International Journal of Medical and Health Sciences
Volume 11 Issue 04 Dec 2025
ISSN- 2456 - 6063
DOI**: https://doi.org/10.69980/kchgts19**

CLINICAL AND EPIDEMIOLOGICAL DETERMINANTS OF STROKE IN ADULTS

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Received:- 25/09/25	Revised:-26/10/25	Accepted:-26/11/25	Published:- 27/12/25

Abstract

Stroke remains a major cause of mortality and long-term disability worldwide, posing a substantial burden on individuals, healthcare systems, and public health. This study aimed to examine the clinical and epidemiological determinants associated with stroke occurrence in adults. A quantitative cross-sectional analytical design was adopted using a structured secondary dataset comprising 5,110 adult records. The analysis included demographic, clinical, and lifestyle-related variables, namely age, gender, hypertension, heart disease, marital status, work type, residence type, average glucose level, body mass index, smoking status, and stroke status. Descriptive statistics were used to summarize the study variables, while inferential statistical techniques, including Chi-square tests and independent sample *t*-tests, were applied to assess the association between predictor variables and stroke occurrence. The findings revealed that age, hypertension, heart disease, average glucose level, body mass index, marital status, work type, and smoking status were significantly associated with stroke. Individuals with stroke had higher mean age, glucose level, and body mass index than those without stroke. Hypertension and heart disease emerged as the strongest clinical determinants, with substantially higher stroke prevalence among affected participants. In contrast, gender and residence type were not significantly associated with stroke occurrence. Overall, the findings indicate that stroke in adults is influenced by a combination of clinical, epidemiological, and lifestyle-related factors. These results highlight the need for integrated prevention strategies emphasizing cardiovascular risk screening, metabolic monitoring, and targeted public health interventions to reduce stroke burden and improve adult health outcomes.

Keywords: Stroke; Epidemiological determinants; Clinical risk factors; Hypertension; Adult population

1. Introduction

Stroke is a significant world health issue and one of the causes of mortality and disability in the world. Although medical science and medical care have improved, the stroke burden is on the increase, especially in developing countries. The Global Burden of Disease study estimates a high percentage of morbidity and mortality caused by stroke with the need to enhance prevention and management measures (GBD 2019 Stroke Collaborators, 2021). Moreover, there has been global epidemiological evidence that stroke remains a heavy and growing health burden among populations, which is why it is an important topic of focus in the area of public health (Feigin et al., 2021). The growing level of stroke emphasizes the need to detect its major determinants and the effects it has on the health of the population. Stroke is a multifactorial disease whose clinical, demographic and lifestyle related factors interact in a complex way. Hypertension, diabetes, cardiovascular diseases, and abnormal metabolic conditions are common clinical determinants that have been known to contribute to stroke. Hypertension is viewed as the most important modifiable risk factor among them, which has a significant risk of both ischemic and hemorrhagic stroke (Hankey, 2020). Equally, there are cardiovascular diseases like heart disease which lead to poor blood circulation and high vascular flaws, thus raising the risk of stroke. Stroke can also be dependent on genetic predisposition and biological processes in addition to known modifiable risk factors and preventive aspects of cerebrovascular disease (Boehme et al., 2017). All these clinical factors are vital in determining the outcomes of stroke and need to be closely monitored and managed. On top of clinical aspects, epidemiological variables including age, gender and social character are influential factors that affect stroke. One of the strongest non-modifiable risk factors is age, as the incidence of stroke in the older populations is on a steep rise. Moreover, disparities in prevalence of strokes have been noted between different demographic groups and this has emphasized the impact of population-level factors in the occurrence of diseases. The modifiable risk factors such as smoking and lack of exercise also contribute to the risk of stroke, which indicates the impact of behavioural habits on health (Guzik and Bushnell, 2017). These are the epidemiological aspects that are necessary in the larger distribution of stroke in populations. The distribution of global burden of stroke is never evenly spread and some regions have disproportionate higher rates. Specifically, urbanization, lifestyle changes, and the rising number of cardiovascular risk factors put a growing burden of stroke on countries in the Southeast Asia region (Pandian et al., 2023). Inaccessibility to healthcare services and preventive measures also makes the situation in such areas even worse. Consequently, the urgent necessity to determine the region-specific determinants and implement specific approaches to tackle the increase in stroke cases has emerged.

Stroke is also a big economic burden to healthcare systems because it frequently results in long-term disability and more use of healthcare facilities. CVDs, such as stroke, have an ever-increasing global burden, and they are putting a strain on individuals and health care systems (Roth et al., 2020). In addition, the recurrence of stroke is also a critical issue because people who suffered the first stroke are at risk of having a second stroke, which in most cases is more severe. This highlights the need to detect and manage the risk factors early in order to mitigate the burden of stroke in general (Xu et al., 2022).

The recent developments in stroke research have highlighted the need to combine clinical and epidemiological studies to gain a better insight into the patterns of disease. Whereas clinical research is concerned with the risk factors at an individual level, epidemiological research presents an understanding of trends and variations at a population level. These two points of view can be merged to gain a more in-depth insight into stroke determinants and facilitate the creation of effective prevention strategies (Katan & Luft, 2018). Moreover, the importance of tackling disparities in stroke outcomes is also a priority because considerable differences still exist in socioeconomic and demographic populations (Sacco, 2020).

Although there have been a lot of studies, there are still gaps in the knowledge of the interaction of multiple determinants to affect the stroke occurrence among real-world populations. The research on single risk factors has been conducted extensively, but the necessity to conduct integrated research where clinical and epidemiological variables are taken into account at the same time has emerged. This kind of approach would allow obtaining a more comprehensive picture of stroke risk and would be able to identify high-risk groups in the population. Also, the systematic studies based on structured data might provide important information about the relative significance of various risk factors and aid in making evidence-based healthcare choices.

In this regard, the current research seeks to investigate the clinical and epidemiological determinants of stroke among adults through investigating the relationship between demographic, clinical and lifestyle-related factors and incidence of stroke. With an elaborate analytical approach, the study aims to add to the body of knowledge in this area and give information that can help in preventing and planning healthcare. The aims of the research are:

1. To assess the association between clinical factors and stroke occurrence among adults.
2. To examine the relationship between epidemiological and lifestyle factors and stroke occurrence among adults.

3. To identify the major determinants associated with stroke in an adult population.

2. Methodology

2.1 Research Design

The analysis used the stroke dataset to analyze the clinical and epidemiological determinants of stroke in adults (fadesoriano, 2021). The research design used to conduct the study was a quantitative analytical research design to assess the relationship between the occurrence of stroke and various demographic, clinical and lifestyle related factors. As the status of stroke was measured as a binary outcome, the research was performed as an empirical observational study in the shape of classification-based association test. The aim was to determine the impact of the chosen risk-related variables on the prevalence of stroke in adults and to determine the key determinants related to stroke in the target population.

2.2 Data Source and Sample

The data were in the form of 5,110 observations, which were the health-related record of an adult person. The variables that were used in the dataset are gender, age, hypertension, heart disease, ever married, type of work, type of residence, average glucose level, body mass index, status of smoking and stroke. These variables were used to give demographic, epidemiological, clinical, and lifestyle-related data pertinent to the occurrence of stroke. The analysis included all the valid observations. The screening of records was done to achieve consistency in the variables and the dataset was deemed as appropriate to assess the stroke-related determinants in adult population statistically.

2.3 Variables and Measures

Stroke was considered as the dependent variable, which was a binary variable being either absent or present. The main independent variables included age, hypertension, heart disease, average glucose level, body mass index and smoking status since they were the main demographic, clinical and lifestyle factors linked with stroke risk. Also, gender, marital status, work type, and residence type were considered as contextual variables to provide social and epidemiological variation in the occurrence of stroke. The variable id was not included in the analysis as it was only a unique identifier and was not adding any value to the analysis.

2.4 Data Processing and Preparation

Pre-processing of the dataset was done prior to statistical analysis to provide a sense of analytical consistency and appropriateness, which would allow a meaningful interpretation. In the first step, the id column that was irrelevant was eliminated. The data was then analyzed on the basis of the structural consistency, type of variable, and completeness. Categorical variables (gender, ever married, work type, residence type and smoking status) were categorized into meaningful categories to be analyzed. Continuous variables such as age, average glucose level and body mass index were kept in numerical form to be compared statistically. The variables where the missing values were found were mainly the body mass index variable and were filled with the right imputation strategy to ensure the completeness of the data. Outliers in continuous variables were filtered and were kept in cases where it was possible in clinical practice, and they represented realistic variation in adult health patterns.

2.5 Data Analysis Technique

This analysis was done in two phases. Firstly, the study variables were summarized using descriptive statistics. Continuous variables were in the form of mean and standard deviation whereas categorical variables were in form of frequencies and percentages. This gave a general clinical and epidemiological description of the adult population. Second, a statistical analysis was conducted to analyze the relationship between independent variables and the presence of stroke through inferential statistics. Categorical variables, such as gender, hypertension, heart disease, marital status, work type, residence type and smoking status were tested via the Chi-square test. Continuous variables like age, body mass index and average level of glucose were used to compare stroke and non-stroke groups using independent sample t-tests. Comparison of the relative strength of association of the key clinical factors was also done using odds-based comparisons. A p-value of below 0.05 was deemed to be significant in identifying the significant determinants of stroke in adult.

3. Results

3.1 Descriptive Statistics of Study Variables

There were 5,110 adult records that were analyzed. The average age was 43.23 years old, the average level of glucose was 106.15 and the average BMI was 28.89. The lowest and highest values revealed that there was a

great degree of variability in the clinical profile of the study population, as presented in Table 1. Figure 1 shows that the outcome of stroke was very unequal as majority of the participants were non-stroke.

Table 1. Descriptive statistics of study variables

Variable	Mean	Std. Dev.	Minimum	Maximum
Age (years)	43.23	22.61	0.08	82.00
Average glucose level	106.15	45.28	55.12	271.74
Body mass index (BMI)	28.89	7.85	10.30	97.60

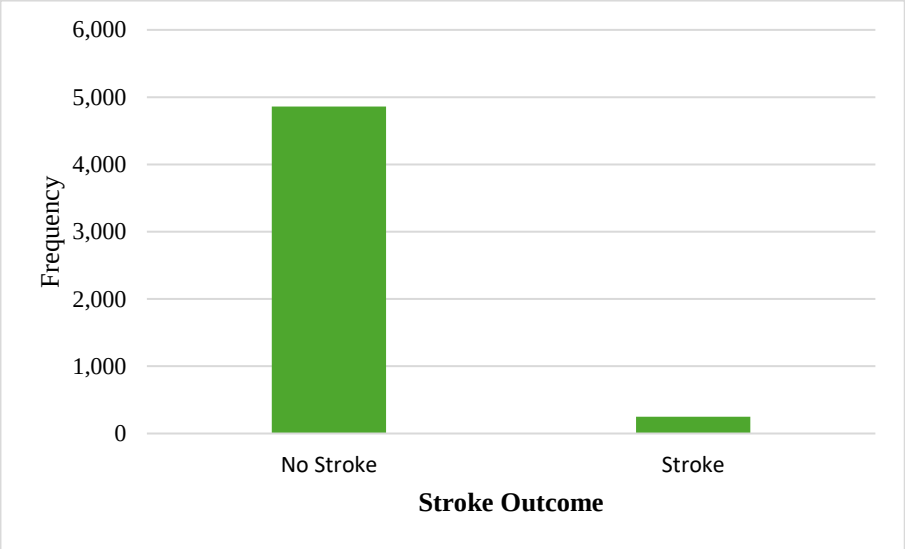

Figure 1. Distribution of stroke outcome

3.2 Distribution of Stroke Outcome

The variables were the imbalance in the population of the study in the outcome variable, stroke. The participants were 5,110, out of which, 4,861 (95.13) had not suffered stroke, and only 249 (4.87) were victims of stroke. It means that the incidence of stroke was rather low in the data set; however, the fact that the stroke cases were adequate was enough to investigate important clinical and epidemiological variations. The frequency observed in Table 2 supports that the outcome variable is imbalanced and binary, which is in line with the epidemiological trend of stroke in the general adult populations.

Table 2. Distribution of stroke outcome

Stroke status	Frequency	Percentage
No stroke	4,861	95.13
Stroke	249	4.87

3.3 Association Between Categorical Variables and Stroke

Table 3 indicated that the Chi-square test revealed that hypertension, heart disease, marital status, work type, and smoking status significantly related to occurrence of stroke. The prevalence of stroke was increased in individuals having hypertension and heart diseases and also among individuals who were ever married. On the other hand, there was no significant relationship between gender and residence type and stroke.

Table 3. Association between categorical variables and stroke

Variable	Category	Total (n)	Stroke cases (n)	Stroke (%)	p-value
Gender	Female	2,994	141	4.71	0.789
	Male	2,115	108	5.11	
Hypertension	No	4,612	183	3.97	<0.001
	Yes	498	66	13.25	
Heart disease	No	4,834	202	4.18	<0.001
	Yes	276	47	17.03	
Ever married	No	1,757	29	1.65	<0.001
	Yes	3,353	220	6.56	
Work type	Govt_job	657	33	5.02	<0.001

	Private	2,925	149	5.09	
	Self-employed	819	65	7.94	
	Children	687	2	0.29	
Residence type	Rural	2,514	114	4.53	0.298
	Urban	2,596	135	5.20	
Smoking status	Unknown	1,544	47	3.04	<0.001
	Formerly smoked	885	70	7.91	
	Never smoked	1,892	90	4.76	
	Smokes	789	42	5.32	

3.4 Comparison of Continuous Variables Between Stroke and Non-Stroke Groups

To test the different continuous variables, the independent sample t-tests were used to determine the difference in the participants with and without stroke. Table 4 indicates that the three continuous variables had statistically significant differences in the two groups. Age of the participants who suffered a stroke (67.73 years) was significantly greater than that of non stroke participants (41.97 years). On the same note, the average glucose level was more in the stroke group (132.54) as compared to the non-stroke group (104.80). There were also higher BMI in stroke cases (30.22) than non-stroke cases (28.83). The results indicate that age, glucose level, and BMI are the clinically significant continuous variables that are related to stroke.

Table 4. Comparison of continuous variables by stroke status

Variable	No stroke (Mean ± SD)	Stroke (Mean ± SD)	t-value	p-value
Age (years)	41.97 ± 22.29	67.73 ± 12.73	-29.69	<0.001
Average glucose level	104.80 ± 43.85	132.54 ± 61.92	-6.98	<0.001
Body mass index (BMI)	28.83 ± 7.78	30.22 ± 5.83	-3.61	<0.001

3.5 Odds-Based Comparison of Key Clinical Factors

Odds-based comparisons were conducted to further assess the strength of the association of major clinical factors with the occurrence of stroke. Table 5 showed that hypertensive participants were almost 3.70 times more likely to suffer a stroke compared to those who were not hypertensive. Similarly, the odds of stroke were found to be significantly higher (4.71) amongst people with heart disease in comparison to people without heart disease. Ever married was also linked with higher risks of stroke (OR = 4.18) but this is partly due to the effect of older age in married individuals. Altogether, these findings underline the great role of cardiometabolic conditions in the appearance of stroke.

Table 5. Odds ratios for selected clinical factors

Variable	Exposed group	Reference group	Odds Ratio
Hypertension	Yes	No	3.70
Heart disease	Yes	No	4.71
Ever married	Yes	No	4.18

4. Discussion

Stroke is a significant health issue of the population due to its significant role in mortality and disability rates, as well as the burden of healthcare in the long-term. The results of this analysis revealed that the incidence of stroke had a strong relationship with age, hypertension, heart disease, average glucose level, body mass index, marital status, work type as well as smoking status but not gender and residence type.

Hypertension turned out to be one of the most significant factors of stroke. Higher rate of stroke cases was observed in the participants with hypertension than in those without hypertension. This trend is in line with proven cardiovascular findings that high blood pressure is one of the most significant risk factors that can be modified in preventing stroke. Massive cardiovascular monitoring has always highlighted that unmanaged hypertension is the significant risk factor of cerebrovascular in adult groups (Benjamin et al., 2017). This observation underscores the ongoing significance of screening blood pressure, early detection and the long-term therapeutic management as the key elements of stroke prevention.

Stroke also was closely related to heart disease. Heart disease patients demonstrated a significantly high ratio of stroke and higher chances of stroke as compared to the heart disease patients with no cardiac comorbidity. This association is medically explainable since cardiac conditions could be among the factors that lead to thromboembolic processes, poor blood circulation and vascular instability, which can all increase the risk of cerebral vascularity. International stroke service evaluations have also noted that cardiovascular comorbidity

needs to be well managed to enhance prevention and treatment outcomes of stroke patients (Owolabi et al., 2021). These results thus indicate the importance of cardiovascular and stroke risk evaluation that is integrated into the routine adult healthcare practice.

Another very important determinant was the age. Mean age of the participants with stroke was significantly higher than that of the stroke-free population, which means that prevalence of stroke increases dramatically in the older age. This trend is entirely consistent with the epidemiological evidence of the disproportionately high burden of an ageing population with ischemic stroke. International and local reviews have shown that the increasing age is still one of the most powerful non-modifiable factors that increase the risk of stroke, disability, and mortality rates (Ding et al., 2022). The age difference here also underscores the significance of age-sensitive screening and prevention measures especially among elderly persons with other cardiometabolic risk factors.

Mean values of glucose level and body mass index were also considerably greater in the stroke group which means that poor metabolic condition is a significant factor to stroke. High glucose can be an indicator of poor glycemic regulation and vascular dysfunction where high body mass index can lead to inflammatory and metabolic imbalance which increases cardiovascular risk. These results collectively indicate that stroke is not a neurological event, but also a symptom of more general cardiometabolic derangement. This interpretation is also backed by evidence of nutritional epidemiology since dietary quality has been shown to be associated with stroke risk among adult populations. In particular, the risk of stroke has been linked to lower dietary magnesium, which implies that metabolic health and diet could be a valuable input to prevention efforts (Sun et al., 2023).

Smoking status, marital status and work type were also found to have statistically significant relationship with stroke. A higher percentage of stroke was shown in former smokers and this could be indicative of cumulative vascular damage as an effect of smoking. The marital status and type of work might have a more general social and behavioral pressure such as differences by age, job-related stress, access to healthcare, and lifestyles. Such results indicate that stroke risk cannot be determined exclusively by biomedical variables but it has to be understood in the context of an epidemiological and a social one too. Gender and residence type, on the other hand, had no significant results with stroke in this dataset suggesting that they might have a lesser impact, indirect or reliant on other determinants.

These results have broader implications to stroke prevention and management. Stroke is not a cause of acute clinical treatment alone, but also a disease that is indicative of cumulative exposure to cardiovascular, metabolic and lifestyle-related risk. Past evidence demonstrated that biological and structural factors (brain volume) could affect functional recovery following acute ischemic stroke, highlighting that the impact of incidence is not limited to incidence but also covers the outcomes and disability over the long term (Schirmer et al., 2020). This makes prevention in early years all the more significant, as minimizing exposure to key determinants has the potential to minimize incidence of a stroke and resultant functional outcomes.

All these findings are in favor of a multidimensional concept of stroke among adults. The most significant determinants seem to be hypertension, heart disease, older age, high level of glucose and large body mass index whereas smoking and the choice of social variables also influence the risk variation. The findings thus indicate that there should be an integrated approach to the prevention that involves combination of cardiovascular risk management, metabolic surveillance, lifestyle change and wider population health education. This is needed to decrease the increasing burden of stroke in adults and enhance the overall health outcomes in the long-term of the population.

5. Conclusion

Stroke is still a critical clinical and population health issue because it is closely related to various determinants that can be modified and non-modified. The results of the present research revealed that a set of clinical, epidemiological, and lifestyle-related factors is associated with the incidence of stroke among adults. Of all the variables analyzed, the age, hypertension, heart disease, average level of glucose, and body mass index appeared to be the most significant determinants, yet marital status, type of work, and smoking status also proved to be significantly related to stroke. However, gender, or type of residence, were not statistically significantly associated in this dataset. These results suggest that the risk of stroke is conditioned not only by the underlying cardiovascular and metabolic factors but also more general demographic and behavioral factors.

The close correlations with hypertension and heart disease underscore the importance of heart disease screening and early treatment, whereas the importance of glucose level and body mass index underscores the importance of metabolic health in stroke prevention. In the same vein, the epidemiological impact of age, as well as the chosen lifestyle-related variables, imply that stroke prevention programs ought to embrace a clinical as well as a population-based approach. The proper identification of high-risk patients at an early age, periodic

screening of key clinical predictors, and specific population health policies can possibly decrease the stroke burden and outcomes in adult health.

References

1. Benjamin, E. J., Blaha, M. J., Chiuve, S. E., Cushman, M., Das, S. R., Deo, R., ... & Muntner, P. (2017). Heart disease and stroke statistics—2017 update: a report from the American Heart Association. *circulation*, *135*(10), e146-e603.
2. Boehme, A. K., Esenwa, C., & Elkind, M. S. (2017). Stroke risk factors, genetics, and prevention. *Circulation research*, *120*(3), 472-495.
3. Ding, Q., Liu, S., Yao, Y., Liu, H., Cai, T., & Han, L. (2022). Global, regional, and national burden of ischemic stroke, 1990–2019. *Neurology*, *98*(3), e279-e290.
4. fedesoriano. (2021). *Stroke prediction dataset* [Data set]. Kaggle. https://www.kaggle.com/datasets/fedesoriano/stroke-prediction-dataset
5. Feigin, V. L., Stark, B. A., Johnson, C. O., Roth, G. A., Bisignano, C., Abady, G. G., ... & Hamidi, S. (2021). Global, regional, and national burden of stroke and its risk factors, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet Neurology*, *20*(10), 795-820.
6. GBD 2019 Stroke Collaborators. (2021). Global, regional, and national burden of stroke and its risk factors, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet. Neurology*, *20*(10), 795.
7. Guzik, A., & Bushnell, C. (2017). Stroke epidemiology and risk factor management. *CONTINUUM: Lifelong Learning in Neurology*, *23*(1, Cerebrovascular Disease), 15-39.
8. Hankey, G. J. (2020). Population impact of potentially modifiable risk factors for stroke. *Stroke*, *51*(3), 719-728.
9. Katan, M., & Luft, A. (2018, April). Global burden of stroke. In *Seminars in neurology* (Vol. 38, No. 02, pp. 208-211). Thieme Medical Publishers.
10. Owolabi, M. O., Thrift, A. G., Martins, S., Johnson, W., Pandian, J., Abd-Allah, F., ... & Stroke Experts Collaboration Group. (2021). The state of stroke services across the globe: report of World Stroke Organization–World Health Organization surveys. *International Journal of Stroke*, *16*(8), 889-901.
11. Pandian, J. D., Srivastava, M. V. P., Aaron, S., Ranawaka, U. K., Venketasubramanian, N., Sebastian, I. A., ... & Kalkonde, Y. V. (2023). The burden, risk factors and unique etiologies of stroke in South-East Asia Region (SEAR). *The Lancet Regional Health-Southeast Asia*, *17*.
12. Roth, G. A., Mensah, G. A., Johnson, C. O., Addolorato, G., Ammirati, E., Baddour, L. M., ... & GBD-NHLBI-JACC Global Burden of Cardiovascular Diseases Writing Group. (2020). Global burden of cardiovascular diseases and risk factors, 1990–2019: update from the GBD 2019 study. *Journal of the American college of cardiology*, *76*(25), 2982-3021.
13. Sacco, R. L. (2020). Stroke disparities: from observations to actions: inaugural Edward J. Kenton lecture 2020. *Stroke*, *51*(11), 3392-3405.
14. Schirmer, M. D., Donahue, K. L., Nardin, M. J., Dalca, A. V., Giese, A. K., Etherton, M. R., ... & Rost, N. S. (2020, May). Brain volume: an important determinant of functional outcome after acute ischemic stroke. In *Mayo Clinic Proceedings* (Vol. 95, No. 5, pp. 955-965). Elsevier.
15. Sun, P., Wang, Z., Li, B., & Chen, S. (2023). Association of dietary magnesium intake with the risk of stroke among adults NHANES 2007-2018. *International Heart Journal*, *64*(6), 1002-1009.
16. Xu, J., Zhang, X., Jin, A., Pan, Y., Li, Z., Meng, X., & Wang, Y. (2022). Trends and risk factors associated with stroke recurrence in China, 2007-2018. *JAMA network open*, *5*(6), e2216341.