Association Between Subjective Cognitive Decline and Social and Emotional Support in US Adults

Xingran Weng, MSW1, Daniel R. George, MSc, PhD1,2, Bibo Jiang, MA, PhD1, and Li Wang, PhD1

Abstract
Subjective cognitive decline (SCD) has been linked to Alzheimer’s Disease in the literature. However, little is known about whether SCD is associated with social/emotional support (SES). To investigate this association, this study utilized the 2015 and 2016 Behavioral Risk Factor Surveillance System data. A study population of 17206 participants aged 45 years and older who responded to both the Emotional Support and Life Satisfaction survey module and the Cognition Decline survey module were included. Of this study population, 11.22% had SCD, and 21.83% reported insufficient SES. A much higher percentage of those with insufficient SES experienced SCD compared to those with sufficient SES (21.15% vs 8.45%, \( P < .0001 \)). Insufficient SES was significantly associated with SCD (odds ratio = 1.68, 95% confidence interval: 1.37-2.06), after controlling for other factors. Furthermore, this study found certain demographic groups such as female, white, or married groups were more likely to receive sufficient SES.

Keywords
social support, emotional support, BRFSS, subjective cognitive decline, Alzheimer disease, dementia

Introduction
It is estimated that 5% to 7% of people aged 60 and older have dementia globally, with Alzheimer’s Disease (AD) being the most common form of dementia.1 Identifying precursors of dementia is a critical step in prevention. Mild cognitive impairment (MCI), particularly the amnestic form of MCI where the memory loss is predominant, is recognized as a precursor for AD, with a conversion rate of 10% to 15% per year.2-4

Recent literature has shown increasing evidence that even before MCI, subjective cognitive decline (SCD), often referred to as subjective cognitive impairment, or subjective memory complaints, without objective measurements can “announce dementia” as a “pre-MCI stage of subsequently manifest Alzheimer disease.”5-12 A large cohort study following elderly participants for 5 years found that 15% of those with baseline subjective memory deterioration developed dementia compared to 6% of those without subjective memory deterioration.13 Another study demonstrated that among 21 individuals who had subjective cognitive worsening complaints, a total of 8 (38%) developed dementia (6 developed AD) within a 3-year follow-up period.14

Research on SCD focused mainly on biomarkers for people with SCD, or predictive factors for progression to AD, or cognitive outcomes, with little research on risk factors for SCD.3,11,15,16 Since growing evidence shows people with SCD are at an increased risk of developing AD, identifying risk factors for SCD may help prevent AD by preventing SCD in the first place. Reducing SCD can also lead to other health benefits, because SCD itself is shown to significantly reduce quality of life, shorten life expectancy, and lead to other neurodegenerative diseases and psychiatric diseases.10,17

Despite the usefulness of identifying risk factors for SCD, limited research exists in the literature. Using large telephone interviews, the study by Chen et al identified several modifiable risk factors for SCD including depression, lower education level, less exercise, and hypertension.18 Focusing on older...
African Americans, another study identified the following risk factors for subjective memory change: depression, anxiety, and total number of cerebrovascular risk factors.\textsuperscript{19} Peterson et al found household income was associated with SCD.\textsuperscript{20} These studies have identified some risk factors, but more research is needed to identify additional risk factors for SCD to better prevent the development of SCD and subsequent dementia. Despite the risk factors that have previously been identified, the effects of psychosocial elements (eg, social and emotional support [SES]) on SCD have hardly been investigated. Indeed, psychosocial elements are less studied factors according to a systematic review on risk factors for dementia and (objective) cognitive decline.\textsuperscript{21} This study focuses on one particular psychosocial element, namely SES, which to the best of our knowledge has not been directly explored as a risk factor for SCD in the literature.

There is a need to examine whether insufficient SES is a risk factor for SCD. Social and emotional support is an important factor that influences individuals’ overall well-being, both mentally and physically.\textsuperscript{22,23} Multiple studies have suggested that receiving sufficient SES may promote cognitive performance, resilience, and reduce memory loss among those studied.\textsuperscript{24-28} The mechanism of how SES benefits cognitive function has been explored in the literature. People with sufficient SES tend to lead more active social lives with more positive social relationships, which could possibly reduce the likelihood of developing dementia.\textsuperscript{29} Engaging actively in social activities provides the brain with complex stimuli to prevent cognitive decline.\textsuperscript{30} In addition, positive social relationships may be a protective factor against depression, which is strongly linked to cognitive decline.\textsuperscript{31}

Despite the evidence that SES is beneficial for cognitive performance, it is still unclear whether insufficient SES is a risk factor for SCD. In this article, we will use national US survey data from the Behavioral Risk Factor Surveillance System (BRFSS) to study the association between insufficient SES and SCD. Having sufficient SES is largely a subjective feeling; therefore, this information is best collected by interviews and surveys. The BRFSS data used for this study contain information on participant’s SES status. We hypothesize that insufficient SES is associated with SCD. Additionally, to better inform interventions aimed at improving SES, this study will further investigate which factors are associated with the receipt of sufficient SES.

Method

Data Source
This study used the BRFSS data, which is a large national telephone survey of non-institutionalized US adults conducted by the Centers for Disease Control and Prevention (CDC).\textsuperscript{32} The BRFSS survey questions consist of (1) required modules, which are required survey components for all 50 states and the District of Columbia; (2) optional modules, which are optional for states to choose from; and (3) state-added modules, which are modules added and used by individual states to collect data of interest to the state.\textsuperscript{33} The BRFSS survey conducts more than 400 000 adult interviews annually, and the CDC has various measures in place to ensure high-quality data.\textsuperscript{32}

The main data fields needed to examine the association between SCD and emotional and SES are contained in two optional modules from BRFSS: the Emotional Support and Life Satisfaction module (ESLS module) and the Cognitive Decline module (CD module). Behavioral Risk Factor Surveillance System data prior to 2011 were not included since they were not comparable to data after 2011 which include cellphone interviews and use of new weighting strategies.\textsuperscript{35} For the BRFSS data from 2011 to the most recent data year 2018, only the following states have conducted surveys using both ESLS module and the CD module: Minnesota in 2015, Rhode Island in 2015, and Tennessee in 2016. Therefore, the BRFSS data used for this study were from those three states in either 2015 or 2016.

Variables
A participant’s SCD status was defined by the answer to the question “During the past 12 months, have you experienced confusion or memory loss that is happening more often or is getting worse?” An answer of “yes” was considered as experiencing SCD. An answer of “no” was considered as confirming the absence of SCD. The primary predictor of our interest was SES status, which was assessed by the answer to the question “How often do you get the social and emotional support you need?” With five answer choices to select from: “always,” “usually,” “sometimes,” “rarely,” and “never,” a binary variable was created where “always” and “usually” were considered as having sufficient SES and “sometimes,” “rarely,” and “never” were considered as having insufficient SES. In our sensitivity analysis to see whether the study results were robust to the categorization of SES levels, we used an alternative grouping method, which grouped “sometimes” into sufficient SES.

To control for other variables that could contribute to SCD, we also considered age, gender, race, marital status, employment status, education level, exercise, depressive disorder, and chronic health conditions (coronary heart disease and diabetes) in the model. We chose to study adults aged 45 years and older since cognitive decline can begin as early as middle age.\textsuperscript{34,35} Depending on the original answer to the multiple-choice question, marital status was regrouped into four categories: married, divorced, widowed, and single. The divorced group included those who answered “divorced” as well as those who answered “separated” due to the small sample size of “separated.” The category “single” combined individuals who were never married and those who were a member of an unmarried couple. Employment status was also regrouped into the following categories: employed (including “employed for wages” and “self-employed”), out of work (including “out of work for less than one year” and “out of work for more than one year”), homemaker, retired, and unable to work. Education level was divided into three categories: “did not
graduate from high school,” “only graduated high school but not higher,” and “graduated from college or technical school” based on the original survey answer. Lastly, respondents’ diabetes status was regrouped into two categories: “having diabetes” and “not having diabetes” (including “no diagnosis of diabetes” and “having prediabetes”). The exercise variable was created based on dichotomous answer to the question “During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?” Observations with missing data were excluded.

Statistical Analysis

SAS version 9.4 was used to perform the statistical analysis. The data analysis incorporated the weighting variables to be statistically representative of the overall population according to the CDC’s codebook instruction. \(^{37}\) \(\chi^2\) tests were used to test the associations between SES and various categorical predictors.

Logistic regression models were fit to test the association between SCD and various covariates. Both univariate logistic regression models including one covariate of interest at a time and a multiple logistic regression model including all covariates simultaneously in one model were performed to evaluate the impact of different predictors on SCD. The multiple logistic regression model controlled for other categorical factors including age, gender, race, marital status, education level, employment status, exercise, depressive disorder, and other chronic health issues. In addition, logistic regression was employed to investigate what factors were associated with the receipt of sufficient SES.

Results

A total of 17206 participants from the 2015 and 2016 BRFSS survey were included in this study; 13727 participants from the 2015 survey and 3479 from the 2016 survey, respectively. Table 1 shows the demographic characteristics as well as the percentages of SCD within each subgroup of respondents. The second column in Table 1 summarizes the distribution of various participant characteristics for the entire study population. The third and fourth columns show the percentages of respondents with and without SCD respectively, among those who have the same categorical value listed in column 2.

As shown in Table 1, the study population contained a greater number of females than males (53.01% vs 46.99%, respectively). Each of the three age groups (45-54, 55-64, and 65 and older) accounted for approximately one third of the study population. Since the data originated from the three states with relatively higher percentages of white populations, the non-white population in this study (12.73%) was lower than the national average, even after properly weighting the data. \(^{38}\)

Since the study population was older than the general population, a higher percentage of widowed participants (12.35%) and higher percentage without high school diplomas (12.93%) were observed. Among the study population, 33.39% were retired, 48.41% were currently employed, and 9.79% were unable to work.

In total, 21.83% of the study population (n = 3204) reported insufficient SES and 78.17% had sufficient SES. Specifically, for the frequency of receiving SES, 6.18% reported “never,” 3.54% reported “occasionally” and 12.11% reported “sometimes”, while 24.71% responded “usually,” and 53.46% responded “always.”

Columns 3 and 4 in Table 1 show the distribution of SCD status. In total, 11.22% (n = 1773) of the study population experienced SCD. As shown in Table 1, there was no statistical difference in SCD by gender \((P = .54)\), with 10.96% of males and 11.46% of females experiencing SCD. By race, non-whites were more likely to experience SCD \((P = .01)\), with 13.32% of blacks and 16.52% of other race experiencing SCD compared to 10.73% of whites. Subjective cognitive decline status differed by marital status \((P < .0001)\), with those divorced most likely to experience SCD (18.07%). \(\chi^2\) tests showed that SCD status was also distributed differently for other demographic variables including education level and employment status (both \(P < .0001\)). The distribution of SCD status was statistically different for various participant characteristics including having exercise \((P < .0001)\), depressive disorder \((P < .0001)\), coronary heart disease \((P < .0001)\), and diabetes \((P < .0001)\).

With respect to the primary risk factor of interest-SES, 21.15% of those with insufficient SES experienced SCD, compared to just 8.45% of those with sufficient SES \((P < .0001)\).

Table 2 shows the logistic regression results to assess the effect of various risk factors for SCD. To examine the effects of different predictors, this study utilized both univariate (columns 3 and 4 in Table 2) and multiple logistic regression models (columns 5 and 6 in Table 2).

In the univariate analysis, the following binary variables were statistically significantly associated with SCD: insufficient SES (odds ratio \([OR]\) = 2.90, 95% confidence interval \([CI]\): 2.45-3.44), no exercise \((OR = 2.04, 95\% CI: 1.72-2.41)\), depressive disorder \((OR = 5.65, 95\% CI: 4.78-6.68)\), coronary heart disease \((OR = 2.52, 95\% CI: 2.00-3.17)\), and diabetes \((OR = 2.18, 95\% CI: 1.80-2.64)\). In the univariate analysis, the following categorical variables with multiple categories were also statistically significant in explaining SCD. For example, being white was less likely to have SCD compared to being of other race \((OR = 0.61, 95\% CI: 0.42-0.87)\), whereas being divorced was more likely to experience SCD compared to being married \((OR = 2.19, 95\% CI: 1.79-2.69)\). Not graduating from high school was associated with a greater likelihood of experiencing SCD compared to graduating from college or technical school \((OR = 3.62, 95\% CI: 3.17-4.13)\). Compared to the employed respondents, those who were out of work \((OR = 3.69, 95\% CI: 2.59-5.25)\), unable to work \((OR = 9.71, 95\% CI: 7.59-12.44)\), or retired \((OR = 2.18, 95\% CI: 1.79-2.65)\) were more likely to experience SCD.

As shown in the last 2 columns in Table 2, in the multiple logistic regression model which included all the covariates of interest, insufficient SES still significantly increased the risk of
having SCD (OR_adj = 1.68, 95% CI: 1.37-2.06). With other variables being controlled for in the multiple logistic regression, the following risk factors for experiencing SCD were identified: unable to work (compared to being employed; OR_adj = 3.83, 95% CI: 2.88-5.08), no exercise (OR_adj = 3.23, 95% CI: 1.02-1.49), depressive disorder (OR_adj = 3.80, 95% CI: 3.16-4.57), coronary heart disease (OR_adj = 1.66, 95% CI: 1.25-2.19), and diabetes (OR_adj = 1.45, 95% CI: 1.18-1.78).

To investigate how robust the study results were, we performed some sensitivity analyses. The SES level variable was redefined by grouping “sometimes” into the “sufficient SES” group in sensitivity analysis. The results still showed a strong significant protective effect of sufficient SES against SCD. We also did some subgroup analyses to analyze the SES effect within subgroups stratified by gender or age. Within each subgroup, insufficient SES was consistently significantly associated with an increased risk of SCD.

Since insufficient SES was found to be an important risk factor for SCD based on our analysis, we did a further analysis to investigate what factors are associated with having sufficient SES, in order to inform efforts to improve SES level. As shown in Table 3, results from fitting a multiple logistic regression model indicated that the following factors were associated with a higher likelihood of receiving SES: being female (OR_adj = 1.30, 95% CI: 1.13-1.50), white (compared to other race, OR_adj = 1.46, 95% CI: 1.07-1.98), married (compared to being single, OR_adj = 1.83, 95% CI: 1.45-2.32), having graduated from high school (compared to not graduating from high school, OR_adj = 1.49, 95% CI: 1.18-1.86) or having graduated from college or technical school (compared to not having graduated from high school, OR_adj = 2.25, 95% CI: 1.74-

Table 1. Demographic Characteristics and Percentages With Subjective Cognitive Decline (SCD).

| Variablesa, P Values | All Participantsb (n = 17 206) | % of Respondents With SCDc (n = 1773) | % of Respondents Without SCDc (n = 15 433) |
|---------------------|--------------------------------|--------------------------------------|------------------------------------------|
| Gender; P = .5447   | Male (46.99%)                   | 10.96%                               | 89.04%                                   |
|                     | Female (53.01%)                 | 11.46%                               | 88.54%                                   |
| Age; P = .2321      | 45-54 (30.66%)                  | 10.27%                               | 89.73%                                   |
|                     | 55-64 (31.84%)                  | 12.08%                               | 87.92%                                   |
|                     | 65 and older (37.50%)           | 11.28%                               | 88.72%                                   |
| Race; P = .0109     | White (87.27%)                  | 10.73%                               | 89.27%                                   |
|                     | Black (7.47%)                   | 13.32%                               | 86.68%                                   |
|                     | Other races (5.26%)             | 16.52%                               | 83.48%                                   |
| Marital status; P < .0001 | Married (62.28%)              | 9.14%                                | 90.86%                                   |
|                     | Divorced (16.54%)               | 18.07%                               | 81.93%                                   |
|                     | Widowed (12.35%)                | 11.30%                               | 88.70%                                   |
|                     | Single (8.83%)                  | 13.02%                               | 86.98%                                   |
| Education level; P < .0001 | Did not graduate from high school (12.93%)  | 20.92%                               | 79.08%                                   |
|                     | Only graduated from high school but not higher (60.99%)  | 11.05%                               | 88.95%                                   |
|                     | Graduated from college or technical school (26.08%) | 6.82%                                | 93.18%                                   |
| Employment status; P < .0001 | Employed (48.41%)           | 5.56%                                | 94.44%                                   |
|                     | Out of work (3.44%)             | 17.85%                               | 82.15%                                   |
|                     | Homemaker (4.97%)               | 11.08%                               | 88.92%                                   |
|                     | Retired (33.39%)                | 11.39%                               | 88.61%                                   |
|                     | Unable to work (9.79%)          | 36.40%                               | 63.60%                                   |
| Social and emotional support level; P < .0001 | Insufficient (21.83%)        | 21.15%                               | 78.85%                                   |
|                     | Sufficient (78.17%)             | 8.45%                                | 91.55%                                   |
| Exercise; P < .0001 | Exercised in the past month (70.10%) | 8.92%                                | 91.08%                                   |
|                     | No exercise in the past month (29.90%) | 16.62%                               | 83.38%                                   |
| Depressive disorder; P < .0001 | Yes (20.09%)                  | 29.02%                               | 70.98%                                   |
|                     | No (79.91%)                     | 6.85%                                | 93.25%                                   |
| Coronary heart disease; P < .0001 | Yes (7.68%)                  | 22.42%                               | 77.58%                                   |
|                     | No (92.32%)                     | 10.29%                               | 89.71%                                   |
| Diabetes; P < .0001 | Yes (16.42%)                    | 18.98%                               | 81.02%                                   |
|                     | No (83.58%)                     | 9.70%                                | 90.30%                                   |

aThe P values are for testing whether the categorical variable under study is associated with SCD status.
bThe percentages under the column “all participants” represent the distribution among all categorical values of a given categorical variable. The percentages under the same categorical variable in this column adds up to 100% vertically. For instance, for the gender variable, 46.99% + 53.01% = 100%.
cThe percentages in the third and fourth columns are the distribution of SCD status for a given subgroup of respondents with the same categorical value of a categorical variable. Those percentages add up to 100% horizontally. For instance, within the male subgroup, 10.96% (with SCD) + 89.04% (without SCD) = 100%.
2.90), and employed (compared to unable to work, OR_adj = 1.55, 95% CI: 1.22-1.98), exercise (OR_adj = 1.37, 95% CI: 1.18-1.58), no depressive disorder (OR_adj = 2.28, 95% CI: 1.96-2.66), and no diabetes (OR_adj = 1.22, 95% CI: 1.01-1.46).

**Table 2. Logistic Regression Models for SCD Explained by SES.**

| Variables                        | Categories                          | Univariate Logistic Regression | Multiple Logistic Regression |
|----------------------------------|-------------------------------------|--------------------------------|------------------------------|
|                                  |                                     | ORs (95% CI) | P Values | ORs (95% CI) | P Values |
| Social and emotional support     | Sufficient (Ref)                    |                |          |              |          |
|                                  | Insufficient                        | 2.90 (2.45-3.44)\(^a\) | <.0001   | 1.68 (1.37-2.06)\(^a\) | <.0001   |
| Gender                           | Female (Ref)                        |                |          |              |          |
|                                  | Male                                | 1.05 (0.89-1.24) | .54      | 0.84 (0.70-1.00) | .555     |
| Age                              | 45-54 (Ref)                         |                |          |              |          |
|                                  | 55-64                               | 1.20 (0.96-1.50) | .11      | 0.99 (0.78-1.25) | .90      |
|                                  | 65 and older                        | 1.11 (0.91-1.36) | .31      | 1.00 (0.76-1.32) | .99      |
| Race                             | Other races (Ref)                   |                |          |              |          |
|                                  | White                               | 0.61 (0.42-0.87)\(^b\) | .0064   | 0.73 (0.52-1.02) | .06      |
|                                  | Black                               | 0.78 (0.48-1.25) | .29      | 0.84 (0.53-1.35) | .47      |
| Marital status                   | Married (Ref)                       |                |          |              |          |
|                                  | Divorced                            | 2.19 (1.79-2.69)\(^a\) | <.0001   | 1.24 (0.98-1.57) | .07      |
|                                  | Widowed                             | 1.27 (1.03-1.56) | .03      | 0.90 (0.70-1.15) | .41      |
|                                  | Single                              | 1.49 (1.09-2.03)\(^c\) | .01      | 0.97 (0.70-1.33) | .84      |
| Education level                  | Graduated from college or technical school (Ref) |                |          |              |          |
|                                  | Did not graduate high school        | 3.62 (2.77-4.72)\(^a\) | <.0001   | 1.43 (1.04-1.97)\(^c\) | .03      |
|                                  | Graduated high school but not higher| 1.70 (1.44-2.00)\(^a\) | <.0001   | 1.20 (1.00-1.44) | .05      |
| Employment status                | Employed (Ref)                      |                |          |              |          |
|                                  | Out of work                         | 3.69 (2.59-5.25)\(^a\) | <.0001   | 2.29 (1.55-3.38)\(^a\) | <.0001   |
|                                  | A homemaker                         | 2.12 (1.40-3.20)\(^b\) | .0004   | 2.01 (1.29, 3.14)\(^b\) | .002     |
|                                  | Retired                             | 2.18 (1.79-2.65)\(^a\) | <.0001   | 1.95 (1.51-2.52)\(^a\) | <.0001   |
|                                  | Unable to work                       | 9.71 (7.59-12.44)\(^a\) | <.0001   | 3.83 (2.88, 5.08) | <.0001   |
| Exercise                         | Exercised in the past month (Ref)   |                |          |              |          |
|                                  | No exercise in the past month       | 2.04 (1.72-2.41)\(^a\) | <.0001   | 1.23 (1.02-1.49)\(^c\) | .03      |
| Depressive disorder              | No (Ref)                            |                |          |              |          |
|                                  | Yes                                 | 5.65 (4.78-6.68)\(^a\) | <.0001   | 3.80 (3.16-4.57)\(^a\) | <.0001   |
| Coronary heart disease           | No (Ref)                            |                |          |              |          |
|                                  | Yes                                 | 2.52 (2.00-3.17)\(^a\) | <.0001   | 1.66 (1.25, 2.19)\(^b\) | .0004    |
| Diabetes                         | No (Ref)                            |                |          |              |          |
|                                  | Yes                                 | 2.18 (1.80-2.64)\(^a\) | <.0001   | 1.45 (1.18, 1.78)\(^b\) | .0005    |

Abbreviations: CI, confidence interval; ORs, odds ratios; SCD, subjective cognitive decline.

\(^a\)P < .0001.

\(^b\)P < .01.

\(^c\)P < .05.

**Discussion**

This study shows that insufficient SES is a significant risk factor for SCD. The odds ratio in multiple logistic regression model was 1.68, higher than most other well-recognized risk factors such as no exercise, having history of coronary heart disease, or history of diabetes. Not only is SES statistically significant, but the magnitude of its effect is clinically large, for as many as 21.15% of people with insufficient SES reported SCD, whereas only 8.45% of those with sufficient SES reported SCD. The reasons why insufficient SES is linked to SCD are similar to those that explain why insufficient SES is linked to dementia. The reasons may include that lack of SES is associated with less positive relationships and less engagement in social activities which result in less brain stimulation and a greater degree of depression, whereas more SES is associated with more social activities and better functioning of the brain.29-31

To the best of our knowledge, this study is the first to directly investigate the association between SES and SCD using recent large scale US survey data. In the general literature on MCI and dementia, SES is widely recognized as a risk factor for MCI and dementia, though possibly expressed under a variety of terminology representing psychosocial factors, including social support, social engagement, social relations, social network, active social life, informational support, and emotional support.21,30,39-45 The fact that SCD, MCI, and dementia share the same risk factor, that is, SES, highlights the importance of
increasing SES level, as it may prevent not only SCD but also MCI and dementia.

In addition, our analysis identified several factors that are associated with a higher likelihood of receiving SES. Some of these factors, such as being employed or having a higher education level, are modifiable which can lead to a higher SES level. Awareness of the detrimental effects of insufficient SES and its risk factors can motivate patients and families to consciously self-evaluate their own SES levels and actively seek more SES. Acknowledging the importance of SES will assist physicians with improving patient care and provide guidance for health interventions and policies that aim to prevent SCD, MCI, and dementia by increasing the level of SES. Various interventions to improve SES have been explored in the literature, including education of spouse, involvement of a support person, and group problem-solving.46

In addition to SES, other variables were found to be significant risk factors for SCD in our study, including divorce, out of work, lower education level, no exercise, and history of a depressive disorder, coronary heart disease, and diabetes. Being divorced, out of work, or less educated may indicate smaller social network, less mind-stimulating activities, or a higher likelihood of depression, which may contribute to the development of SCD. No exercise, history of depression, coronary heart disease, or diabetes may lead to physical health problems, which may reciprocally affect one’s mental health and lead to SCD. Interestingly, while older adults are more prone to develop dementia, old age was not found to be a risk factor for SCD in our study population. A likely reason was that the survey questionnaire was only administered to those who were mentally capable of answering surveys, thus elderly people with dementia generally would not have been included as survey respondents.47 Caution needs to be taken when interpreting the age effect in our model.

Most of the risk factors identified in this study are consistent with findings in the few related studies on risk factors for SCD. For example, depression and less exercise were also identified as risk factors in the study by Chen et al.18 Less education was identified to be a risk factor by both Chen et al and Peterson et al.18,20 Depression, a statistically significant risk factor in our study, was also identified by Sperling et al.19 However, none of those studies specifically considered SES or any other psychosocial factor as a risk factor, which turned out to be one of the strongest risk factors for SCD in our study.

This study has several limitations. First, the SCD status was based on a respondent’s answer to the survey question, which may be subject to recall bias. However, we believe that this possible bias should be minimal since the respondents were required to be mentally and physically capable to complete the interview.47 In addition, the recall bias is probably small because the percentages of respondents who reported having experienced SCD were consistent across all the years in the BRFSS data including the data years that were not included in this study. Second, our data were from three US states and may not be generalizable to the entire US population. Another limitation is that the BRFSS data are cross-sectional with no follow-up over time. Without proper follow-up, it is difficult to know whether a change in SES status over time can result in a change in SCD status, which is of great interest to study.

Despite these limitations, our study using large nationally representative survey data shows a strong association between insufficient SES and SCD, suggesting that obtaining and maintaining sufficient SES may be a critical approach to preventing SCD and possibly subsequent dementia. When designing

### Table 3. Multiple Logistic Regression of the Associations Between Demographic Characteristics and Having Sufficient SES.

|                                          | Sufficient SES |
|------------------------------------------|----------------|
|                                          | Adjusted ORs (95% CI) | P Values |
| **Gender**                               |                |          |
| Male (Ref)                               | 1.30 (1.13-1.50) | .003     |
| Female                                   |                |          |
| **Age**                                  |                |          |
| 45-54 (Ref)                              | 1.09 (0.91-1.31) | .34      |
| 55-64                                    | 1.08 (0.87-1.33) | .49      |
| 65 and older                             |                |          |
| **Race**                                 |                |          |
| White (Ref)                              | 1.46 (1.07-1.98) | .02      |
| Black and African American               | 0.75 (0.50-1.13) | .16      |
| **Marital status**                       |                |          |
| Married                                  | 1.83 (1.45-2.32) | <.0001   |
| Divorced                                 | 0.75 (0.58-0.97) | .03      |
| Widowed                                  | 1.37 (1.03-1.82) | .03      |
| **Education level**                      |                |          |
| Did not graduate from high school (Ref)  | 1.49 (1.18-1.86) | .0007    |
| Only graduated from high school but not higher | 2.25 (1.74-2.90) | <.0001   |
| Graduated from college or technical school |                |          |
| Employed                                 | 1.55 (1.22-1.98) | .0004    |
| Out of work                              | 0.89 (0.62-1.29) | .55      |
| A homemaker                              | 1.53 (1.05-2.24) | .03      |
| Retired                                  | 1.26 (0.98-1.63) | .08      |
| **Exercise**                             |                |          |
| No exercise in the past month (Ref)      | 1.37 (1.18-1.58) | <.0001   |
| Exercised in the past month              |                |          |
| **Depression disorder**                  |                |          |
| Yes (Ref)                                | 2.28 (1.96-2.66) | <.0001   |
| No                                       |                |          |
| **Coronary heart disease**               |                |          |
| Yes (Ref)                                | 1.00 (0.79-1.26) | .99      |
| No                                       |                |          |
| **Diabetes**                             |                |          |
| Yes (Ref)                                | 1.22 (1.01-1.46) | .04      |
| No                                       |                |          |

Abbreviations: CI, confidence interval; ORs, odds ratios; SES, social and emotional support.

a P < .001.
b P < .05.
c P < .0001.

The American Journal of Alzheimer’s Disease & Other Dementias
preventative programs for SCD and dementia, improving SES should be considered by addressing the factors that are associated with insufficient SES.

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ORCID iDs
Xingran Weng https://orcid.org/0000-0002-9585-5727
Li Wang https://orcid.org/0000-0001-7908-7388

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