

## Original Research Article

# Unravelling healthcare access disparities in stroke care: a comprehensive analysis of socio-economic and racial disparities impacting patient outcomes

Eryka Thelline Roxas<sup>1</sup>, Sushmitha Priya Narra<sup>2</sup>, Nigel Leon Martis<sup>3</sup>, Rasha Konane Afthab<sup>4\*</sup>, Anvit Nanavati<sup>5</sup>, Naga Siva Naveen Chodiseti<sup>1</sup>

<sup>1</sup>Cebu Institute of Medicine, Cebu City, Cebu, Philippines

<sup>2</sup>Pinnamaneni Sidhartha Institute of Medical Sciences and Research Foundation, Gannavaram, Andhra Pradesh, India

<sup>3</sup>Teaching University Geomedi, Tbilisi, Georgia

<sup>4</sup>Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia

<sup>5</sup>Davao Medical School Foundation, Davao City, Davao Del Sur, Philippines

**Received:** 03 March 2025

**Revised:** 04 July 2025

**Accepted:** 18 February 2026

### \*Correspondence:

Dr. Rasha Konane Afthab,

E-mail: 098rasha@gmail.com

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## ABSTRACT

**Background:** Stroke is a primary cause of chronic disability in the United States (U. S.). The annual prevalence in 2022 is 84-262 per 100,000 people, with a 102% increase since 2021. This has led to a reduced quality of life index and increased depression rates, especially in the elderly population. Thus, the primary aim of our study was to determine any healthcare access disparities due to various socioeconomic and demographic factors, and the type of insurance companies used.

**Methods:** A retrospective observational study was conducted using the BRFSS (behavioral risk factor surveillance system) 2021 data. Descriptive and logistic regression analyses using the web enabled analysis tool (WEAT) were performed to assess various socioeconomic factors, demographic factors, and the type of insurance plans used.

**Results:** A total of 341,299 people were analyzed based on demographic and socioeconomic factors, and 403,145 people were analyzed based on access to healthcare and health status. Patients aged  $\geq 65$  years had the highest risk of developing stroke (4.97;  $p < 0.0001$ ). Individuals who were unable to work had the highest risk of stroke development (5.13;  $p < 0.0001$ ). Participants earning more than \$200,000 had the lowest risk of stroke development (0.49;  $p < 0.0001$ ). Hispanic participants had the lowest risk of stroke (0.75;  $p < 0.0016$ ). Participants with Medicare insurance were most likely to develop stroke (4.77;  $p < 0.0001$ ).

**Conclusions:** Healthcare access disparities were noted based on various socioeconomic and demographic factors. Identifying these factors is important to minimize disparities, along with increasing affordability and accessibility to various stroke services, aiding in reducing its incidence.

**Keywords:** Stroke, Socio-economic disparities, Health insurance, Racial disparities, Access to care, Equity in healthcare

## INTRODUCTION

Stroke remains a health hazard for a long time, affecting approximately 790,000 to 800,000 people in the U. S. per year, with the risk increasing in individuals with pre-existing conditions such as hypertension, diabetes, obesity,

and dyslipidemia. Smoking, low mobility, and unhealthy diet contribute to heightened vulnerability.<sup>1</sup> The damage to the brain caused by stroke leads to reduced productivity, lower quality of life, and increased mortality.<sup>2</sup> Racial minorities, such as the Black population, are at a greater risk of stroke than white people. The incidence of stroke

has increased notably in the Hispanic population.<sup>3</sup> A recent study stating the disparity in Middle Eastern incidence conducted in Qatar also showed disparity in the diagnosis and treatment of stroke among women.<sup>4</sup>

The BRFSS is a comprehensive survey in U. S. that gathers data on health-related behaviors and chronic conditions among adults and plays a vital role in monitoring public health trends and shaping health policies. In the context of stroke, it offers valuable insights into the risk factors, prevalence, and awareness, allowing for the identification of various disparities in healthcare, thus aiding targeted interventions and policy enhancements.<sup>5,6</sup>

### ***Aims and objectives***

This study aims to utilize the BRFSS database to determine any healthcare access disparities to stroke healthcare due to various socioeconomic factors, demographic factors, and the type of insurance companies used, and thus contribute valuable insights into addressing healthcare access disparities and promoting equity in stroke care in order to improve patient outcomes.

## **METHODS**

### ***Study design and setting***

This retrospective observational study utilized the BRFSS, which is a publicly available dataset.<sup>7</sup> Data were extracted on January 3, 2024, using the BRFSS WEAT for the year 2021 across all U.S. states. As the study involved no human participants, the present study was deemed exempt from ethical clearance.

### ***Inclusion and exclusion criteria***

The dependent variable, “ever told you had stroke?” (CVDSTRK3) was used. Independent variables included demographic characteristics (age-calculated variable for 6-level age category, race-calculated variable for 8-level race category, gender-SEX1), socioeconomic factors (Education level-EDUCA, employment status-EMPLOY1, annual household income-INCOME3), health status (Mental health status-calculated variable for 3 level not good mental health status MENT14D, physical health status-calculated variable for 3 level not good physical health status PHYS14D), and healthcare access indicators (Do you have one person or a group of doctors that you think as your personal healthcare provider, PERSDOC3, The current primary source of your health insurance-PRIMINSR, In the past 12 months, needed to see a doctor but could not afford-MEDCOST1). A total of 438,693 individuals participated in the BRFSS in 2021 in the USA, of which 341,299 were included in our analysis

### ***Data and statistical analysis***

Descriptive and logistic regression analyses were performed via the WEAT. Descriptive data elucidated

frequencies, numerical distributions, and percentages across the spectrum of demographic, socioeconomic, health status, and healthcare access inquiries. Logistic regression analysis was used to assess the relationships between the dependent and selected independent variables. The reference category for the dependent variable (“Ever told you had stroke?”) was defined as “yes,” and unique reference categories were established for each independent variable. Statistical analyses included independent t-tests, odds ratios (ORs), and 95% confidence intervals (CIs). Statistical significance was defined as  $p < 0.05$ .

The organized data were exported to Microsoft excel. GraphPad Prism, version 9.4.1, facilitated graphical analyses and visual representations.

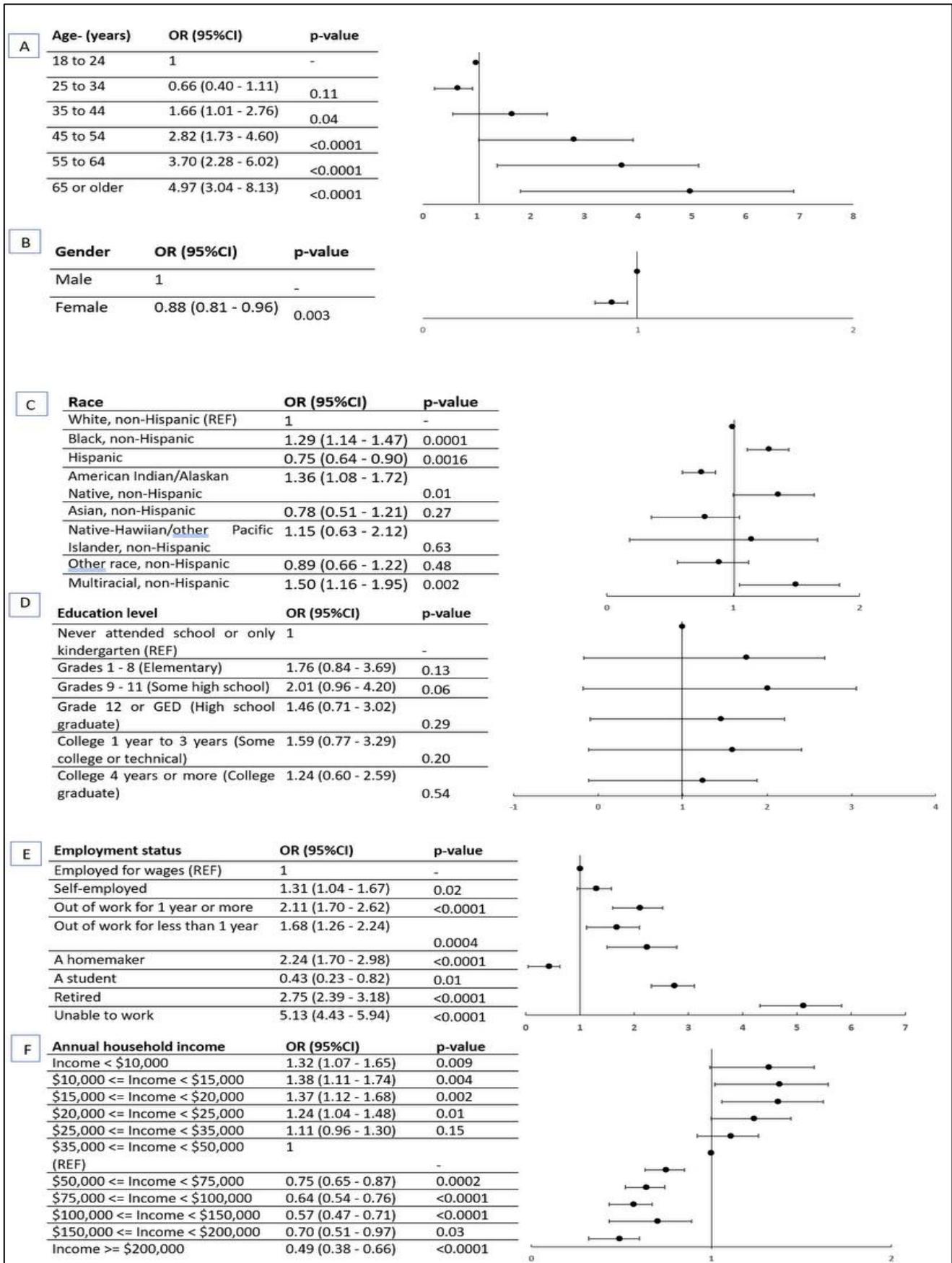
## **RESULTS**

A total of 438,693 individuals participated in the BRFSS in 2021 in the USA, of which 341,299 were included in our analysis on data pertaining to Figure 1 and self-identified/answered “Yes” to the question of chronic health care conditions. (CVDSTRK3) Demographic and socioeconomic characteristics were studied and are depicted in Figure 1. Compared to the reference age group of 18 to 24 years, the incidence of stroke was almost 5 times higher in the age group of 65 years or older (51.8%). The incidence of stroke was lower in females by around 12% (52.7%). The incidence of stroke was higher by 50% among multiracial, non-Hispanics (1.6%) and was 25% lower among Hispanics (11.8%).

The incidence of stroke had no statistically significant data correlating to educational level. The incidence of stroke was the highest at being 5 times higher in the group of participants unable to work (23.7%), which was even higher than the retired group which had 3 times the risk (45.7%) as opposed to respondents employed for wages. Compared to the reference group of income between \$35,000 and \$50,000 (16.9%), the incidence of developing stroke was the lowest in the group earning \$200,000 or higher at half the risk (2.2%).

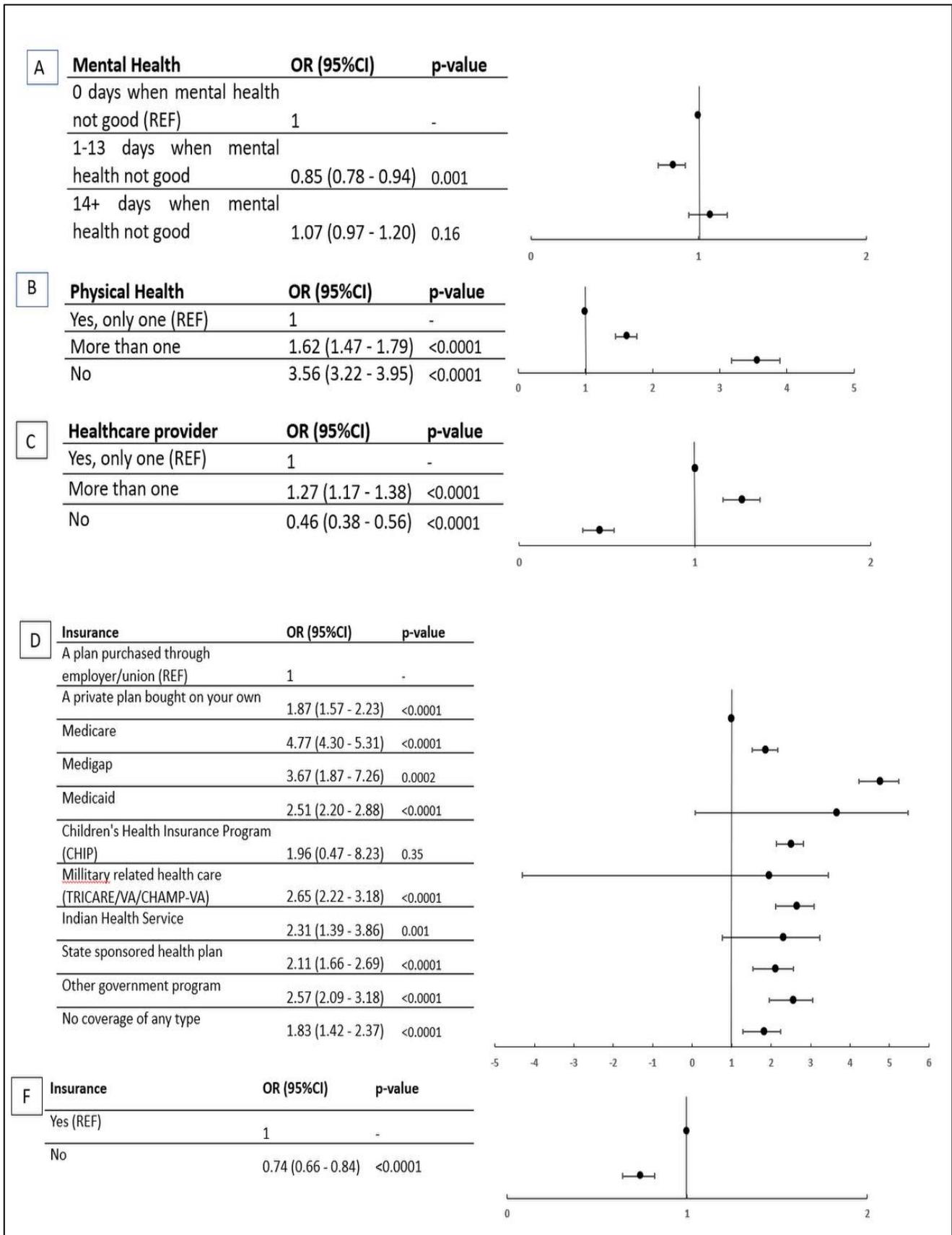
Health status and health access characteristics were studied as well and are included in Figure 2. The 403,145 individuals had their data included in our analysis. Compared to people with no mental health issues, the incidence of stroke was 15% lower in people who had mental health issues for around 14 days (23.2%). The incidence of stroke was 3.5 times higher in the group with no physical health issues (42.9%).

The incidence of developing stroke was 27% higher in the group having multiple healthcare providers at the same time (38.7%). The incidence of stroke was almost 5 times higher in the Medicare insurance group (48.9%). The lowest incidence of stroke was in the group that had no insurance coverage at all (5.2%), albeit 83% higher than someone who bought an insurance plan through his employer, which was used as a reference value.



**Figure 1 (A-F): Odds of stroke stratified by demographic and socio-economic characteristics.**

\*Number of records on the BRFSS dataset for the year and location selected-438,693; sample size used for analysis-341,299.



**Figure 2 (A-F): Odds of stroke stratified by health status and healthcare access.**

\*Number of records on the BRFSS dataset for the year and location selected-438,693; sample size (Number of records used in the analysis)-403,145.

**Table 1: Demographic and socio-economic, characteristics of study population.**

Demographic variables	N (%)
<b>Age (in years)</b>	
18 to 24	116 (2.3)
25 to 34	292 (3.1)
35 to 44	744 (7)
45 to 54	1682 (12.8)
55 to 64	3430 (23)
65 Or older	10949 (51.8)
<b>Gender</b>	
Male	7894 (47.3)
Female	9319 (52.7)
<b>Race</b>	
White, non-Hispanic	13162 (64.7)
Black, non-Hispanic	1798 (17)
Hispanic	937 (11.8)
American Indian/Alaskan Native, non-Hispanic	421 (1.6)
Asian, non-Hispanic	196 (2.2)
Native-Hawaiian/other Pacific Islander, non-Hispanic	66 (0.2)
Other race, non-Hispanic	213 (0.9)
Multiracial, non-Hispanic	420 (1.6)
<b>Socio-economic</b>	
<b>Education level</b>	(n=17,122)
Never attended school or only kindergarten	23 (0.2)
Grades 1-8 (Elementary)	542 (6.8)
Grades 9-11 (Some high school)	1276 (14.9)
Grade 12 or GED (High school graduate)	5272 (29.2)
College 1 year to 3 years (Some college or technical)	5168 (30.9)
College 4 years or more (College graduate)	4841 (17.9)
<b>Employment status</b>	(n=16,943)
Employed for wages	2331 (15.4)
Self-employed	805 (4.9)
Out of work for 1 year or more	507 (3.7)
Out of work for less than 1 year	247 (2)
A homemaker	522 (4.4)
A student	51 (0.5)
Retired	9207 (45.7)
Unable to work	3273 (23.5)
<b>Annual household income (in \$)</b>	(n=13,221)
Income <\$10,000	884 (8.4)
\$10,000 ≤Income <\$15,000	1003 (8.9)
\$15,000 ≤Income <\$20,000	1182 (9.3)
\$20,000 ≤Income <\$25,000	1423 (10.7)
\$25,000 ≤Income <\$35,000	2340 (16.9)
\$35,000 ≤Income <\$50,000	2073 (14.8)
\$50,000 ≤Income <\$75,000	1853 (12)
\$75,000 ≤Income <\$100,000	1095 (7.5)
\$100,000 ≤Income <\$150,000	803 (6.1)
\$150,000 ≤Income <\$200,000	311 (3)
Income ≥\$200,000	254 (2.2)

**Table 2: Health status and healthcare access of study population.**

Health status	N (%)
<b>Mental health</b>	(n=16,718)
0 days when mental health not good (REF)	10008 (56)
1-13 days when mental health not good	3419 (20.8)
14+ days when mental health not good	3291 (23.2)
<b>Physical health</b>	(n=16,476)
Yes, only one (REF)	3724 (22.7)
More than one	5281 (34.4)
No	7471 (42.9)

Continued.

Health status	N (%)
<b>Healthcare provider</b>	(n=17,083)
Yes, only one (REF)	9483 (54.9)
More than one	6760 (38.7)
No	840 (6.4)
<b>Insurance</b>	(n=16,492)
A plan purchased through employer/union (REF)	2374 (17.3)
A private plan bought on your own	1063 (7.3)
Medicare	9350 (48.9)
Medigap	31
Medicaid	1477 (9.9)
Children's health insurance program (CHIP)	4
Military related health care (TRICARE/VA/CHAMP-VA)	767 (4.1)
Indian health service	63 (0.2)
State sponsored health plan	401 (3.3)
Other government program	484 (3.5)
No coverage of any type	478 (5.2)
<b>Past 12 months, needed to see a doctor but could not afford (Sentense)</b>	(n=17,139)
Yes (REF)	1667 (12.9)
No	15472 (87.1)

## DISCUSSION

The results of this study demonstrated associations between stroke, which is a condition wherein there is a blockage of blood flow to the brain or spontaneous bleeding in the brain, and other parameters such as demographic, socioeconomic, health status, and healthcare access.<sup>8</sup>

Demographic disparities in the incidence of stroke have been reported in various studies. The results of this study showed that the incidence of stroke was higher in the study population within the age bracket of 65 and older, male gender, and multiracial, non-Hispanic race. Comparatively, a study in 2019 found that stroke had a higher incidence in the median age of 71 years (interquartile range, 60-81), near-equivalent sex distribution among males and females (51% and 49%, respectively), and white race being the majority.<sup>9</sup> Another study by Madsen et al observed that the incidence of stroke was higher in women, with a mean age of incidence of 71.8 for women and 67.5 for men.<sup>10</sup> A nationwide cohort study assessing the incidence of stroke in young adults also found that the stroke incidence increased with age in patients aged >35 years and was more common in women.<sup>11</sup> The disparity in the responses from this study as opposed to previous studies may be due to the respondents' self-reported data.

With regard to socioeconomic status, this study did show any statistical significance regarding educational level. However, participants with an income between \$25,000 and \$35,000 and those who are unable to work or retired had a higher incidence of stroke. In line with this, a previous study showed that voluntary unemployment was linked to an increased risk of stroke. The authors correlated this with an increased prevalence of the hypertension, diabetes, and obesity in those who were unemployed.<sup>12</sup> A

separate study using the National Health Interview Survey database from 2012 to 2018 showed a higher incidence of stroke in non-elderly adults with low family income and educational attainment.<sup>13</sup>

The mental and physical health conditions reported by the population included in this study showed that the incidence of stroke was higher in those who experienced 14 or more days when mental health was not good and in those with no physical health problems. A study on the bidirectional causal association between ischemic stroke and five mental disorders from a genetic perspective showed a positive correlation between ischemic stroke and depression.<sup>14</sup> Another study analyzing data from the emerging risk factors collaboration and the UK Biobank showed a modest association between depressive symptoms and stroke development.<sup>15</sup> Additionally, a report from the American Heart Association stated that stroke patients have an increased risk of depression, with approximately one-third of stroke survivors developing poststroke depression. In the same report, stroke symptoms were more prevalent in patients with a fair to poor perceived health status.<sup>16</sup>

In this study, the incidence of stroke was higher in those with Medicare insurance, more than one healthcare provider, and who needed to see a doctor in the past 12 months but could not afford it. These results are in line with a previous study analyzing data from 2002-2017 and another study analyzing data from 2019 that the majority of stroke patients had Medicare insurance. These same studies also showed that hospitalization related to stroke was increasing, especially among young and middle-aged adults, and low socioeconomic status and lower access to care are among the contributing factors toward young stroke cases.<sup>8,17</sup>

Based on the data presented in this study, a framework to address the role of physicians in addressing healthcare access disparities, especially in patients who have had a stroke, may be developed. Overall, associations were present between stroke and older age, male sex, multiracial, non-Hispanic population, lower income, inability to work, poor mental health, no physical health problems, Medicare insurance status, multiple healthcare providers, and in those who needed to see a doctor in the past 12 months but could not afford it. Raising public awareness of these disparities is essential for advancing research and facilitating the formation of focused health-policy initiatives. Individually, physicians may also benefit from this research by reflecting on their current practices and seeking opportunities to decrease these disparities. Additionally, with an increase in stroke incidence in populations with lower socioeconomic status, outreach initiatives to educate the community and reach more remote areas may also be formed. From the local to the national level, knowledge of these disparities can help in the implementation of future solutions and healthcare policies to benefit the higher-risk population.

### Limitations

The limitations of this study are related to the nature of the survey used for the data collection. The survey was a self-reported telephone survey that was available in English and Spanish. Thus, those without access to a telephone or who did not answer the phone were excluded, and those who did not speak these languages adequately may have been underrepresented and excluded. Additionally, because the information was self-reported, bias may be present, or there might be information incorrectly recalled by the respondent. The questions included in the survey also varied according to the state and year of the survey. As this study only uses data from the year 2021, questions present in previous surveys but not in the 2021 survey, as well as unique questions that were only relevant to selected states, were not reflected. Certain race and ethnicity combinations might also have been excluded, as the study only identified eight combinations. Furthermore, the data presented by the BRFSS are available as cohort rather than individual data. Confounding factors that may have been present could not be removed during data gathering. Lastly, as this was a cross-sectional nationwide survey, this study only identified the association and not the causative nature.

### CONCLUSION

This study identified significant associations between stroke incidence and various demographic, socioeconomic, health status, and healthcare access parameters using data from the 2021 BRFSS survey. Key findings include a higher incidence of stroke among individuals aged 65 years or older, males, and multiracial non-Hispanic populations. Socioeconomic factors such as low income, inability to work, and Medicare insurance were also linked to increased stroke prevalence.

Additionally, health status factors, including poor mental health and multiple healthcare providers, further highlighted disparities in stroke outcomes. While these findings align with previous research, they also underscore the unique associations present in this dataset, particularly the role of insurance status and access to healthcare.

These findings emphasize the need for targeted public health interventions and policy changes to address stroke-related health disparities. Future research should focus on longitudinal studies to better understand the causal pathways linking these factors to stroke. Moreover, initiatives to improve healthcare access, such as community outreach programs and education on stroke prevention in underserved populations, are critical. Physicians and healthcare providers should also prioritize equitable care and consider the socioeconomic and demographic contexts of their patients when developing treatment plans. Together, these efforts can contribute to reducing the burden of stroke and its associated disparities on a national scale.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

### REFERENCES

1. Barthels D, Das H. Current advances in ischemic stroke research and therapies. *Biochim Biophys Acta Mol Basis Dis.* 2020;1866(4):165260.
2. Liu Y, Wang H, Bai B. Trends in Unhealthy Lifestyle Factors among Adults with Stroke in the United States between 1999 and 2018. *J Clin Med.* 2023;12(3):1223.
3. Ikeme S, Kottenmeier E, Uzochukwu G, Brinjikji W. Evidence-Based Disparities in Stroke Care Metrics and Outcomes in the United States: A Systematic Review. *Stroke.* 2022;53(3):670-9.
4. Naveed H, Almasri M, Kazani B. Women and stroke: disparities in clinical presentation, severity, and short- and long-term outcomes. *Front Neurol.* 2023;14:1147858.
5. Greenlund KJ, Denny CH, Mokdad AH, Watkins N, Croft JB, Mensah GA. Using behavioral risk factor surveillance data for heart disease and stroke prevention programs. *Am J Prev Med.* 2005;29(5-1):81-7.
6. Zhu C, Tran PM, Dreyer RP, Goldstein LB, Lichtman JH. Disparities in Internet Use Among US Stroke Survivors: Implications for Telerehabilitation During COVID-19 and beyond. *Stroke.* 2022;53(3):e90-1.
7. Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System (BRFSS). Available at: <https://www.cdc.gov/brfss/index.html>. Accessed on 25 April 2025.
8. U.S. Department of Health and Human Services. 2023. What is a stroke? National Heart Lung and

- Blood Institute. h Available at: <https://www.nhlbi.nih.gov/health/stroke>. Accessed on 25 April 2025.
9. Ziaecian, B, Xu H, Matsouaka RA, Xian Y, Khan Y, Schwamm LS, et al. US Surveillance of Acute Ischemic Stroke Patient Characteristics, Care Quality, and Outcomes for 2019. *Stroke*. 2022;53(11):3386-93.
  10. Madsen TE, Khoury JC, Leppert M, Alwell K, Moomaw CJ, Sucharew H, et al. Temporal Trends in Stroke Incidence Over Time by Sex and Age in the GCNKSS. *Stroke*. 2020;51(4):1070-6.
  11. Ekker MS, Verhoeven JI, Vaartjes I, van Nieuwenhuizen KM, Klijn CJM, de Leeuw FE. Stroke incidence in young adults according to age, subtype, sex, and time trends. *Neurology*. 2019;92(21):e2444-54.
  12. Błaż M, Banaszkiwicz K, Michalski M, Sarzyńska-Długosz I. Voluntary Unemployment Is Associated with Increased Prevalence of Stroke and its Risk Factors in Middle-Aged Adults. *J Occupat Environm Med*. 2022;64(11):e672-6.
  13. Nguyen RT, Khan SU, Valero-Elizondo J, Cainzos-Achirica M, Nasir K. Association of Income Status with Stroke in Non-Elderly Adults in the United States, 2012-2018. *Curr Problems Cardiol*. 2023;48(8):101235.
  14. Ji Y, Du Z, Zheng K, Jiang Y, Ren C, Zhu H, et al. Bidirectional causal association between ischemic stroke and five mental disorders. *Acta Psychiatrica Scandinavica*. 2023;148(4):359-67.
  15. Harshfield EL, Pennells L, Schwartz JE, Willeit P, Kaptoge S, Bell S, et al. Emerging Risk Factors Collaboration. Association Between Depressive Symptoms and Incident Cardiovascular Diseases. *JAMA*. 2020;324(23):2396-05.
  16. Tsao CW, Aday AW, Almarzooq ZI, Anderson CAM, Arora P, Avery CL, et al. American Heart Association Council on Epidemiology and Prevention Statistics Committee and Stroke Statistics Subcommittee. Heart Disease and Stroke Statistics-2023 Update: A Report from the American Heart Association. *Circulation*. 2023;147(8):e93-21.
  17. Khan SU, Khan MZ, Khan MU, Khan MS, Mamas MA, Rashid M, et al. Clinical and Economic Burden of Stroke Among Young, Midlife, and Older Adults in the United States, 2002-2017. *Mayo Clinic proceedings. Innovat Qual Outcomes*. 2021;5(2):431-41.

**Cite this article as:** Roxas ET, Narra SP, Martis NL, Afthab RK, Nanavati A, Chodiseti NSN. Unravelling healthcare access disparities in stroke care: a comprehensive analysis of socio-economic and racial disparities impacting patient outcomes. *Int J Res Med Sci* 2026;14:828-35.