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Associations between socioeconomic status and stroke in American adults: A population-based study

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ABSTRACT

Stroke is an acute cerebrovascular disease that can lead to disability and death. This study aimed to investigate the relationship between socioeconomic status (SES) and stroke. SES was evaluated by two variables: poverty to income ratio (PIR) and education level. In this multi-subject study, we collected data from the National Health and Nutrition Examination Survey (NHANES) database between 2009 and 2018, and finally 22,792 adults (≥20 years old) were included in the study. We proceeded with weighted multivariate logistic regression analysis as well as subgroup analysis. When analyzing the effect of PIR on stroke alone, the results showed that an increase in PIR levels was associated with a decrease in stroke incidence (OR = 0.764 95% CI: (0.711, 0.820), $p < 0.001$). The multivariate analysis presented a decline in stroke incidence in the highest quartile PIR group compared to the lowest quartile PIR group (OR = 0.296 95% CI: (0.214, 0.409), $P < 0.001$). Our results indicated that PIR is a protective factor for stroke, but there are exceptions in this relationship among different people. Hence, it is imperative that policymakers, healthcare providers, and clinicians take into account the inequality distribution of SES among adults while developing and executing stroke prevention and treatment strategies.

1. Introduction

Stroke is a major global public health challenge, imposing significant economic burdens on families and society (GBD, 2016; Alwan et al., 2010; Krishnamurthi et al., 2013). In 2019, stroke was the second leading cause of death (11.6% [10.8–12.2] of total deaths) and the third leading cause of disability combined (5.7% [5.1–6.2] of total disability-adjusted life-years) in the world (GBD, 2019). There are multiple risk factors for stroke, including old age, diabetes, hyperlipidemia, high body mass index (BMI), coronary heart disease, and hypertension (Mai and Liang, 2020; Aigner et al., 2017; Aono et al., 2021; Schutte et al., 2021; Gregory et al., 2021; Dieteren and Bonfrer, 2021). Studies have shown that income poverty is a risk factor for premature death and increased disease incidence (Marmot, 2002). Multiple studies have shown that populations in low- and middle-income countries have a higher risk of stroke (Saini et al., 2021; Akinyemi et al., 2021; Krishnamurthi et al., 2020; Marshall et al., 2015). Furthermore, in addition to income disparities, racial differences also play a role in influencing disease incidence (Zare et al., 2021). Some studies have shown that the risk of stroke varies by race (Howard et al., 2019; Finnegan et al., 2022).

Socioeconomic status (SES) measures a person's or family's economic and social status relative to other people or families in society. Some studies have shown that SES is associated with non-communicable diseases such as ischemic heart disease, heart failure, diabetes and obesity (Zare et al., 2021; Mustapha et al., 2022; Hawkins Carranza et al., 2022; Zare et al., 2021 Jul 2). Generally speaking, SES from higher socioeconomic status may provide direct or indirect defense against these diseases. In recent decades, growing evidence has suggested an inverse relationship between socioeconomic status and the risk of stroke (Addo et al., 2012). However, according to some studies, stroke risk increases with high socioeconomic status, with an inverted U-shaped association or no association (Avendano et al., 2006; Engels et al., 2014; Seo et al., 2014).

In conclusion, there is no definite conclusion about the relationship

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between SES and stroke, so further studies are needed to verify it (Avendaño et al., 2004). The complexity of SES determines the diversity of its measurement metrics. Every single indicator has its limitations and reflects different aspects of SES. PIR (poverty to income ratio) is calculated by dividing household income in the survey year by the poverty threshold, which many's studies use as a primary indicator of socioeconomic status (Suresh et al., 2011; Xiao et al., 2022). The research chose PIR and education level as metrics because of their more representative of investigating the interrelation between SES and stroke occurrence using a representative accredited sample of National Health and Nutrition Examination Survey (NHANES).

2. Materials and methods

2.1. Data and sample sources

We used data from the NHANES for a decade from 2009 to 2018. Using a stratified, multistage probability design, the NHANES provides a representative sample of the non-institutionalized US population (Zare et al., 2021; Zare et al., 2021 Jul 2; Fan et al., 2023). We selected adults (age $\geq$ 20 years) from NHANES 2009–2018 for this research (Fig. 1). After excluding those without data on stroke, PIR, education level, hypertension, hyperlipidemia, diabetes, coronary heart disease, or BMI, 22,792 participants were included. The NCHS Research Ethics Review Board authorized the survey and ensured all participants gave informed consent. Authors cannot access information that could identify individual participants during or after data collection. The detailed NHANES study design and data are publicly available at https://www.cdc.gov/nchs/nhanes/.

NHANES, National Health and Nutrition Examination Surveys. PIR, poverty to income ratio. BMI, body mass index.

2.2. Main variables and outcome variables

In this study, SES (PIR and educational attainment) was the exposure variable, which has been used as the primary indicator in many studies (Suresh et al., 2011; Xiao et al., 2022). As a measurement of poverty, PIR consults the poverty guidelines provided by the Department of Health and HuMen Services. As the official poverty measurement standard used by the US Census, PIR considers an individual's socioeconomic status relative to the poverty threshold and household size, resulting in a more precise estimate that reflects those individuals' actual poverty experience (Hoge et al., 2020). Four education levels were categorized as <9th grade, 9-11th grade, high school graduate, and college or above. Definition of stroke: Has a doctor or other health professionals ever told you that you had a stroke (Yan et al., 2022 Oct; Mai and Liang, 2020). The Medical Condition Questionnaire (MCQ160f) was evaluated for an accurate stroke diagnosis. The questions were asked, in the home, by trained interviewers using the Computer-Assisted Personal Interview (CAPI) system.

2.3. Covariate

Demographic variables included in the study included age (years),

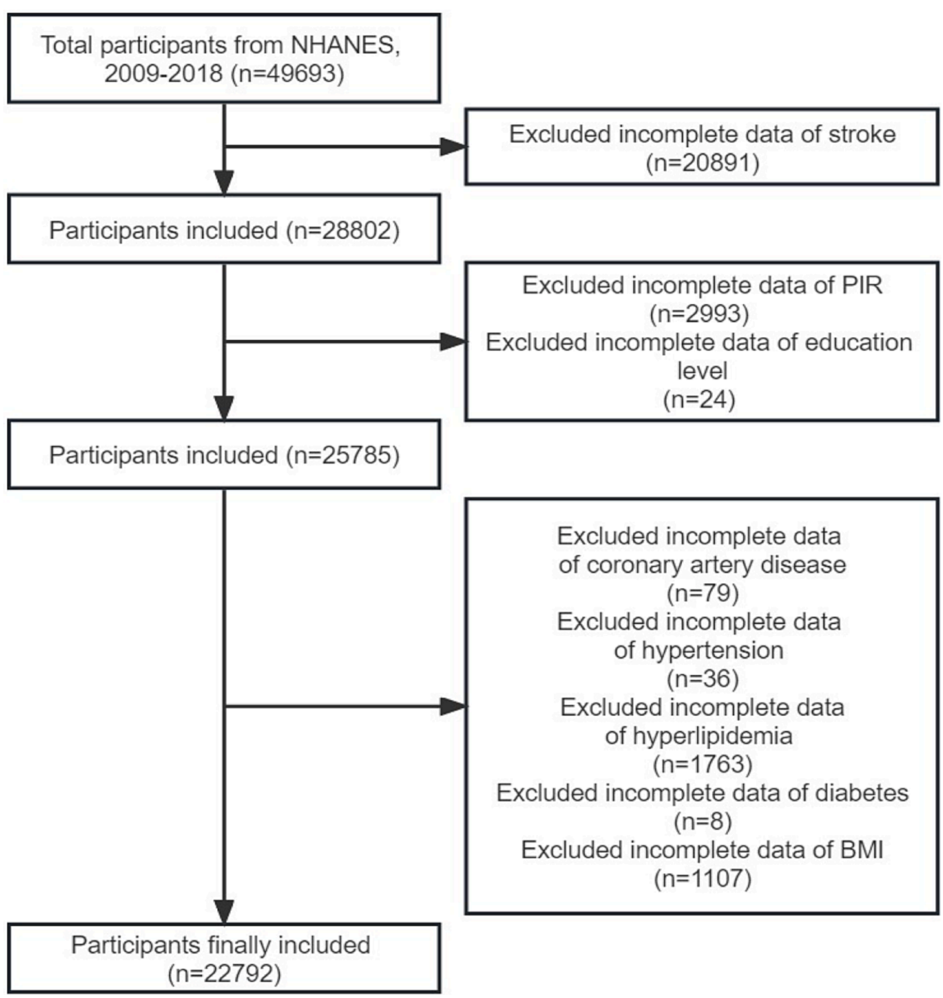

Fig. 1. Flowchart of participants selection.

sex (men/women), and race/ethnicity (Mexican American, Other Hispanic, Non-Hispanic White, Non-Hispanic Black,and other races). We also included stroke-related risk disease factors such as coronary heart disease, hypertension, hyperlipidemia, diabetes (yes/no). In addition, the continuous variable body mass index (BMI) was included in the study. The NHANES website provides more information on variables and covariates (http://www.cdc.gov/nchs/nhanes/).

2.4. Statistical analysis

Measurement data were described as mean ± standard deviation (mean ± SD), and comparisons between groups were made using independent sample t-tests. Data that did not conform to a normal distribution differences between groups were compared using the Kruskal–Wallis rank sum test. An enumeration dataset was described as n (%), and chi-square tests were conducted to compare differences between groups. We used a weighted multiple logistic regression model to assess the relationship between stroke and socioeconomic status (PIR and education level) (Zare et al., 2021; Zare et al., 2021 Jul 2; Chen et al., 2020). We developed an unadjusted model (model 1) and an adjusted model (model 2) that included sex, age, and race or ethnicity. To exclude covariates from interfering with stroke occurrence, we obtained Model 3 by adjusting for sex, age, race/ethnicity, history of hypertension, history of hyperlipidemia, history of diabetes, history of coronary artery disease, and BMI. By adjusting the above covariates, smooth curve fitting was performed to determine whether there was a nonlinear relationship between SES and stroke. Meanwhile, to identify the association between SES and stroke in different population groups, we performed weighted multivariate logistic regression and smooth curve fitting for sex, age and race subgroups, respectively. Furthermore, a threshold effect analysis was performed for those with significant inflection points on the curve. Statistical analysis was conducted using R version 3.4.3 (https://www.R-project.org, The R Foundation) and Empower software (https://www.empowerstats.com; X&Y solutions, Inc., Boston, MA), while setting Statistical significance at $p < 0.05$.

3. Results

3.1. The characteristics of participants

The study included 49,693 individuals aged 20–80 from 2009 to 2018. Participants with incomplete data on stroke (n = 20891), PIR (n = 2993), and education level (n = 24) were excluded. Participants with missing data on coronary heart disease (n = 79), hypertension (n = 36), hyperlipidaemia (n = 1763), diabetes (n = 8), and BMI (n = 1107) were also excluded, resulting in the inclusion of 22,792 participants. The remaining participants were divided into the control group (n = 21896) and the stroke group (n = 896). (Table 1) The findings indicated that the stroke group was older than the control group (65.656 ± 12.708 vs. 49.279 ± 17.331, P < 0.001). In addition, 8.482% of participants in the stroke group were Mexican-American, 6.585% were other Hispanic, 47.210% were non-Hispanic white, 29.018% were non-Hispanic Black, and 8.705% were other races. The most significant percentage of the stroke group had a college degree or higher education level, up to 41.183%, followed by a high school degree at 27.344%. The stroke group was more likely to have coronary heart disease, hypertension, hyperlipidemia, and diabetes(all P < 0.001). Compared to controls, the stroke group had lower PIR (2.054 ± 1.417 vs. 2.540 ± 1.641, P < 0.001) and higher BMI (29.828 ± 7.027 vs. 29.394 ± 7.182, P = 0.014).

3.2. The relationship between SES and stroke

The results of the multivariate logistic regression analysis are shown in Table 2. Model 1 disclosed that as the level of PIR rises, the incidence of stroke declines (OR = 0.781 95% CI: (0.735, 0.829), P < 0.001). After adjusting for covariates, model 2 provided evidence of significant correlation (OR = 0.742 95% CI: (0.691, 0.797), P < 0.001), as well as for model 3 (OR = 0.764 95% CI: (0.711, 0.820), P < 0.001). PIR was then divided into quartile groups to further clarify the relationship between different levels of PIR and stroke. Multivariate analysis in Model 3 showed that the higher the level of PIR, the lower the incidence of stroke (all P < 0.05). In Model 3, the incidence of stroke was significantly lower in the highest quartile subgroup (Q4) than in the lowest quartile(Q1) subgroup of PIR (OR = 0.296 95% CI: (0.214, 0.409), P < 0.001). In the analysis of subgroups, when participants were stratified by sex, we noticed that elevated PIR functioned with more protective in the men population (OR = 0.753 95% CI: (0.673, 0.842), P < 0.001) compared to the women population (OR = 0.769 95% CI: (0.713, 0.829), P < 0.001). A statistical significance (P < 0.05) was obtained in all age groups, conveying a link between higher PIR and lower stroke risk. However, the protective effect was more obvious in the 40–59 years old group (OR = 0.674 95% CI: (0.598, 0.760), P < 0.001). In stratified analyses by race or ethnicity, elevated PIR was associated with a reduced risk of stroke in Non-Hispanic White (OR = 0.728 95% CI: (0.666, 0.795), P < 0.001), and Non-Hispanic Black (OR = 0.836 95% CI: (0.754, 0.927), P = 0.001). At the same time, there was no statistical significance in Mexican Americans, Other Hispanic, or Other Races.

Model 1: The covariates were not adjusted.

Model 2: The age, sex, and race/ethnicity of the participants were adjusted.

Model 3: The age, sex, race/ethnicity, hypertension, hyperlipidemia, diabetes, coronary heart disease, and BMI, were adjusted.

PIR, poverty income ratio. BMI, body mass index.

To explore the relationship between stroke incidence and educational level, an analysis of multivariate logistic regression was performed (Table 3), resulting in the group of college degree or above tying to the lower incidence of stroke (OR = 0.618 95% CI: (0.440, 0.868), P

Table 1
Distribution of selected characteristics of U.S. adults over 20 years of age between 2009 and 2018, National Health and Nutrition Examination Survey (n = 22792).

Variables	Control group (n = 21896)	Stroke group (n = 896)	P-value
Age (years)	49.279 ± 17.331	65.656 ± 12.708	<0.001
Sex (%)			0.941
Men	10,505 (47.977)	431 (48.103)	
Women	11,391 (52.023)	465 (51.897)	
Race/ Ethnicity (%)			<0.001
Mexican American	2894(13.217)	76 (8.482)	
Other Hispanic	2182 (9.965)	59 (6.585)	
Non-Hispanic White	8860(40.464)	423 (47.210)	
Non-Hispanic Black	4720 (21.556)	260(29.018)	
Other Race	3240 (14.797)	78 (8.705)	
Education level (%)			<0.001
<9th grade	1912 (8.732)	115 (12.835)	
9–11th grade	2691 (12.290)	167 (18.638)	
High school graduate	4785 (21.853)	245 (27.344)	
College degree or above	12,508 (57.125)	369(41.183)	
Coronary heart disease (%)			<0.001
Yes	796 (3.635)	170 (18.973)	
No	21,100 (96.365)	726 (81.027)	
Hypertension (%)			<0.001
Yes	7873 (35.956)	685(76.451)	
No	14,023 (64.044)	211 (23.549)	
Hyperlipidemia (%)			<0.001
Yes	7645 (34.915)	536 (59.821)	
No	14,251 (65.085)	360 (40.179)	
Diabetes (%)			<0.001
Yes	2825 (12.902)	310 (34.598)	
No	18,517 (84.568)	551 (61.496)	
Borderline	554 (2.530)	35 (3.906)	
BMI (kg/m^2)	29.394 ± 7.182	29.828 ± 7.027	0.014
PIR	2.540 ± 1.641	2.054 ± 1.417	<0.001

PIR, poverty to income ratio. BMI, body mass index.

Table 2
The association between PIR and stroke in U.S. adults in the 2009–2018.

	Model 1 OR (95% CI) P-value	Model 2 OR (95% CI) P-value	Model 3 OR (95% CI) P-value
PIR	0.781 (0.735, 0.829) < 0.001	0.742 (0.691, 0.797) < 0.001	0.764 (0.711, 0.820) < 0.001
PIR categories			
Q1	Reference	Reference	Reference
Q2	0.917 (0.752, 1.117) 0.391	0.645 (0.520, 0.799) < 0.001	0.664 (0.538, 0.818) < 0.001
Q3	0.617 (0.478, 0.796) < 0.001	0.450 (0.344, 0.588) < 0.001	0.480 (0.366, 0.630) < 0.001
Q4	0.342 (0.255, 0.458) < 0.001	0.261 (0.189, 0.361) < 0.001	0.296 (0.214, 0.409) < 0.001
Sex categories			
Men	0.795 (0.727, 0.869) < 0.001	0.748 (0.671, 0.833) < 0.001	0.753 (0.673, 0.842) < 0.001
Women	0.772 (0.723, 0.824) < 0.001	0.737 (0.682, 0.795) < 0.001	0.769 (0.713, 0.829) < 0.001
Age categories			
20–39	0.696 (0.523, 0.926) 0.015	0.706 (0.518, 0.963) 0.031	0.724 (0.534, 0.980) 0.041
40–59	0.638 (0.566, 0.719) < 0.001	0.634 (0.562, 0.716) < 0.001	0.674 (0.598, 0.760) < 0.001
≥60	0.775 (0.715, 0.839) < 0.001	0.768 (0.705, 0.838) < 0.001	0.797 (0.731, 0.869) < 0.001
Race/Ethnicity categories			
Mexican American	0.816 (0.664, 1.003) 0.053	0.801 (0.653, 0.983) 0.038	0.819 (0.667, 1.006) 0.062
Other Hispanic	0.780 (0.622, 0.978) 0.035	0.772 (0.595, 1.002) 0.056	0.798 (0.612, 1.040) 0.099
Non-Hispanic White	0.723 (0.669, 0.780) < 0.001	0.704 (0.645, 0.769) < 0.001	0.728 (0.666, 0.795) < 0.001
Non-Hispanic Black	0.872 (0.792, 0.959) 0.006	0.828 (0.747, 0.917) < 0.001	0.836 (0.754, 0.927) 0.001
Other Race	0.877 (0.720, 1.069) 0.198	0.929 (0.749, 1.151) 0.503	0.966 (0.776, 1.203) 0.761

Table 3
The association between education level and stroke in U.S. adults in the 2009–2018.

	Model 1 OR (95% CI) P value	Model 2 OR (95% CI) P value	Model 3 OR (95% CI) P value
Education level			
<9th grade	Reference	Reference	Reference
9–11th grade	0.969 (0.732, 1.283) 0.828	1.228 (0.904, 1.668) 0.193	1.188 (0.875, 1.613) 0.273
High school graduate	0.762 (0.621, 0.935) 0.011	1.000 (0.779, 1.285) 0.998	1.022 (0.794, 1.315) 0.867
College degree or above	0.379 (0.289, 0.497) < 0.001	0.565 (0.403, 0.794) 0.002	0.618 (0.440, 0.868) 0.007

= 0.007). However, there was no statistical significance in subgroups of other education levels.

Model 1: The covariates were not adjusted.

Model 2: The age, sex, and race/thnicity of the participants were adjusted.

Model 3: The age, sex, race/ethnicity, hypertension, hyperlipidemia, diabetes, coronary heart disease, and BMI, were adjusted.

PIR, poverty income ratio. BMI, body mass index.

3.3. Smoothing curve fitting and threshold effect analysis

We performed a smooth curve fit to elaborate the nonlinear relationship between PIR and stroke (Fig. 2). We found that with the increase of PIR, the incidence of stroke decreased significantly. After stratifying the analysis by sex, an nonlinear curve was present in the women group, with inflection points of 0.95 (Table 4). The nonlinear relationship also existed in the 40–59 age subgroup, and the inflection point was 0.90. Upon analyzing by race/ethnicity, we discovered an curve relationship between PIR and stroke in non-Hispanic White, with an inflection point of 0.73. In the other subgroups, the risk of stroke decreased significantly as PIR increased.

(a) The red line represents the smoothed curve fitting between PIR and stroke. The blue line represents its 95% confidence interval. Sex, age, and race/ethnicity, hypertension, hyperlipidemia, diabetes, coronary heart disease, and BMI, were adjusted. (b) Smoothed curve fitting with sex stratification. (c) Smoothed curve fitting with age stratification. (d) Smoothed curve fitting with race/ethnicity stratification. PIR, poverty income ratio.

Model 1: The covariates were not adjusted.

Model 2: The age, sex, and race/ethnicity of the participants were adjusted.

Model 3: The age, sex, race/ethnicity, hypertension, hyperlipidemia, diabetes, coronary heart disease, and BMI, were adjusted.

PIR, poverty income ratio. BMI, body mass index.

4. Discussion

The multiple-subject study used NHANES data to examine the association between SES and stroke. Overall, the incidence of stroke declined as the levels of PIR increased. The protective effect grew more assertive with the level of PIR increased. However, there were some differences in the different subgroups. In addition, we found that college or higher education was a protective factor for stroke.

Several studies also examine the relationship between stroke and SES, and in many developed countries, lower socioeconomic status is associated with a higher risk of stroke (Seo et al., 2014; Avendano et al., 2006; Jakovljević et al., 2001). According to a study by Avendano et al. (2006), a correlation exists between lower socioeconomic status and increased incidence of stroke in the United States among individuals aged 65 to 74. Both educational level and income level were taken into this correlation. A nationwide study by Korea et al. (Seo et al., 2014) revealed that stroke incidence positively correlated with lower income levels among individuals below 74. However, no significant difference in stroke incidence was observed among individuals aged above 74 based on income levels. Li et al. (Li et al., 2008) revealed that the occurrence rate of ischemic stroke significantly increased with decreasing income, which came up with the same results in our study. Using multivariate logistic regression analysis, we found that PIR was a protective factor against stroke, whereas the research showed that the protective effect was more substantial as PIR went up. One of the potential reasons for this circumstance is that higher PIR can lead to lower smoking frequency and reduce the likelihood of diabetes (Zang et al., 2022). Since these behaviors are the risk factors for stroke, they can significantly affect the occurrence of stroke. However, Olivier Grimaud held different opinions and showed that higher household income levels were linked to a greater probability of ischemic stroke. His research data show a statistically significant 70% increased risk of ischemic stroke with higher income (Grimaud et al., 2011). Under this condition, various factors can lead to the loss of genetic determinants of longevity, which are initially evenly distributed across populations (Markides and Machalek, 1984; Liu and Witten, 1995). The feasible explanation for this contrary study is that the study population in our experiment includes all age groups instead of the elderly population. When stratified by gender, age, and race, we found an inflection point associated with PIR and stroke in some people. However, there is a lack of studies on PIR and stroke, and more high-quality studies are needed to prove the above conclusions.

A stratified analysis of education level was performed to analyze stroke incidence further. It showed that those who graduated from college or higher were associated with a lower incidence of stroke. The

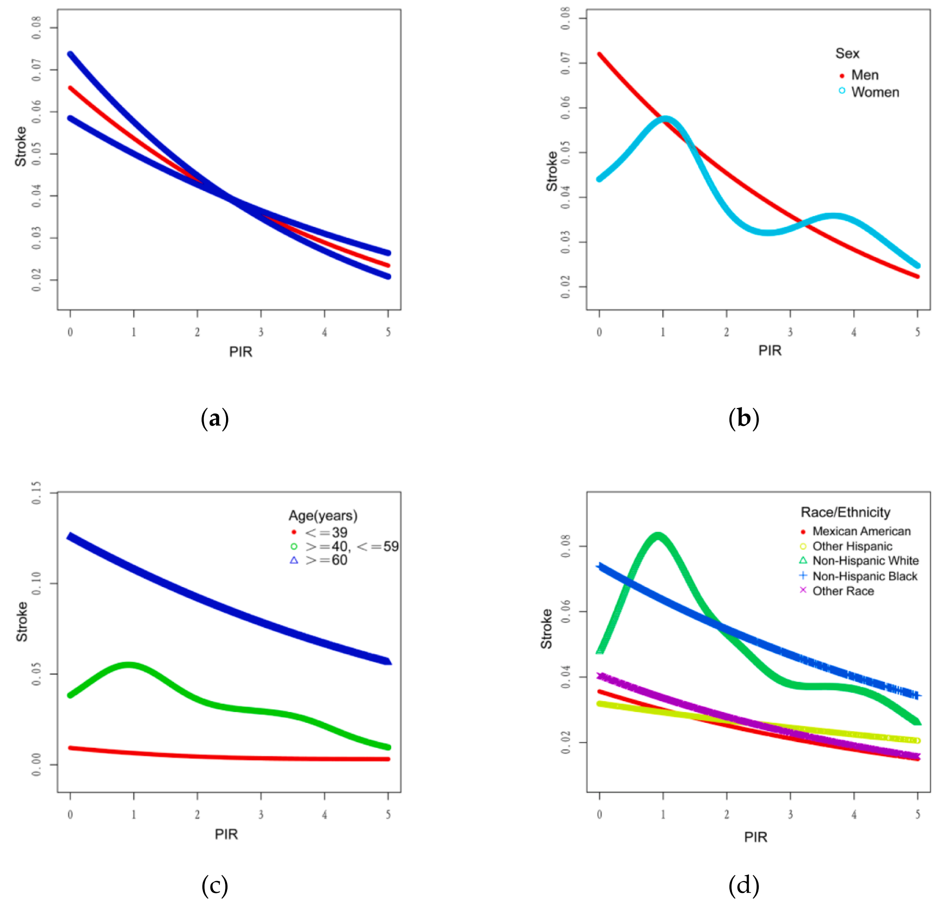

Fig. 2. Smooth curve fittings of the association between PIR and stroke.

education level of a college degree or above is a protective factor, which has no statistical significance in other educational level subgroups. Several possible reasons can be brought out for the conclusions. On the one hand, higher academic level benefits increase the control rate of stroke risk factors, including hypertension, diabetes, atrial fibrillation, and smoking (Arboix, 2015; Chatzikonstantinou et al., 2012; Zhang et al., 2014; Maksimova and Maksimov, 2019). Prompt diagnosis and control of these risk factors are priority goals for adequate prevention of acute stroke (Arboix, 2015). Therefore, receiving more education can contribute to maintaining better lifestyle behaviors and problem-solving abilities, preventing disease (O'Connor et al., 2009; Barakat et al., 2001). On the other hand, people gain positive social, psychological, and economic skills and assets through education, which are protected from adverse outcomes (Winkleby et al., 1990). However, a further study for the lack of statistically significant in the group of high school education and below is still needed. Mauricio Avendano's study showed that a higher level of education leads to the incidence of stroke rising over the age of 75 (Avendano et al., 2006), which is in contrast to ours. He suggested that his discovery could be attributed to the fact that people with lower socioeconomic status may die from other causes. As a result, social groups with higher education may be more likely to "live long enough" to have a stroke at a higher age.

There are several obvious advantages to our results. Firstly, the NHANES survey provides a reliable sample and data standards. By exploiting the multi-layer random sampling in the survey, we can treat the data as a representative of the overall population of the United States. Secondly, the samples in this study were analyzed by weighted multiple regression analysis, while the subgroup analysis was performed. These methods of work gave rise to the results becoming reliable. Lastly, to determine the relationship between SES and stroke, the study chose a more accurate and sensitive measure of PIR and education level rather than household income. To our knowledge, this is the first study to correlate PIR with stroke risk.

However, this study still has some limitations. First, the study's multiple-subject design created problems establishing causality, requiring further longitudinal studies. Secondly, participants in the NHANES database are mainly from western countries lacking racial diversity. More studies are needed to verify the suitability of the findings for other races around the world. A third point is whether some residual and unmeasured confounders may interfere with our results.

5. Conclusions

Based on this study, we explored the relationship between SES and stroke and found that SES is a protective factor for stroke. However, this relationship has some differences among various factors, such as educational level, age, and race. More research is needed to understand the specific mechanisms involved. Hence, it is imperative that policymakers, healthcare providers, and clinicians take into account the inequality distribution of SES among adults while developing and executing stroke prevention and treatment strategies.

Institutional Review Board Statement: Prevention National Center for Health Statistics Research and the Centers for Disease Control Research Ethics Review Board approved the protocol for the NHANES study.

Data Availability Statement: Publicly available datasets were analyzed in this study. This data can be found here: https://wwwn.cdc.gov/nchs/nhanes/Default.aspx.

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Table 4
Threshold effect analysis of PIR on stroke using the two-piecewise linear regression model in U.S. adults in the 2009–2018.

	Model 1 OR (95% CI) P value	Model 2 OR (95% CI) P value	Model 3 OR (95% CI) P value
Female			
Fitting by the standard linear model	0.828 (0.778, 0.881) < 0.001	0.793 (0.741, 0.848) < 0.001	0.828 (0.773, 0.888) < 0.001
Fitting by two-piecewise linear model			
Inflection point	0.99	0.95	0.95
Before the inflection point	2.909 (1.716, 4.929) < 0.001	1.527 (0.856, 2.724) 0.152	1.440 (0.799, 2.595) 0.225
After the inflection point	0.745 (0.690, 0.804) < 0.001	0.758 (0.701, 0.820) < 0.001	0.798 (0.737, 0.865) < 0.001
Log likelihood ratio	<0.001	0.020	0.055
≥39, ≤59 years			
Fitting by the standard linear model	0.693 (0.630, 0.763) < 0.001	0.690 (0.626, 0.760) < 0.001	0.720 (0.653, 0.795) < 0.001
Fitting by two-piecewise linear model			
Inflection point	0.81	0.81	0.90
Before the inflection point	2.415 (0.988, 5.899) 0.053	2.537 (1.037, 6.207) 0.041	2.062 (0.942, 4.516) 0.070
After the inflection point	0.639 (0.570, 0.716) < 0.001	0.633 (0.565, 0.710) < 0.001	0.661 (0.587, 0.744) < 0.001
Log likelihood ratio	0.003	0.002	0.004
Non-Hispanic White			
Fitting by the standard linear model	0.776 (0.728, 0.828) < 0.001	0.743 (0.693, 0.797) < 0.001	0.764 (0.711, 0.820) < 0.030
Fitting by two-piecewise linear model			
Inflection point	0.89	0.70	0.73
Before the inflection point	7.861 (3.113, 19.853) < 0.001	5.693 (1.316, 24.619) 0.020	4.567 (1.158, 18.018) 0.030
After the inflection point	0.706 (0.656, 0.760) < 0.001	0.716 (0.664, 0.772) < 0.001	0.737 (0.683, 0.796) < 0.001
Log likelihood ratio	<0.001	<0.001	0.004

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data can be queried in the NHANES database.

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