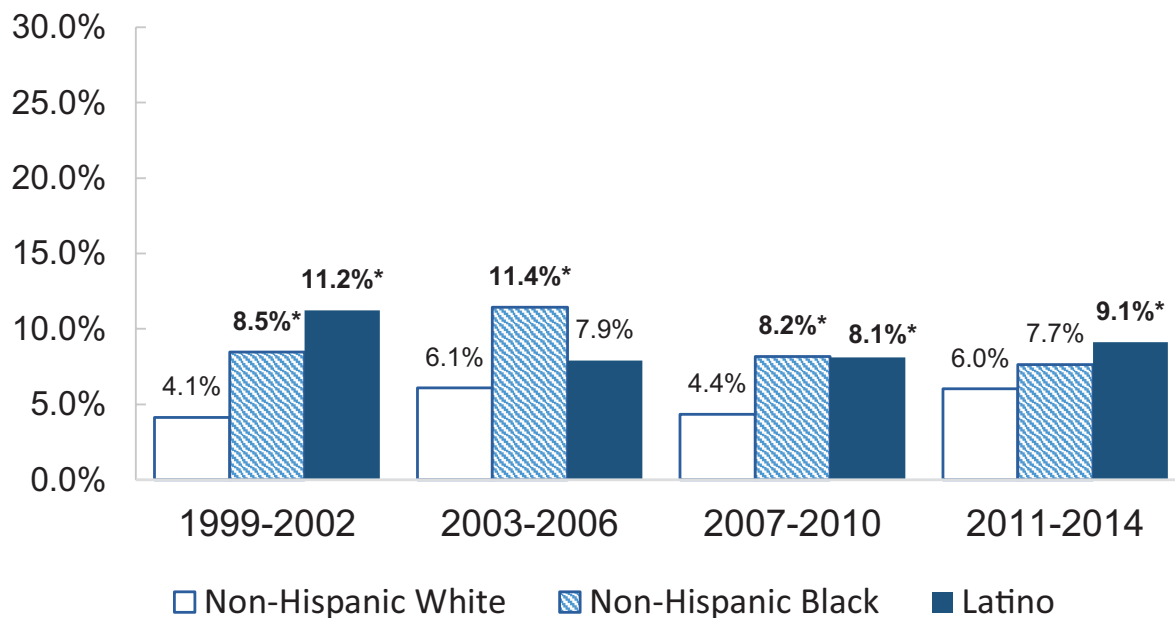
In education-stratified analyses of older adults, older Latinos without a high school education had significantly higher odds of subjective cognitive concerns than NHW adults without a high school education (Figure 5, panel A). Older Latinos who had graduated from high school did not have higher odds of subjective cognitive concerns than older NHW high school graduates (Figure 5, panel B).

## DISCUSSION

In this nationally representative sample of US adults between 1999

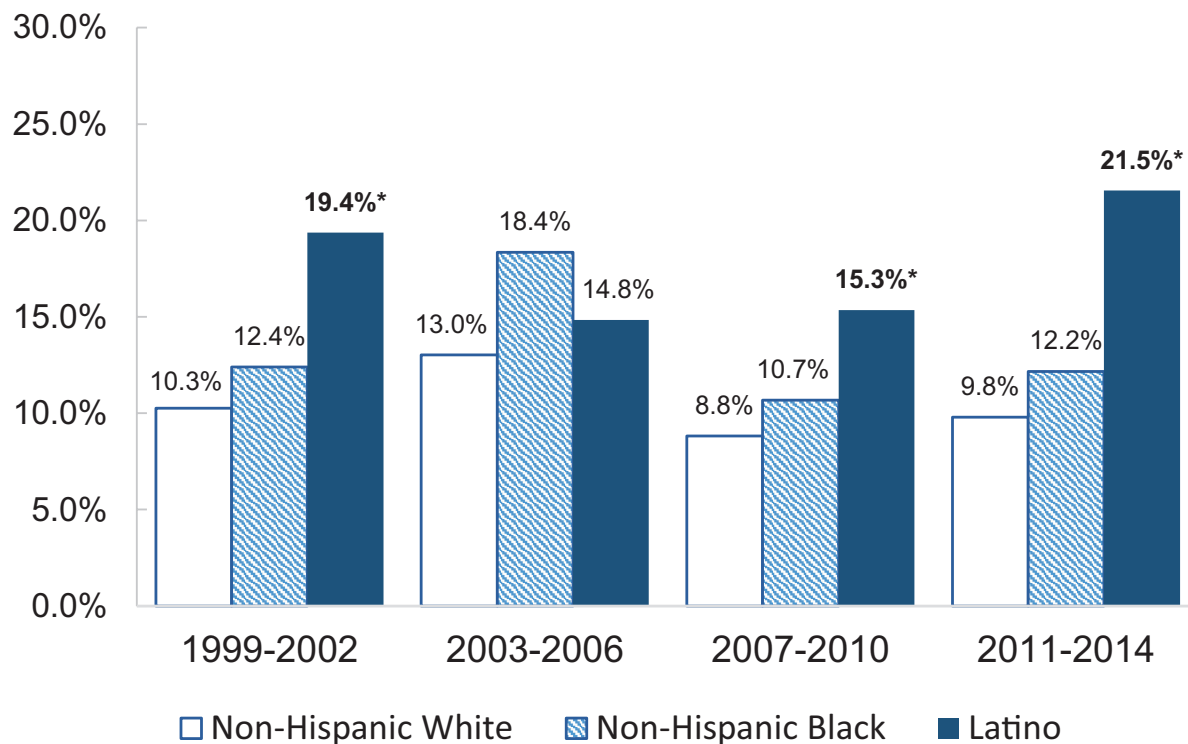
and 2014, subjective cognitive concerns (self-reported memory problems) were more prevalent among middle-aged and older non-Hispanic Black and Latino adults compared with non-Hispanic Whites, and these differences did not change across time periods. After adjustment for demographic and clinical covariates, higher prevalence of subjective cognitive concerns persisted only for older Latinos.

Our analyses address gaps in the current literature in several ways. First, little research addresses the cognitive health among middle-aged adults, and these findings indicate that the prevalence of subjective cognitive concerns among middle-aged minority adults was as high as 13% in some time periods. Our findings are consistent with a 2012 study that found declining cognitive



**Figure 2. Unadjusted weighted percentages of subjective cognitive concerns for participants aged 45-64 years only – across racial groups and periods**

\* Significant difference in weighted percentages of subjective cognitive concerns (self-reported memory problems, ref: Non-Hispanic White) within time period



**Figure 3. Unadjusted weighted percentages of subjective cognitive concerns for participants aged  $\geq 65$  years only – across racial groups and periods**

\* Significant difference in weighted percentages of subjective cognitive concerns (self-reported memory problems, ref: Non-Hispanic White) within time period

skills, including memory and reasoning among of British civil servant adults as young as 45 years of age.<sup>8</sup>

Our study also sought to identify racial/ethnic disparities in subjective cognitive concerns and to determine if observed disparities changed across time periods. Several prior analyses indicate that cognitive impairment among older minorities is higher than for NHW populations.<sup>9-12, 27-29</sup> However, most studies have used only one or two time-points. One analysis of the Health and Retirement (HRS) study used six waves of participants to evaluate differences in cognition test scores between 1993 and 2004. That analysis found a higher prevalence of cognitive impairment in non-White

populations, but also found an annual 3.4% decline in the prevalence of cognitive impairment over this period—with more significant declines for Blacks and Latinos (ref. Whites).<sup>4</sup> Our analyses did not find significant improvements in subjective cognitive concerns, nor did we find changes in disparities between 1999 and 2014. But despite the differences in the studies, the HRS analyses had found that increase in education level over time was the main determinant of change in cognitive impairment across periods.<sup>4</sup> Linear probability models demonstrated larger improvements in cognition scores for Blacks and Latinos (compared with Whites) that were mainly attributed

to increased educational level over time.<sup>4</sup> The present analyses, which showed that education level was persistently lower for Latinos and NHB compared with NHW adults over the periods studied and that lower education level was associated with higher rates of memory problems, is consistent with the HRS results.

The significant association between education level and subjective cognitive concerns among older Latinos in these analyses is consistent with prior research on educational attainment and cognitive impairment. Early-life education may indirectly influence cognitive impairment via neurobiological mechanisms that are then attenuated by the social con-

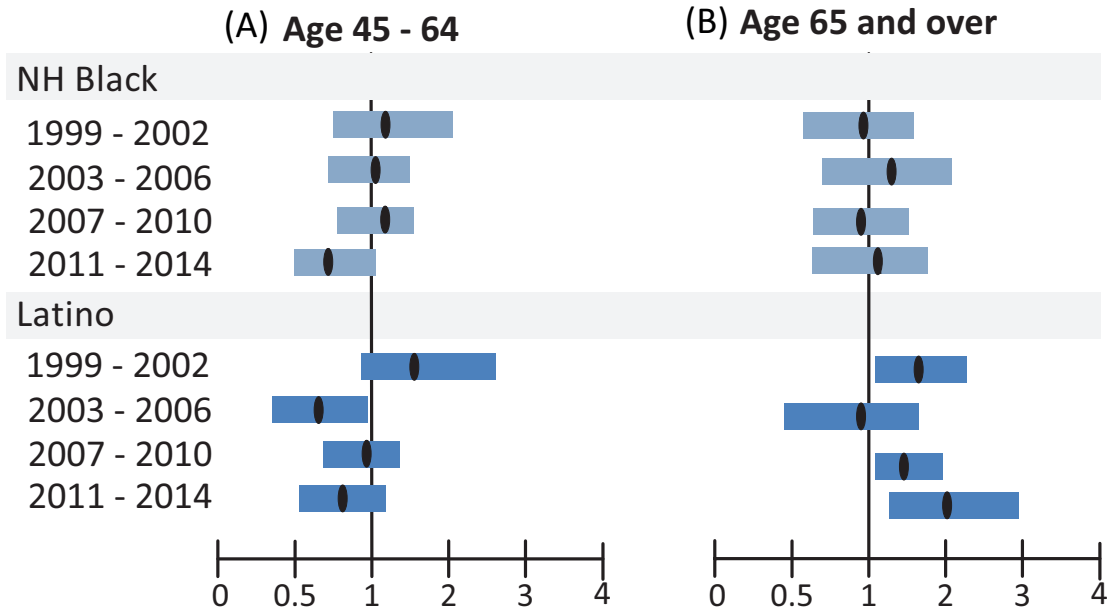


Figure 4. Adjusted odds ratios (with 95%CI) of subjective cognitive concerns across race/ethnicity for age category  
ref: Non-Hispanic White in specified age category

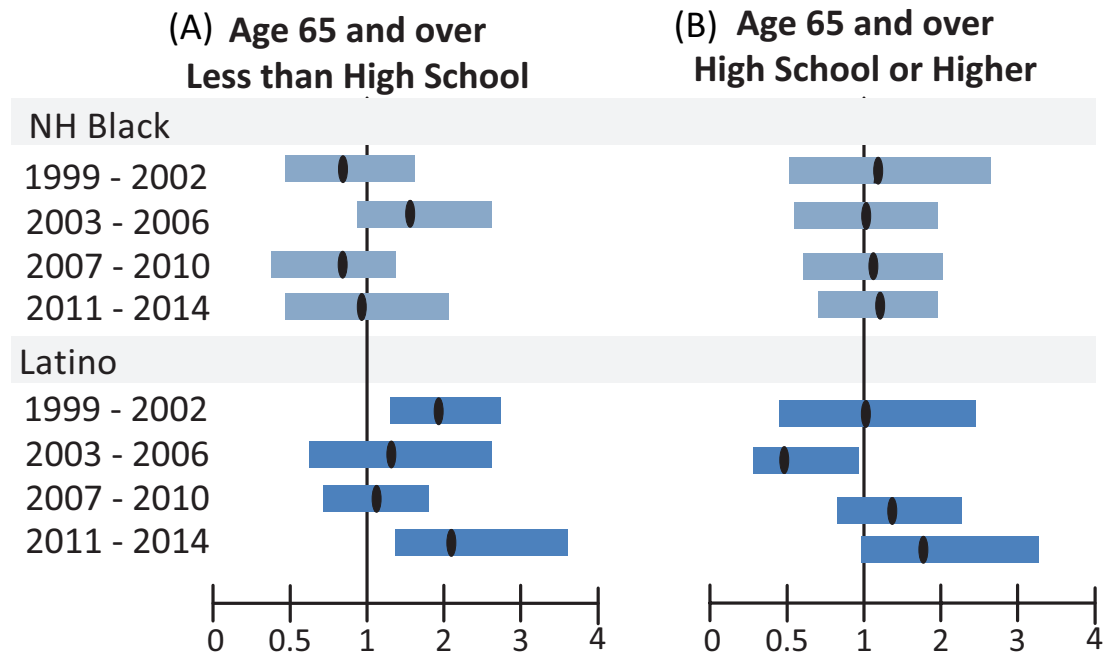


Figure 5. Adjusted odds ratios (with 95%CI) of subjective cognitive concerns across race/ethnicity for education level, among older adults  
ref: Non-Hispanic White in specified education level

text.<sup>30,31</sup> Early education promotes brain growth, synapse development and efficient brain function—all of which may be protective against cognitive impairment upon entering old age.<sup>31</sup> Years of education and higher quality schooling are associated with “better cognitive function, slower cognitive decline, and a lower risk of dementia later in life.”<sup>30</sup> Higher educational attainment is associated with more intellectually demanding careers and jobs— which then pro-

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*...subjective cognitive concerns (self-reported memory problems) were more prevalent among middle-aged and older non-Hispanic Black and Latino adults compared with non-Hispanic Whites...*

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tect cognitive function through the neurobiological processes described above.<sup>30</sup> Education is also positively associated with healthy lifestyles and low-risk behaviors, leading to lower risk of conditions such as diabetes and metabolic syndrome, which in turn contribute to lower cognitive health.<sup>25</sup> Additionally, the combination of higher socioeconomic status, indicated by higher education and income, reduces an older adult’s lifetime exposure to the stress associated

with poverty, a specific stress that has been linked to early cognitive decline and a higher risk of dementia.<sup>30,31</sup>

Thus, the profound impact of education on subjective cognitive concerns in late adult life is cause for concern in the aging minority communities in the United States. These analyses demonstrate that non-Hispanic Blacks and Latinos are more likely than non-Hispanic Whites to complete fewer years of schooling and to earn a lower income. The enormous gap in socioeconomic status between non-Hispanic Whites and both non-Hispanic Blacks and Latinos is a disadvantage that persists throughout the life course and may contribute to the persistent disparities in subjective cognitive concerns among minority communities, over the years studied. These findings provide adjunctive support for life-course socioeconomic (SES) solutions and social determinants of health strategies (including education, literacy, income, migration and financial stability) as public health mechanisms for addressing racial/ethnic disparities in cognitive impairment.<sup>9,30,32,33</sup>

The effects of education level on subjective cognitive concerns in older Latinos warrant even further investigation. A recent study used eight waves from the Hispanic Established Populations for the Epidemiologic Study of the Elderly to examine the role of education in the risk for cognitive impairment by nativity, age of migration, and gender. The investigators found that older age at migration was associated with higher risk for cognitive impairment, and that education significantly mediated the association between age of migration and cogni-

tive impairment.<sup>34</sup> It is possible that, in our present study, the older Latinos without a high school education had higher odds of memory problems for other reasons—such as age of migration, acculturation, nativity, or languages—that were not included in these analyses. Future research should examine the effect of these and related characteristics on subjective cognitive concerns, like self-reported memory problems, and prevalence and severity of cognitive impairment.

These analyses have potential limitations. The measure of subjective cognitive concerns (self-reported memory problems) in this study is not validated by any clinical measurement, and may be subject to recall bias. In addition, adults with higher subjective memory problems have reduced well-being, more depressive symptoms, and more anxiety.<sup>35-38</sup> Unfortunately, we were unable to control for mental health diagnoses (ie, depression, anxiety) because neither these diagnoses nor screening questions were collected consistently in NHANES for each period included in these analyses. However, we ran sensitivity analyses for survey years that included the Center for Epidemiologic Studies Depression Scale (CES-D) two question screener; we found that controlling for these responses did not appreciably change the results of the present analyses.<sup>22</sup>

Cultural factors (such as understanding of the term memory and stigma) may affect how respondents answered questions about cognitive function as they age; if NHB and Latino participants were more likely than NHWs to report memory problems, this could introduce bias.<sup>18</sup>



Confusion or memory loss themselves may interfere with respondents' ability to recall any problems with memory. These could result in an underestimate of the prevalence of subjective cognitive concerns. Finally, the survey does not include residents of nursing homes or other facilities where a high percentage of people with cognitive impairment reside.

Another limitation is a lack of data on the specific causes for subjective cognitive concerns. Persons who reported a history of stroke were excluded in order to assess the burden of cognitive decline not directly related to an acute brain injury.<sup>39</sup> It is important, however, to acknowledge that memory problems and confusion in older adults may be due to numerous causes—including but not limited to: medication and exposure to toxins, metabolic and/or endocrine derangements, delirium due to illness, and traumatic brain injury. We did not have information on these processes, so they could not be included in these analyses. Additionally, although we adjusted for common cardio-metabolic conditions associated with cognitive decline, we could not control for other potential contributors, such as heart disease, obesity, and renal disease. Finally, this study used serial cross-sectional data, and the associations observed may not be causal.

This is the first analysis to investigate prevalence of subjective cognitive concerns (self-reported memory problems) in the American population, across multiple time periods, in middle-aged and older adults. The racial/ethnic variation in respondent reports of memory problems mirrors and complements prior findings

documenting racial/ethnic disparities in cognitive impairment (using validated cognition scores and rates of dementia), and the significant role of educational attainment.<sup>4,7-10,27-29</sup> Given the higher prevalence of subjective cognitive concerns in non-Hispanic Black and Latino US populations in this nationally representative sample, even among middle-aged adults, our findings should push health care leaders to develop strategies for outreach among minority adults regarding memory problems. This includes education to affected communities about overcoming memory loss stigma and talking to a physician about memory difficulty—the latter is particularly important as CDC data has shown that only about 20% of patients who report some memory issue or confusion have talked to their health care provider about this issue.<sup>17</sup> Missed or delayed diagnoses related to cognitive impairment impede the ability to identify and intervene on treatable causes, and to provide timely and accurate information and resources to patients and their communities. Heightened awareness and screening opens the door for more comprehensive, long-term clinical planning (eg, advance directives, care needs), financial planning, and the development of biologic and behavioral interventions, which may improve outcomes for individuals at risk for cognitive impairment, and their surrounding community.

#### CONFLICT OF INTEREST

No conflicts of interest to report.

#### AUTHOR CONTRIBUTIONS

Research concept and design: Casillas, Brown, Liang; Acquisition of data: Casillas, Vassar, Liang; Data analysis and inter-

pretation: Casillas, Vassar, Brown, Liang; Manuscript draft: Casillas, Vassar, Brown, Liang; Statistical expertise: Casillas, Liang; Acquisition of funding: Casillas; Administrative: Casillas, Vassar; Supervision: Casillas, Brown

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