

## Knowledge and attitudes towards stroke in semi-urban communities in North Central Nigeria

Paul O. Onah  

Department of Clinical Pharmacy and Pharmacy Administration, Faculty of Pharmacy, University of Maiduguri, Borno, Nigeria

**Article number:** 196, **Received:** 05-02- 2025, **Accepted:** 23-03-2025, **Published online:** 01-04-2025

**Copyright**© 2025. This open-access article is distributed under the *Creative Commons Attribution License*, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

### HOW TO CITE THIS

Onah PO (2025) Knowledge and attitudes towards stroke in semi-urban communities in North Central Nigeria. *Mediterr J Pharm Pharm Sci.* 5 (2): 8-19. [Article number: 196]. <https://doi.org/10.5281/zenodo.15118429>

**Keywords:** Attitude, knowledge, perception, stroke, risk factor

**Abstract:** Stroke and its associated disabilities are a growing public health challenge in many developing countries where a combination of poor awareness and poor medical care is driving up mortality rates. The rising cases are attributed to the rising prevalence of uncontrolled hypertension, obesity, smoking, alcohol abuse, and diabetes mellitus within the population. The prevention of stroke through awareness, knowledge, and lifestyle modification is a common approach used in public health intervention programs. Awareness and knowledge of stroke vary widely between communities partly because of access to relevant health information. This study assessed awareness, knowledge of stroke risk factors, and attitude toward stroke prevention. This study was a community-based survey among adults  $\geq 40$  years old in semi-urban communities of two local government area councils of Benue State, North Central Nigeria. The sixteen-item questionnaire used in this study is subdivided into socio-demographic information, knowledge of risk factors, symptoms of stroke, current morbidity, and attitude toward stroke prevention. The survey was done using two adults per household selected using simple random method and completed questionnaires were retrieved for analysis. The Chi-square test was used to determine the association between demographic variables and knowledge of stroke. The result showed poor levels of stroke awareness (47.3%), knowledge (44.6%), symptoms (44.6%), risk factors (20.6%), and symptoms (44.6%). Awareness of stroke and its risk factors is significantly association with age, gender, marital status, educational status, occupation, and income. Many respondents had poor knowledge of stroke and its risk factors. There is a need for improvement in stroke awareness in underserved communities, particularly those with limited access to mass media.

### Introduction

Stroke is a disease of multiple etiologies affecting all ages and genders, although older adults  $> 65$  years have a higher risk [1, 2]. The disease accounts for 3.1% of the global disease burden and is directly responsible for 10.8% of all mortality among adults [3-5]. Recent projections indicate that stroke will rise to 23 million new cases annually resulting in 7.8 million deaths by the year 2030 [6, 7]. Several studies have reported a rising incidence of stroke among younger age groups [8, 9] as well as premature deaths [10]. It is estimated that up to 85.0% of strokes resulting in premature deaths occur in low- and middle-income countries [9, 11], although some studies have reported slightly lower mortality rates [12]. While the incidence of stroke is reportedly on the decline in high-income countries, there is a rising number of cases in low- and middle-income countries [13]. Recent epidemiological studies estimated that 15.0% of hospital admissions in sub-Saharan Africa are

related to either stroke or its complications [14]. Several studies suggested that the prevalence of stroke in sub-Saharan Africa is largely underreported as many cases are not also presented to hospitals, particularly from rural areas [15-17]. In Nigeria, stroke prevalence from health facilities and community-based studies estimated prevalence to be around 21.0%-45.0% and reported a mortality rate of 30.0-50.0% [18, 19]. The rising incidence of stroke in low- and middle-income countries is partly driven by increasing risk factors such as the high burden of hypertension, aging population, obesity, and other risk factors [11, 20, 21]. Population-based studies reported that 30.0%-40.0% of strokes are directly linked to uncontrolled hypertension, smoking, dyslipidemia, diabetes mellitus, obesity, alcoholism, and a sedentary lifestyle [22]. Interestingly, these risk factors are largely responsible for cardiovascular diseases and chronic heart failure [23, 24]. There is evidence to indicate that population awareness, access to preventive care, and reduction in risk factors significantly reduce the incidence of stroke among high-risk groups [25-27]. While the reduction in stroke risk through modification of risky life factors is well known, lack of awareness, poor knowledge, early warning signs, and poor treatment-seeking behavior present significant challenges to prevention, treatment, and long-term prognosis [28, 29]. Several studies from sub-Saharan African countries reported poor awareness and knowledge of risk factors [30-33], although satisfactory knowledge has also been reported [34, 35]. While contrasting levels of knowledge have been reported in several Nigerian studies [36-38], most of the results have been poor [39]. Stroke-related disability is associated with a severe impact on quality of life, psychological distress, and socio-economic well-being [29, 40, 41]. Therefore, stroke prevention is a public health need for which success depends on individual and community action. Awareness and knowledge of risk factors are critical for individuals taking responsibility for prevention, screening for risk factors, and adopting healthier lifestyles. This study, therefore, aims to assess awareness, knowledge of risk factors, and attitudes toward stroke in a semi-urban community.

## Materials and methods

*Study setting:* The study was carried out in Oju and Obi local government areas which are located in the South-Central part of Benue State. They share a common boundary with four local government areas which include Gwer East (North), Konshisha (East), Otukpo (West), and Ado (South) on Latitude 6° 52' 12.00"N and Longitude 8° 25' 12.00"E). The area has two public general hospitals located at local government headquarters and several primary healthcare centers spread around rural/semi-rural communities. The survey was carried out in selected five semi-urban communities in each local council area within a 10 km radius of the administrative headquarters.

*Study design:* This was a community-based survey of residents using a multistage sampling method. In the first stage, five communities consisting of several villages were selected based on the availability of a primary healthcare facility and social amenities. This is followed by a selection of one village in each of the selected communities. In the final stage, three major streets were selected for household survey. The survey was done using a maximum of two adults per household with a total of 100 respondents in each survey area.

*Sample size:* The sample size was calculated using the formula below and based on a stroke prevalence estimate of 25.0% in Nigeria [39]. The formula:  $n = Z^2 PQ/e^2 \times deff.$ , Where n sample size,  $Z=1.96$  at 95% confidence interval,  $P$  = prevalence of stroke (25%),  $Q = 1 - P$ ,  $e$  = margin of error (5.0%),  $deff$  = design effect of 1.2 to adjust for clustering effect. An attrition rate of 20.0% was factored in to give a sample size of 415 respondents, however, a total of 600 respondents were surveyed from each local council area.

*Questionnaire/administration:* The questionnaire used in the survey was adopted from previous studies [34, 42, 43]. It consists of seven sections relating to knowledge of risk factors (12 items), the primary source of stroke information (4 items), perception of stroke (6 items), awareness (5 items), knowledge of symptoms (9

items), personal lifestyle risk factors (4 items) and personal risk assessment (one item). While all items were rated on a three-point Likert scale, personal risk assessment is on a four-point scale (likely, average, marginal, and unlikely). A cumulative score of  $\geq 70.0\%$  correct responses in each domain was considered satisfactory. The selected households were visited by a pair of trained local healthcare workers and a questionnaire was self-administered on one or two respondents per household ( $\geq 40$  years old) after obtaining verbal consent. The respondents with non-formal education were assisted by data collectors who speak the local language. A total of 1200 questionnaires were administered out of which 1000 were usable giving an 83.3% return rate.

**Ethical approval:** The approval of this study was obtained from the health research ethics committee of Benue State Ministry of Health, Makurdi (MoH/STA/204/VOL.1/119).

**Statistical analysis:** The data was entered into Microsoft Excel, SPSS version 21 for descriptive and inferential statistics, and was summarized using descriptive statistics for knowledge of risk factors, symptoms, awareness, and perception, while the Chi-square test was used to determine the association between demographic variables, knowledge of stroke, and its risk factors.  $P < 0.05$  was considered statistically significant.

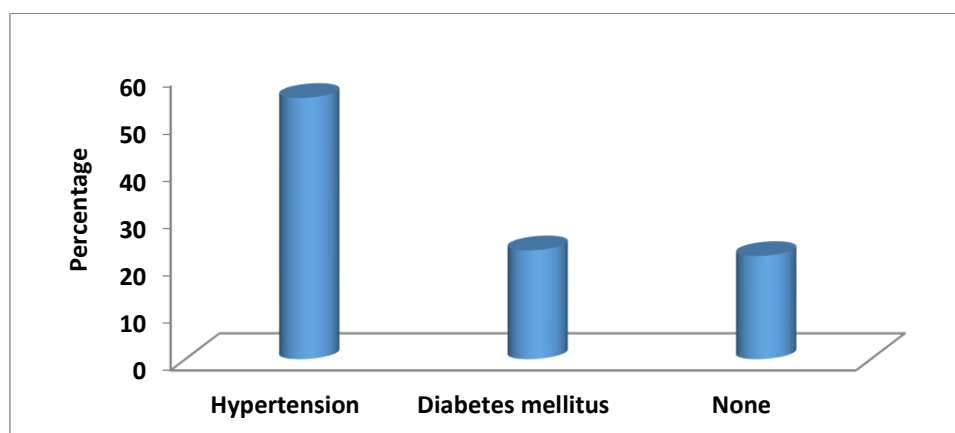
## Results

Demographic data showed that 52.2% of the respondents are males and 55.8% are married. The mean age of respondents was  $44.6 \pm 14.1$  years and 77.8% have primary level education and above (**Table 1**).

**Table 1:** Demographic data of the respondents

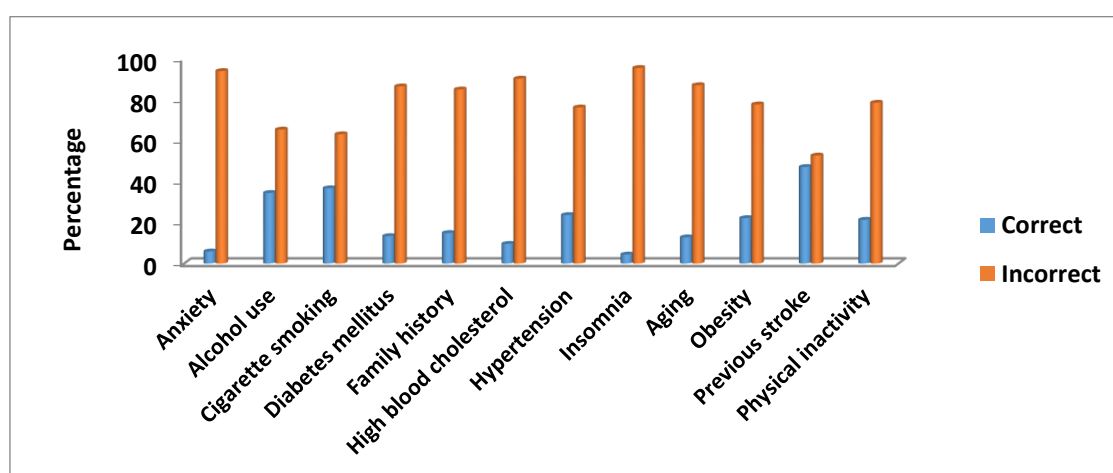
Variable	Frequency (%)
<b>Gender</b>	
Male	522 (52.2%)
Female	478 (47.8%)
<b>Marital status</b>	
Single	98 (9.8)
Married	558 (55.8)
Divorced	194 (19.4)
Widowed	150 (15.0)
<b>Education</b>	
Nonformal	222 (22.2)
Primary	188 (18.8)
Secondary	400 (40.0)
Tertiary	190 (19.0)
<b>Occupation</b>	
Family	222 (22.2)
Business	208 (20.8)
Civil servant	190 (19.0)
Housewife	380 (38.0)
<b>Age (year)</b>	
$\leq 40$	198 (19.8)
41-50	226 (22.6)
51-60	258 (25.8)
61-70	188 (18.8)
$\geq 71$	130 (13.0)
Mean age (SD)	$50.7 \pm 17.8$
<b>Income/month (\$)</b>	
$\leq 40$	290 (29.0)
41-80	388 (38.8)
81-120	258 (25.8)
121-160	48 (4.8)
161-200	16 (1.6)
Mean income	$64.8 \pm 38.1$
<i>N1200 to 1USD was used for calculations</i>	

In **Figure 1**, the most self-reported chronic diseases with stroke risk included hypertension (55.3%) and diabetes mellitus (23.0%).



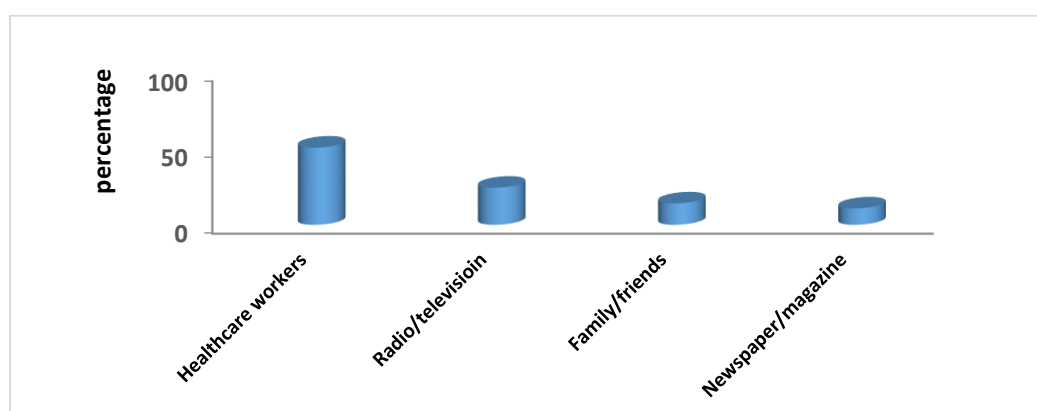
**Figure 1:** Self-reported chronic diseases with a high risk of stroke

In **Figure 2**, 47.0% of the respondents correctly identified previous stroke as a major stroke risk and poorer score for knowledge of alcohol (34.5%), cigarette smoking (36.8%), and sedentary lifestyle (21.4%) as other risk factors.



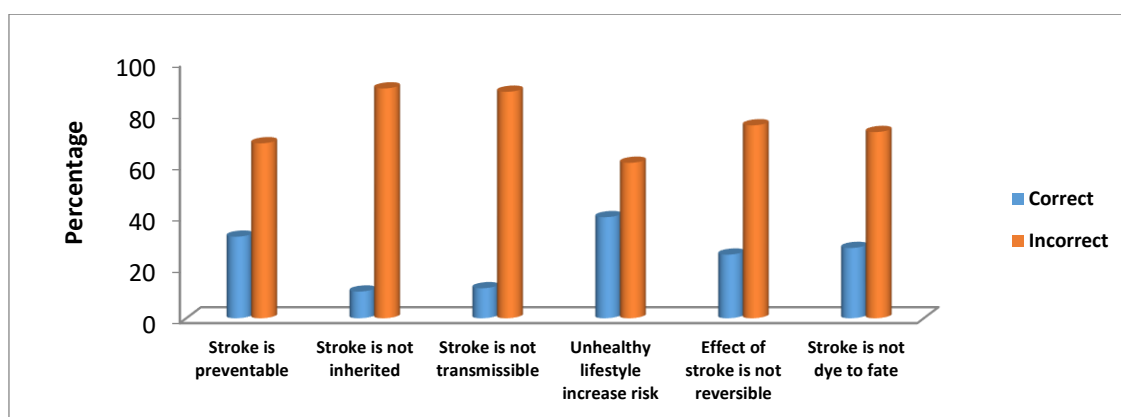
**Figure 2:** Knowledge of risk factors reported by the respondents

**Figure 4** shows that the major sources of stroke information were community health workers (50.6%), radio/television (24.3%), family/friends (14.0%), and print media (10.7%).



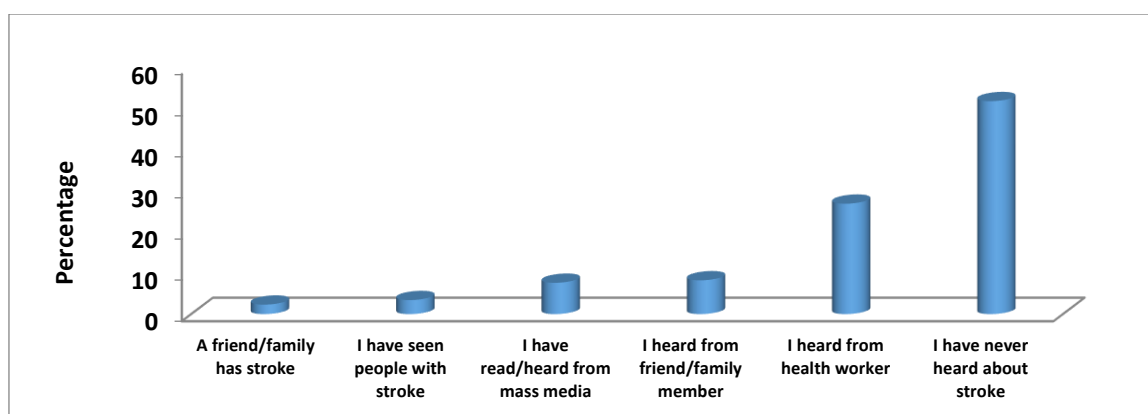
**Figure 3:** Sources of stroke information

In **Figure 4**, stroke perception among the respondents was poor as 39.4% recognized unhealthy lifestyles as a risk factor and therefore preventable (31.8%). However, 90.0% of the respondents believe that stroke is inherited or transmissible and 24.8% understand that the effect of stroke is not reversible on treatment.



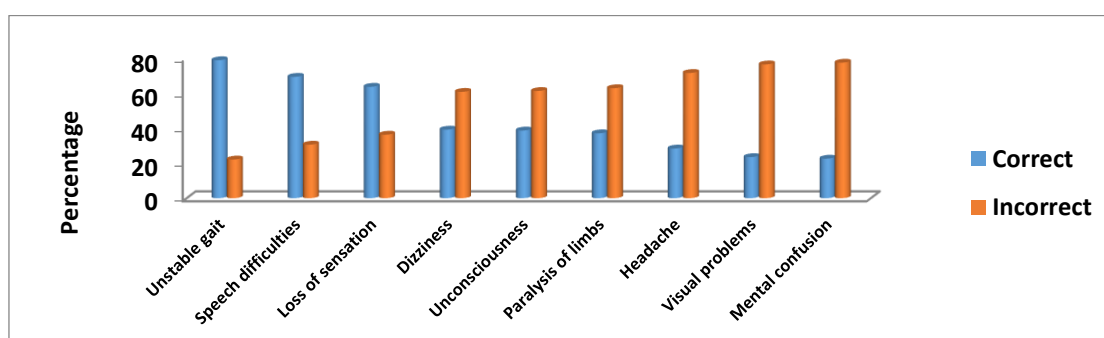
**Figure 4:** Perception of stroke among the respondents

In **Figure 5**, 51.7% of the respondents have never heard about stroke, and those who heard from community health workers (26.8%), family/friends (08.2%), and mass media (07.6%) among others. 02.3% became aware because they witnessed somebody with a stroke (03.4%) or a family member/friend living with a stroke.

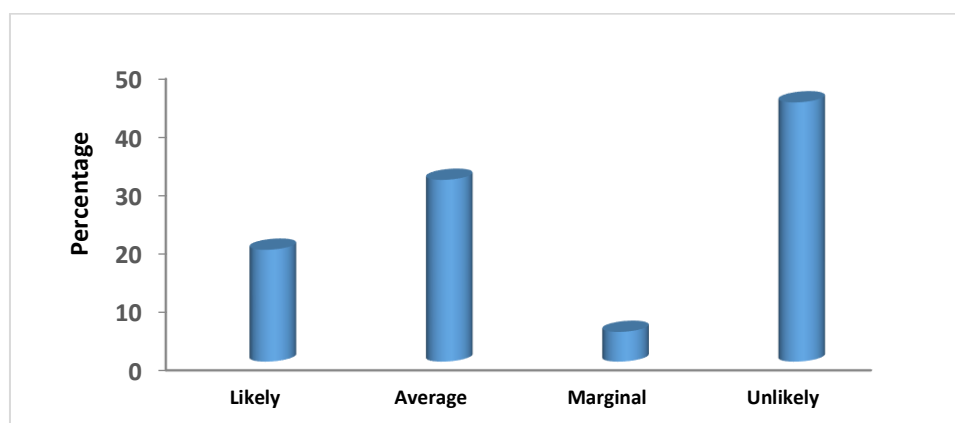


**Figure 5:** Awareness of stroke among the respondents

Among those who have heard or have some knowledge of stroke difficulty in walking (78.9%), speech difficulties (69.4%), loss of sensation (63.7%), and paralysis (37.1%) were the commonly identified symptoms (**Figure 6**). Among respondents with awareness of stroke, 44.5% believed that they are unlikely to suffer from stroke while a third considered themselves to have average risk (31.2%) and marginal risk (05.1%). 19.2% of the respondents agree that there is a likelihood of stroke based on their current lifestyle (**Figure 7**).



**Figure 6:** Knowledge of stroke symptoms among the respondents



**Figure 7:** Perceived risk of stroke

In **Table 2**, there was a significant association between knowledge of stroke and demographic factors including gender, marital status, educational status, occupation, age, and income level ( $p < 0.001$ ).

**Table 2:** Association between demographic variables and knowledge of stroke

	Satisfactory	Unsatisfactory	Chi-square	P value
<b>Gender</b>				
Male	166 (16.6)	356 (35.6)	12.54	0.004
Female	226 (22.6)	252 (25.2)		
<b>Marital Status</b>				
Single	68 (06.8)	30 (3.0)	15.3	0.002
Married	228 (22.8)	330 (33.0)		
Divorced	78 (07.8)	116 (11.6)		
Widowed	58 (5.8)	92 (9.2)		
<b>Educational status</b>				
Non formal	48 (04.8)	174 (17.4)	66.98	<0.001
Primary	64 (06.4)	104 (10.4)		
Secondary	82 (16.4)	236 (23.6)		
Tertiary	136 (13.6)	54 (5.4)		
<b>Occupation</b>				
Business	88 (8.8)	120 (12.0)	62.12	<0.001
Farming	24 (02.4)	198 (19.8)		
Civil servant	120 (12.0)	70 (7.0)		
Housewife	172 (17.2)	208 (20.8)		
<b>Age (yrs.)</b>				
≤40	54 (05.4)	144 (14.4)	38.06	<0.001
41-50	128 (12.8)	98 (9.8)		
51-60	172 (17.2)	86 (8.6)		
61-70	108 (10.8)	80 (8.0)		
≥71	76 (7.6)	54 (05.4)		
<b>Income (\$)</b>				
≤40	110 (11.0)	180 (18.0)	39.69	<0.001
41-80	142 (14.2)	246 (24.6)		
81-120	170 (17.0)	88 (08.8)		
121-160	34 (3.4)	14 (01.4)		
161-200	12 (1.2)	04 (0.4)		

In **Table 3**, there is a significant association between alcohol use and knowledge of stroke, however, other factors such as body mass index and lifestyle are not associated with knowledge of stroke.

**Table 3:** Association between sociodemographic factors and knowledge of stroke

Variable	Satisfactory	Unsatisfactory	Chi-square	P value
<b>Source of information</b>				
Health worker	240 (24.0)	133 (26.6)	2.743	0.097
Other sources	198 (19.8)	148 (29.6)		
<b>BMI (Kg/M<sup>2</sup>)</b>				
Normal (18.5-24.9)	196 (19.6)	244 (24.4)	0.314	0.855
Overweight (25-29.9)	164 (16.4)	186 (18.6)		
Obese ( $\geq 30$ )	92 (9.2)	118 (11.8)		
<b>Physical exercise</b>				
None	294 (29.4)	286 (28.6)	4.733	0.094
<5 days/week	144 (14.4)	106 (10.6)		
>5 days/week	72 (07.2)	98 (09.8)		
<b>Alcohol use</b>				
None	112 (11.2)	168 (16.8)	15.419	0.001
1-2 drinks/week	194 (18.4)	236 (23.6)		
3-6 drinks/week	84 (08.4)	94 (09.4)		
>7 drinks/week	22 (02.2)	100 (10.0)		
<b>Chronic diseases</b>				
None	88 (08.8)	130 (13.0)	0.369	0.832
Hypertension	236 (23.6)	316 (31.6)		
Diabetes mellitus	102 (10.2)	128 (12.8)		
<b>Family history of stroke</b>				
Yes	58 (05.8)	90 (09.0)	1.029	0.310
No	388 (38.8)	464 (46.4)		
<b>I Know someone with stroke</b>				
Yes	74 (7.4)	176 (17.6)	3.149	0.076
No	246 (24.6)	504 (50.4)		
<b>Cigarette smoking</b>				
Never smoked	316 (31.6)	354 (35.4)	0.665	0.717
Smoked in the past	130 (13.0)	14 (14.0)		
Currently smoking	24 (02.4)	36 (03.6)		

## Discussion

The burden of stroke is a growing public health challenge in urban and rural communities in developing countries for which awareness is generally poor. The importance of community awareness of risk factors, knowledge, and early recognition of warning symptoms is critical to prevention. The findings of the current study showed that awareness and knowledge of stroke risk factors are generally poor comparable to studies [44, 45]. There was also poor perception of the implications of the stroke on personal well-being [46, 47], although contrasting reports have been reported from developing countries [48, 49]. The prevalence of self-reported hypertension among respondents was found in more than half of respondents [22]. The lack of knowledge and awareness of stroke risk factors found in the current study is comparable to previous studies [50, 51]. Access to accurate public health information is fundamental in enabling the recognition of risk factors and lifestyle changes needed to reduce risk. While community health workers are primarily the major sources of health information in most rural communities [43], increasing access to mass media, and the Internet in some semi-urban residents is creating new opportunities for access to health information [52]. However, in many rural communities' residents typically rely on family/friends and sometimes personal experience with acquaintances who are victims to be aware of stroke [39]. A significant proportion of the respondents had little unawareness of stroke and its risk factors comparable to other studies [53], although contrasting results have been reported [54, 55].

The poor awareness of stroke and its risk factors is related to poor health literacy in rural communities where there is acute lack of public health information. In most situations, the first awareness of stroke is from cases witnessed in the community and much of the information obtained is of poor quality which leaves individuals



with confusion, doubts, and unable to engage in changing modifiable risk factors. The knowledge of symptoms and early warning signs was generally poor, although, most respondents correctly identified paralysis, speech difficulties, and loss of sensation as common symptoms of stroke [56, 57]. The poor perception of stroke as a disease that is non-transmissible or inherited and the inability to relate an unhealthy lifestyle to stroke risk is comparable to previous studies [58, 59]. This may be due to related to inaccurate information, poor education, lack of healthcare facilities, poor health literacy, and absence of public health information systems in rural communities. This lack of public information makes it difficult for rural residents to properly assess their stroke risk in light of their current lifestyle choices [60, 61]. While a significant proportion of respondents were aware that they have hypertension, they demonstrated little knowledge of its relationship to a higher risk of stroke from uncontrolled blood pressure. The influence of demographic factors on awareness and knowledge of stroke has produced conflicting results. A previous study reported the contrasting influence of demographic factors on knowledge and attitudes towards stroke as well as its risk factors [49]. While this study showed significant association between knowledge of stroke and educational status [35, 62, 63], gender [64, 65], marital status [66, 67], occupation [68, 69], income [70] and age [71], no association with family history [72, 73], hypertension [74, 75], body mass index [76, 77], physical activity [75, 78], diabetes mellitus [79, 80], smoking [81] and previous episode of stroke [82, 83] was found in this study. Several studies from Nigeria have, however, reported contrasting from that observed in this study [64, 82, 84], which may be attributed to differences in study settings, assessment tools, level of health literacy, and access to health information resources. The observation from this study demonstrates the urgent need to strengthen the public health information system in rural/semi-urban areas where the majority of the population resides in Nigeria. The social and economic impact of stroke on household income and community productivity is enormous, particularly in rural areas where the major economic activity is related to agriculture and smallholder businesses.

**Conclusion:** Awareness and knowledge of stroke and its risk factors were generally poor among respondents. This lack of knowledge is influenced by demographic factors and a lack of access to health information. There is, therefore, a need to improve awareness of stroke risk factors among residents of rural communities.

## References

1. Zeng X, Deng A, Ding Y (2017) The INTERSTROKE study on risk factors for stroke. *The Lancet*. 389: 35. doi: 10.1016/S0140-6736(16)32620-4
2. Madsen TE, Khoury JC, Leppert M, Alwell K, Moomaw CJ, Sucharew H, Woo D, Ferioli S, Martini S, Adeoye O, Khatri P, Flaherty M, De Los Rios La Rosa F, Mackey J, Mistry E, Demel SL, Coleman E, Jasne A, Slavin SJ, Walsh K, Star M, Broderick JP, Kissela BM, Kleindorfer DO (2020) Temporal trends in stroke incidence over time by sex and age in the GCNKSS. *Stroke*. 51: 1070-1076. doi: 10.1161/STROKEAHA.120.028910
3. Avan A, Digaleh H, Di Napoli M, Stranges S, Behrouz SR, Shojaeianbabaei G, Amiri A, Tabrizi R, Mokhber N, Spence JD, Azarpazhooh MR (2019) Socioeconomic status and stroke incidence, prevalence, mortality, and worldwide burden: an ecological analysis from the global burden of disease study 2017. *BMC Medicine*. 17 (1): 191. doi: 10.1186/s12916-019-1397-3
4. Rahbar MH, Medrano M, Diaz-Garelli F, Villaman CG, Saroukhani S, Kim S, Tahanan A, Franco Y, Castro-Tejada G, Diaz SA, Hessabi M, Savitz SI (2022) Younger age of stroke in low-middle income countries is related to healthcare access and quality. *Annals of Clinical and Translational Neurology*. 9 (3): 415-442. doi: 10.1002/acn3.51507
5. Fan J, Li X, Yu X, Liu Z, Jiang Y, Fang Y, Zong M, Suo C, Man Q, Xiong L (2023) Global burden, risk factor analysis and prediction study of ischemic stroke, 1990-2030. *Neurology*. 101: e137-e150. doi: 10.1212/WNL.0000000000207387
6. Pu L, Wang L, Ruijie Zhang MM, Zhao T, Jiang Y, Han L (2023) Projected global trends in ischemic stroke incidence, deaths and disability-adjusted life years from 2020 to 2030. *Stroke*. 54 (5): 1330-1339. doi: 10.1161/STROKEAHA.122.040073



7. Zhang T, Yin X, Zhang Y, Chen H, Man J, Li Y, Chen J, Yang X, Lu M (2022) Global trends in mortality and burden of stroke attributable to lead exposure from 1990 to 2019. *Frontiers in Cardiovascular Medicine*. 9: 870747. doi: 10.3389/fcvm.2022.870747
8. Smajlović D (2015) Strokes in young adults: Epidemiology and prevention. *Vascular Health and Risk Management*. 11: 157-164. doi: 10.2147/VHRM.S53203
9. Rochmah TN, Rahmawati IT, Dahlui M, Budiarto W, Bilqis N (2021) Economic burden of stroke disease: A systematic review. *International Journal of Environmental Research and Public Health*. 18 (14): 7552. doi: 10.3390/ijerph18147552
10. Yahya T, Jilani, MH, Khan SU, Mszar R, Hassan SZ, Blaha MJ, Blankstein R, Virani SS, Johansen MC, Vahidy F, Cainzos-Achirica M, Nasir K (2020) Stroke in young adults: Current trends, opportunities for prevention and pathways forward. *American Journal of Preventive Cardiology*. 3: 100085. doi: 10.1016/j.ajpc.2020.100085
11. Akinyemi RO, Brainin M (2021) The African stroke organization - a new dawn for stroke in Africa. *Nature Reviews Neurology*. 17 (3): 127-128. doi: 10.1038/s41582-021-00456-1
12. Banerjee TK (2022) Editorial: Neuroepidemiology of stroke in low- and middle-income countries. *Frontiers in Neurology*. 13: 1059974. doi: 10.3389/fneur.2022.1059974
13. Li L, Scott CA, Rothwell PM (2020) Trends in stroke incidence in high-income countries in the 21<sup>st</sup> century: Population-based study and systematic review. *Stroke*. 51 (5): 1372-1380. doi: 10.1161/strokeaha.119.028484
14. Okekunle AP, Jones S, Adeniji O, Watkins C, Hackett M, Di Tanna GL, Owolabi M, Akinyemi R (2023) Stroke in Africa: A systematic review and meta-analysis of the incidence and case-fatality rates. *International Journal of Stroke*. 18 (6): 634-644. doi: 10.1177/17474930221147164
15. Sarfo FS, Akassi J, Awuah D, Adamu S, Nkyi C, Owolabi M, Ovbiagele B (2015) Trends in stroke admission and mortality rates from 1983 to 2013 in central Ghana. *Journal of Neurological Sciences*. 357 (1-2): 240-245. doi: 10.1016/j.jns.2015.07.043
16. Owolabi MO, Akarolo-Anthony S, Akinyemi R, Arnett D, Gebregziabher M, Jenkins C, Lackland D, Ovbiagele B, Akpalu A, Sagoe K, Sarfo FS, Obiako R, Owolabi L (2015) The burden of stroke in Africa: a glance at the present and a glimpse into the future. *Cardiovascular Journal of Africa*. 26 (2 H3 Africa Suppl): S27-S38. doi: 10.5830/CVJA-2015-038
17. Lekoubou A, Nkoke C, Dzudie A, Kengne AP (2015) Stroke admission and case-fatality in an urban medical unit in sub-Saharan Africa: a fourteen-year trend study from 1999 to 2012. *Journal of Neurological Sciences*. 350 (1-2): 24-32. doi: 10.1016/j.jns.2015.02.002
18. Enwereji KO, Nwosu MC, Ogunniyi A, Nwani PO, Asomugha AL, Enwereji EE (2014) Epidemiology of stroke in a rural community in Southeastern Nigeria. *Vascular Health and Risk Management*. 10: 375-388. doi: 10.2147/VHRM.S57623.
19. Ekeh B, Ogunniyi A, Isamade E, Ekrikpo U (2015) Stroke mortality and its predictors in a Nigerian teaching hospital. *African Health Sciences*. 15 (1): 74-81. doi: 10.4314/ahs.v15i1.10
20. Kalkonde YV, Alladi S, Kaul S, Hachinski V (2018) Stroke prevention strategies in the developing world. *Stroke*. 49 (12): 3092-3097. doi: 10.1161/STROKEAHA.118.017384
21. Duncan PW, Bushnell C, Sissine M, Coleman S, Lutz BJ, Johnson AM, Radman M, Bettger JP, Zorowitz RD, Stein J (2021) Comprehensive stroke care and outcomes: Time for a paradigm shift. *Stroke*. 52 (1): 385-393. doi: 10.1161/STROKEAHA.120.029678
22. Boehme AK, Esenwa C, Elkind MSV (2017) Stroke risk factors, genetics and prevention. *Circulation Research*. 120 (3): 472-492. doi: 10.1161/CIRCRESAHA.116.308398
23. Muhammad IF, Suneela YB, Soderholm ZM, Johnson L, Persson M, Melander O, Engstrom G (2021) Comparison of risk factors for ischaemic stroke and coronary events in a population-based cohort. *BMC Cardiovascular Disorders*. 21: 536. doi: 10.1186/s12872-021-02344-4
24. Alawneh KZ, Al Qawasmeh M, Raffee LA, Abuzayed B, Hani DAB, Abdalla KM, AL-Mnayyis AM, Fataftah J (2020) A snapshot of ischemic stroke risk factors, sub-types, and its epidemiology: Cohort study. *Annals of Medicine and Surgery*. 59: 101-105. doi: 10.1016/j.amsu.2020.09.016
25. Liu L, Xue F, Ma J, Ma M, Long Y, Newschaffer CJ (2013) Social position and chronic conditions across the life span and risk of stroke: a life course epidemiological analysis of 22,847 American adults in ages over 50. *International Journal of Stroke*. 8 Suppl A100(0100): 50-55. doi: 10.1111/j.1747-4949.2012.00927.x
26. Becher H, Palm F, Aigner A, Safer A, Urbanek C, Buggle F, Grond-Ginsbach C, Grau AJ (2016) Socioeconomic conditions in childhood, adolescence, and adulthood and the risk of ischemic stroke. *Stroke*. 47 (1): 173-179. doi: 10.1161/STROKEAHA.115.011523
27. Ferrario MM, Veronesi G, Kee F, Chambless LE, Kuulasmaa K, Jørgensen T, Amouye P, Arveiler D, Bobak M, Cesana G, Drygas W, Ferrieres J, Giampaoli S, Lacoviello L, Nikitin Y, Peters A, Salomaa V, Saderberg S, Tamosiunas A, Wilsgaard T, Tunstall-Pedoe H (2017) Determinants of social inequalities in stroke incidence

- across Europe: a collaborative analysis of 126 635 individuals from 48 cohort studies. *Journal of Epidemiology and Community Health*. 71 (12): 1210-1216. doi: 10.1136/jech-2017-209728
28. Kupferman JC, Zafeiriou DI, Lande MB, Kirkham FJ, Pavlakis SG (2017) Stroke and hypertension in children and adolescents. *Journal of Child Neurology*. 32 (4): 408-417. doi: 10.1177/0883073816685240
  29. Krishnamurthi RV, Ikeda T, Feigin VL (2020) Global, regional and country specific burden of ischemic stroke, intracerebral hemorrhage and subarachnoid hemorrhage: a systematic analysis of the global burden of disease study 2017. *Neuroepidemiology*. 54 (2): 171-179. doi: 10.1159/000506396
  30. Kharbach A, Obtel M, Achbani A, Bouchriti Y, Hassouni K, Lahlou L, Razine R (2020) Level of knowledge on stroke and associated factors: a cross-sectional study at primary health care centers in Morocco. *Annals of Global Health*. 86: 83. doi: 10.5334/aogh.2885
  31. Melak AD, Wondimsigegn D, Kifle ZD (2021) Knowledge, prevention practice and associated factors of stroke among hypertensive and diabetic patients—a systematic review. *Risk Management and Healthcare Policy*. 14: 3295. doi: 10.2147/RMHP.S324960
  32. Nigat AB, Abate MW, Demelash AT, Tibebe NS, Tiruneh CM, Emiru TD, Yimam MA, Nega AD, Yimer YS (2021) Knowledge on stroke warning signs and associated factors among hypertensive patients, Northwest Ethiopia: an institution based cross-sectional study. *Vascular Health Risk Management*. 17: 721. doi: 10.2147/VHRM.S333394
  33. Tibebe NS, Emiru TD, Tiruneh CM, Nigat AB, Abate MW, Demelash AT (2021) Knowledge on prevention of stroke and its associated factors among hypertensive patients at Debre Tabor general hospital: An institution based cross-sectional study. *Risk Management and Healthcare Policy*. 14: 1681-1688. doi: 10.2147/RMHP.S303876
  34. Kaddumukasa M, Kayima J, Nakibuuka J, Mugenyi L, Ddumba E, Blixen C, Welter E, Katabira E, Sajatovic M (2017) A cross-sectional population survey on stroke knowledge and attitudes in Greater Kampala, Uganda. *Cogent Medicine*. 4 (1): 1327129. doi: 10.1080/2331205X.2017.1327129
  35. Arisege SA, Awosan KJ, Oche MO, Sabir AA, Ibrahim MT (2018) Knowledge and practices related to stroke prevention among hypertensive and diabetic patients attending specialist hospital, Sokoto, Nigeria. *Pan African Medical Journal*. 29: 63. doi: 10.11604/pamj.2018.29.63.13252
  36. Obembe AO, Olaogun MO, Bamikole AA, Komolafe MA, Odetunde MO (2014) Awareness of risk factors and warning signs of stroke in a Nigeria University. *Journal of Stroke Cerebrovascular Disorders*. 23 (4): 749-758. doi: 10.1016/j.jstrokecerebrovasdis.2013.06.036
  37. Komolafe MA, Obembe AO, Olaogun MO, Adebisi AM, Ugalahi T, Dada O, Kanu A, Adebisi OC, Akilo F, Ogunkoya B, Fawale B (2015) Awareness of stroke risk factors and warning signs in Nigerian adolescents compared with adults. *Journal of Stroke Cerebrovascular Disorders*. 24 (3): 687-693. doi: 10.1016/j.jstrokecerebrovasdis.2014.11.013
  38. Vincent-Onabajo G, Moses T (2016) Knowledge of stroke risk factors among stroke survivors in Nigeria. *Stroke Research and Treatment*. 2016: 1902151. doi: 10.1155/2016/1902151
  39. Olorukooba AA, Mohammed Y, Yahaya SS, Amadu L, Ibrahim JM, Onoja-Alexander MO (2018) Awareness of stroke and knowledge of its risk factors among respondents in Shika community, Kaduna State, Nigeria. *Archives in Medical Surgery*. 3 (1): 30-34. doi: 10.4103/archms.archms\_1\_18
  40. 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: 795-820. doi: 10.1016/S1474-4422(21)00252-0
  41. Torre GL, Lia L, Francavilla F, Chiappetta M, De Sio S (2022) Factors that facilitate and hinder the return to work after stroke: An overview of systematic reviews. *La Medicina del Lavoro*. 113 (3): e2022029. doi: 10.23749/mdl.v113i3.13238
  42. Ayanniyi O, Akande O, Mustapha AF (2006) Knowledge and perception of stroke among adults in Oshogbo, Nigeria. *African Journal of Medicine and Medical Sciences*. 35 (4): 447-452. PMID: 17722811.
  43. Nakibuuka J, Sajatovic M, Katabira E, Ddumba E, Byakika-Tusiime J, Furlan AJ (2014) Knowledge and perception of stroke: A population-based survey in Uganda. *ISRN Stroke*. 2014:10.1155/2014/309106.
  44. Bhat V, Gs T, Kasthuri A (2021) Stroke awareness among elderly hypertensive patients in a rural area of Bangalore district India. *Journal of Stroke and Cardiovascular Diseases*. 30 (1): 105467. doi: 10.1016/j.jstrokecerebrovasdis.2020.105467
  45. Houessou M, Hountada H, Yahouedeou B, Choki B, Kossi O, Adoukonou T (2021) Knowledge of stroke risk factors and signs in Paraku, a northern city of Benin in West Africa. *Cerebrovascular Disorders*. 50 (1): 88-93. doi: 10.1159/000512715
  46. Dar NZ, Khan SA, Ahmad A, Maqsood S (2019) Awareness of stroke and health-seeking practices among hypertensive patients in a Tertiary Care Hospital: A cross-sectional survey. *Cureus*. 11 (5): e4774. doi: 10.7759/cureus.4774

47. Adusumilli D, Syed S (2018) Community stroke awareness: Knowledge, attitude, and health seeking behavior of adults in an urban slum of Hyderabad, India. *International Journal of Medical Sciences and Public Health*. 7 (10): 848-853. doi: 10.5455/ijmsph.20180720313072018
48. Kayode-Iyasere E, Odiase FE (2019) Awareness of stroke, its warning signs, and risk factors in the community: A study from the urban population of Benin City, Nigeria. *Sahel Medical Journal*. 22 (3): 134-139. doi: 10.4103/smj.smj\_4\_18
49. Liang J, Luo C, Ke S, Tung T-H (2023) Stroke related knowledge, prevention practices and associated factors among stroke patients in Tiazhou, China. *Preventive Medicine Reports*. 35: 102340. doi: 10.1016/j.pmedr.2023.102340
50. Abdalla SM, Mohamed EY, Elsabagh HM (2020) Stroke prevention and risk factors, knowledge within Saudi population. *Ethics, Medicine and Public Health*. 20: 100736. doi: 10.1016/j.jemep.2021.100736
51. Hu J, Zheng X, Shi G, Guo L (2020) Association of multiple chronic diseases and depressive symptoms with stroke among Chinese middle aged and elderly adults: a nationwide population-based cohort study. *BMC Geriatrics*. 22 (1): 660. doi: 10.1186/s12877-022-03329-4
52. Wafa HA, Wolfe C, Rudd A, Wang Y (2018) Long-term trends in incidence and risk factors for ischemic stroke subtypes: prospective population study of the South London stroke register. *PLoS Medicine*. 15 (10): e1002669. doi: 10.1371/journal.pmed.1002669
53. Sanya EO, Desalu OO, Adepoju F, Aderibigbe SA, Shittu A, Olaosebikan O (2015) Prevalence of stroke in three semi-urban communities in middle-belt region of Nigeria: a door-to-door survey. *Pan African Medical Journal*. 20: 33. doi: 10.11604/pamj.2015.20.33.4594
54. Magwood GS, Nichols M, Jenkins C, Logan A, Qunango S, Zigbuo-Wenzler E, Ellis Jr C (2020) Community-based interventions for stroke provided by nurses and community health workers: A review of the literature. *Journal of Neuroscience Nursing*. 52 (4): 152-159. doi: 10.1097/JNN.0000000000000512
55. Norwrin I, Mahareen J, Bhattacharya DS, Saif-Ur-Rahman KM (2023) Community-based interventions to prevent stroke in low and middle-income countries: A systematic review. *Health Sciences Review*. 9: 100123. doi: 10.1016/j.hsr.2023.100123
56. Getu RA, Aga F, Badada T, Workie SG, Belew MA, Mekonnen RNK (2023) Knowledge of stroke risk factors and warning symptoms among adults with type 2 diabetes in Addis Ababa, Ethiopia, 2021: An institution based cross sectional study. *BMC Cardiovascular Disorders*. 23 (1): 21. doi: 10.1186/s12872-022-03031-8
57. Krzystanek E, Krzak-Kubica A, Swiat M, Galus W, Gawryluk J (2020) Adequate knowledge of stroke symptoms, risk factors and necessary actions in the general population of southern Poland. *Brain Sciences*. 10 (12): 1009. doi: 10.3390/brainsci10121009
58. Ramadan A, Kharaba Z, Ghemrawi R, Elnour AA, Hussain N, Kouhgard P, Al-Dammok N, Hait SA, AL-Ghanem L, Attassi R, Sobeh RL, Al-Meslamani AZ (2023) Assessment of knowledge and attitude towards stroke among the UAE population during the COVID-19 pandemic: A cross-sectional study. *F1000Research*. 12: 322. doi: 10.12688/f1000research.129873.2
59. Alhowaymel FM, Abdelmalik MA, Mohammed AM, Mohamaed MO, Alenezi A (2023) Knowledge, attitudes, and practices of hypertensive patients towards stroke prevention among rural population in Saudi Arabia: A cross-sectional study. *SAGE Open Nursing*. 9. 23779608221150717. doi: 10.1177/23779608221150717
60. Howard G, McClure LA, Moy CS, Howard VJ, Judd SE, Yuan Y, Long DL, Muntner P, Safford MM, Kleindorfer DO (2017) Self-reported stroke risk stratification: Reasons for geographic and racial differences in stroke study. *Stroke*. 48 (7): 1737-1743. doi: 10.1161/STROKEAHA.117.016757
61. Dharma KK, Parellangi (2020) Use of mobile-stroke risk scale and lifestyle guidance promote healthy lifestyles and decrease stroke risk factors. *International Journal of Nursing Sciences*. 7 (4): 401-407. doi: 10.1016/j.ijnss.2020.08.001
62. Wahab KW, Kayode OO, Musa OI (2015) Knowledge of stroke risk factors among Nigerians at high risk. *Journal of Stroke Cerebrovascular Disease*. 24 (1): 125-129. doi: 10.1016/j.jstrokecerebrovasdis.2014.07.053
63. Workina A, Kebede S, Fekadu C, Wubetie Snr A (2021) Knowledge of risk factors and warning signs of stroke among patients with heart disease at Tikur Anbessa specialized hospital. *Open Access Emergency Medicine*. 13: 57-66. doi: 10.2147/OAEM.S291648
64. Alkali HN, Chiroma AA, Tinja RM, Garba M, Dunga JA, Saidu A, Misau YA, Mohammed A, Jibrin YB, Umar MS, Dachi RA, Saad FK (2022) Stroke-related knowledge and attitudes among university students in Northeast Nigeria. *Annals of African Medical Research*. 5: 163. doi: 10.4081/aamr.2022.163
65. Itzhaki M, Melnikov S, Koton S (2016) Gender differences in feelings and knowledge about stroke. *Journal of Clinical Nursing*. 25 (19-20): 2958-2966. doi: 10.1111/jocn.13366
66. Andersen KK, Olsen TS (2018) Stroke case-fatality and marital status. *Acta Neurologica Scandinavica*. 138 (4): 377-383. doi: 10.1111/ane.12975



67. Honjo K, Iso H, Ikeda A, Inoue M, Sawada N, Tsugane S, JPHC Study Group (2016) Marital transition and risk of stroke: How living arrangement and employment status modify associations? *Stroke*. 47 (4): 991-998. doi: 10.1161/STROKEAHA.115.011926
68. Asaba E, Bergstrom A, Patomella AH, Guidetti S (2022) Engaging occupations among persons at risk for stroke: A health paradox. *Scandinavian Journal of Occupational Therapy*. 29 (2): 116-125. doi: 10.1080/11038128.2020.1829036
69. Huynh TB, McClure LA, Howard VJ, Stafford MM, Judd SE, Burstyn I (2023) Duration of employment within occupations and incident stroke in a US general population cohort 45 years of age or older (REGARDS study). *American Journal of Industrial Medicine*. 66 (2): 142-154. doi: 10.1002/ajim.23446
70. Tertziaff J, Geyer S, Tertziaff F, Epping J (2020) Income inequalities in stroke incidence and mortality: Trends in stroke-free and stroke-affected life years based on German health insurance data. *PLoS One*. 15 (1): e0227541. doi: 10.1371/journal.pone.0227541
71. Yousufuddin M, Young N (2019) Aging and ischemic stroke. *Aging*. 11 (9): 2542-2544. doi: 10.18632/aging.101931
72. Pourasgari M, Mohamadkhani A (2020) Heritability for stroke: Essential for taking family history. *Caspian Journal of Internal Medicine*. 11 (3): 237-243. doi: 10.22088/cjim.11.3.237
73. Blaz M, Sarzynska-Dlugosz I (2023) Family history of stroke - a useful clue for the primary care physician and stroke neurologist: A narrative review. *Postepy Psychiatrii Neurologii*. 32 (1): 31-39. doi: 10.5114/ppn.2023.126482
74. Kengne AP, Mayosi BM (2018) Modifiable stroke risk factors in Africa: Lessons from SIREN. *The Lancet Global Health*. 6: e363-e364. doi: 10.1016/S2214-109X(18)30030-5
75. Jamiu MO, Maiha BB, Danjuma NM, Giwa A (2024) Educational intervention on knowledge of hypertension and lifestyle/dietary modification among hypertensive patients attending a tertiary health facility in Nigeria. *Mediterranean Journal of Pharmacy and Pharmaceutical Sciences*. 4 (1): 1-11. doi: 10.5281/zenodo.10535778
76. Wang X, Huang Y, Chen Y, Yang T, Su W, Chen X, Yan F, Han L, Ma Y (2022) The relationship between body mass index and stroke: a systematic review and meta-analysis. *Journal of Neurology*. 269 (12): 6279-6289. doi: 10.1007/s00415-022-11318-1
77. Horn JW, Feng T, Morkedal B, Aune D, Strand LB, Horn J, Mukamal KJ, Janszky I (2023) Body mass index over 42 years as a risk factor for ischaemic stroke: The HUNT study. *Nutrients*. 15 (5): 1232. doi: 10.3390/nu15051232
78. Susts J, Reinholdsson M, Sunnerhagen K, Abzhandadze T (2023) Physical inactivity before stroke is associated with dependency in basic activities of daily living 3 months after stroke. *Frontiers in Neurology*. 14: 1094232. doi: 10.3389/fneur.2023.1094232
79. Mosenzon O, Cheng AY, Rabinstein AA, Sacco S (2023) Diabetes and stroke: What are the connections? *JOS Journal Stroke*. 25 (1): 26-38. doi: 10.5853/jos.2022.02306
80. Elmiladi SA, Elgdhafi EO (2023) Prevalence of cardiovascular risk factors in Libyan patients with type 2 diabetes mellitus, 2013-2022. 3 (2): 27-33. *Mediterranean Journal of Pharmacy and Pharmaceutical Sciences*. doi: 10.5281/zenodo.7877416
81. Pan B, Jin X, Jun L, Qiu S, Zheng Q, Pan M (2019) The relationship between smoking and stroke: A meta-analysis. *Medicine (Baltimore)*. 98 (12): e14872. doi: 10.1097/MD.00000000000014872
82. Adebimpe WO (2018) Knowledge and risk factors for stroke among undergraduates in Southwestern Nigeria. *Marshall Journal of Medicine*. 4 (3): 4. doi: 10.33470/2379-9536.1175
83. Ehidiamen OF, Ehinwenma OJ (2018) Awareness of stroke risk factors and warning symptoms amongst hypertensive patients in Benin City. *Annals of Medical Health Sciences Research*. 8 (1): 40-44. Corpus ID: 42193703.
84. Okonkwo UP, Uzuh FN, Nwankwo MJ, Okoye EC, Ummuna JO, Igwe ES, Maduagwu SM, Ani KU, Akobundu UN, Nwanne CA (2021) Awareness of the risk factors of stroke among non-teaching staff of the Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria. *Bulletin of Faculty of Physical Therapy*. 26: 37. doi: 10.1186/s43161-021-00057-5

**Acknowledgments:** The author would like to thank all the participants for their involvement in the study.

**Conflict of interest:** The author declares the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

**Ethical issues:** Including plagiarism, informed consent, data fabrication or falsification, and double publication or submission were completely observed by the author.

**Data availability statement:** The raw data that support the findings of this article are available from the author upon request.

**Author declarations:** The author confirms that they have followed all relevant ethical guidelines and obtained any necessary IRB and/or ethics committee approvals.