Original Article

Prevalence of stroke and associated risk factors among elderly patients in a primary care setting: A retrospective cohort study

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Abstract

Background: Stroke is a major health concern worldwide, with significant morbidity and mortality. This study aims to retrospectively analyze the prevalence and risk factors associated with stroke in a primary care setting in Riyadh, Saudi Arabia. **Methods:** A retrospective cohort study was conducted at the Family Medicine and Polyclinics, King Faisal Specialist Hospital and Research Centre in Riyadh. Data were collected from patients aged 50 years and older who visited the clinic between January 1, 2021, and December 31, 2022. Stroke diagnoses were determined using ICD-10 codes, and data on demographic variables and stroke risk factors were extracted from medical records. Statistical analyses included Chi-square or Fisher's Exact tests, Mann–Whitney U test, and logistic regression analysis. **Results:** Out of 2034 patients, 36 (1.8%) were diagnosed with stroke, predominantly ischemic (91.7%). Significant correlations with stroke occurrence included advanced age, male gender, family history of stroke, and comorbidities such as hypertension, transient ischemic attack, ischemic heart disease, brain aneurysm, and carotid artery disease. Multivariable analysis identified older age (≥80 years, OR = 8.949, $P = 0.013$), male gender (OR = 5.980, $P = 0.010$), underweight status (OR = 50.873, $P = 0.005$), family history of stroke (OR = 12.603, $P = 0.040$), and hypertension (OR = 7.984, $P = 0.009$) as significant risk factors for stroke. **Conclusion:** Stroke prevalence in the sampled population was 18 per 100,000 individuals, with advanced age, male gender, and hypertension identified as significant risk factors. These findings highlight the need for targeted preventive strategies and further prospective research to establish causal relationships and improve stroke management in Saudi Arabia.

Keywords: Cardiac outcomes, hypertension, ischemic stroke, primary care, retrospective study, Saudi Arabia, stroke, stroke prevalence

Introduction

A stroke occurs when blood flow to a part of the brain is disrupted or decreased, depriving brain tissue of oxygen and nutrients. This causes brain cells to begin dying within minutes, making immediate medical attention crucial. Without quick treatment, strokes can lead to long-term disabilities affecting speech, movement, and other vital functions.[1,2]

Recent statistics from the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) indicate that stroke remains a major health issue. In 2019, stroke was the second-ranked source of mortality, responsible for 11.6% of all mortalities, and the third-ranked source of mortality and morbidity combined, accounting for 5.7% of total disability-adjusted life-years (DALYs). The study estimated that there were 12.2 million new cases of stroke, 101 million people living with

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Received: 11-09-2024 **Revised:** 16-10-2024
Accepted: 26-10-2024 **Published:** 21-02-2025

Access this article online

Quick Response Code:

Website: http://journals.lww.com/JFMPC

DOI: 10.4103/jfmpc.jfmpc_1569_24

How to cite this article: Alabduljabbar K, Elabd K, Alsaif A, Basudan L. Prevalence of stroke and associated risk factors among elderly patients in a primary care setting: A retrospective cohort study. J Family Med Prim Care 2025;14:749-56.

stroke, and 143 million DALYs due to stroke. Additionally, there were 6.55 million deaths attributed to stroke. These numbers have significantly increased from 1990 to 2019, underscoring the growing healthcare challenge. Notably, age-standardized stroke-related death and DALY rates were approximately 3.6-folds greater in low-income countries contrasted to high-income counterparts.[3]

Strokes are classified into two primary types: ischemic and hemorrhagic. Hemorrhagic strokes are subdivided into intracerebral and subarachnoid hemorrhage. Ischemic strokes arise from reduced blood flow and oxygen to the brain, commonly caused by arterial blockages or narrowing. Conversely, hemorrhagic strokes occur due to brain bleeding from ruptured or leaky vessels.[1,2] Epidemiologically, the 2019 GBD study estimated that ischemic strokes contributed to 62.4% of all new stroke cases, with approximately 7.63 million incidents. Intracerebral hemorrhages made up 27.9% of the cases, amounting to around 3.41 million incidents, while subarachnoid hemorrhages constituted 9.7% of the cases, with an estimated 1.18 million incidents.[3]

Stroke predisposing factors can be segregated into two categories: those that can be changed (modifiable) and those that cannot (nonmodifiable). Nonmodifiable risk factors for both ischemic and hemorrhagic stroke include advanced age, male gender, and black ethnicity/race. Modifiable risk factors, on the other hand, commonly reported in studies, include hypertension, smoking, suboptimal diet, obesity, and lack of physical activity.[4,5] According to the 2019 GBD study, the top five risk factors associated with stroke were high systolic blood pressure, obesity, elevated fasting plasma glucose levels, airborne particulate matter pollution, and smoking.[3]

The Kingdom of Saudi Arabia faces a significant challenge as stroke emerges with increasing severity and potentially higher mortality rates.[6] A recent pooled analysis of five studies revealed that the collective yearly incidence of stroke in Saudi Arabia is 0.029%, translating to 29 strokes per 100,000 people annually (95% confidence interval: 15 to 47).[7] Saudi Arabia, a large Middle Eastern country, comprises more than 150 major cities and has a population of nearly 36 million people in 2023. Global research suggests that different cities exhibit varying prevalence rates and risk factors for stroke.[8-10] However, comprehensive research on the incidence, prevalence, and socio-demographic characteristics of stroke in Saudi Arabia remains inadequate due to a shortage of suitable investigations. Such research is crucial for enhancing the existing literature, enabling comprehensive national insights, and facilitating international comparisons. Most studies conducted in Saudi Arabia have focused on patients who already had strokes, rather than examining the influence of risk factors among patients both with and without these factors.[11-16]

This research aims to retrospectively report the prevalence and risk factors of stroke among patients sampled from Riyadh, the capital city of Saudi Arabia. To the best of our knowledge, no previous research of this nature has been conducted.

Methods

We carried out a retrospective cohort investigation with the primary objective of determining the occurrence and risk factors associated with stroke in our sampled population. The study was conducted at the Department of Family Medicine and Polyclinics, King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia. Instead of performing a formal sample size calculation, we included all consecutive patients who visited the clinic and met the inclusion criteria between January 1st, 2021, and December 31st, 2022. This approach aimed to encompass the entire accessible population, maximizing both sample size and representativeness. The key inclusion criteria were patients aged 50 years or older with complete data. The Research Ethics Committee (REC) at King Faisal Specialist Hospital and Research Centre has reviewed and approved the research protocol (identifier: 2191290).

The sampled population was divided into two groups: patients diagnosed with stroke and those without stroke. Stroke diagnoses were established according to specific International Classification of Diseases, Revision 10 (ICD-10) codes: I60 for nontraumatic subarachnoid hemorrhage, I61 for nontraumatic intracerebral hemorrhage, and I63 for cerebral infarction (ischemic stroke). All diagnoses relied on physician assessment, clinical findings, and imaging reports, supplemented by patient self-reported information when reliable. Patients initially diagnosed with unspecified stroke (ICD-10 code I62) underwent further scrutiny by a specialist coder to ensure accurate coding based on imaging scan findings, or consultation with the attending family medicine physician, radiologist, and/or neurologist. Patients diagnosed with transient cerebral ischemic attacks (ICD-10 code G45) were not classified as stroke patients in our study.

A predefined data gathering form was employed to collect information from the medical charts. This form encompassed the following data: patient socio-demographic data (age, sex, nationality, body mass index, and marital status, family history of stroke), stroke category (ischemic or hemorrhagic), and a comprehensive panel of stroke modifiable risk factors (smoking, diabetes mellitus, hypertension, transient ischemic attack, hyperlipidemia, atrial fibrillation, cardiomyopathy, peripheral artery disease, brain aneurysm, carotid artery disease, coagulation disorders, and sickle cell disease). The diagnoses of each of the aforementioned stroke risk factors were established through a combination of physical examinations, laboratory tests, imaging studies, documented ICD-10 codes, and patient self-reported history.

All statistical analyses were performed using STATA software, version 18, for Windows. Descriptive data were summarized using numbers and percentages and analyzed with Chi-square

or Fisher's Exact tests, as appropriate. The Shapiro-Wilk test was used to assess the normality of continuous data. Numerical data were summarized using medians and interquartile ranges (IQR) and analyzed with the Mann–Whitney U test. Univariate and multivariable logistic regression analyses were employed to examine the relationship between patient demographics and the odds of stroke occurring. A *P* value of less than 0.05 was considered statistically significant for all analyses.

Results

Table 1 summarizes the demographics of the included cohort. In total, 2034 patients participated in the study. The majority were female (52.3%), with a median age of 60 years (IQR: 55–66). Additionally, 16.3% of the respondents were smokers, and 43.4% were with obesity. Regarding chronic diseases, 51.2% were diabetic, 50.2% were hypertensive, and 47.6% had hyperlipidemia. Only 36 patients (1.8%) had a diagnosis of stroke, of which 33 cases (91.7%) were ischemic and 3 cases (8.3%) were hemorrhagic [Figure 1].

Table 2 summarizes the correlations between stroke and patient demographics. Stroke patients were older than their non-stroke counterparts (median age 72 vs. 60 years, $P < 0.001$) and stroke was more likely to occur in males compared to females ($P = 0.001$). A family history of stroke and several comorbidities (e.g., hypertension, transient ischemic attack, ischemic heart disease, brain aneurysm, and carotid artery disease) were significantly correlated with the occurrence of stroke ($P < 0.05$). The BMI (median: 28.05 vs. 29 kg/m^2, $P = 0.261$) and the coexisting morbidity of hyperlipidemia (58.33% vs. 47.45%, $P = 0.195$) did not show a significant difference between stroke and non-stroke patients. Although diabetes mellitus was more prevalent in stroke patients than in non-stroke patients (66.67% vs. 50.95%), the difference was not statistically significant ($P = 0.062$).

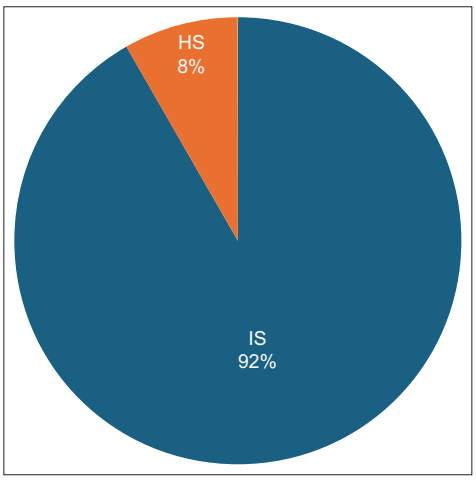

Figure 1: Proportion of stroke subtypes. IS: Ischemic stroke; HS: Hemorrhagic stroke

Table 3 summarizes the logistic regression analyses to examine the direction and magnitude of the relationship between patient demographics and the odds of stroke occurring. The univariate analysis identified several significant risk factors for stroke. Age showed a strong correlation, with those aged 60–69 having an odds ratio (OR) of 2.934 ($P = 0.05$), increasing to 6.434 for ages 70–79 ($P = 0.001$), and reaching 19.321 for those aged 80 and above ($P < 0.0001$). Male gender was also a significant risk factor (OR = 3.350, $P = 0.002$). Other significant factors included being underweight (OR = 17.85,

Table 1: The demographics of the included cohort

Demographics	*n* (%)
Age in years, median (IQR)	60 (55–66)
Age in years	
50–59	963 (47.4)
60–69	663 (32.6)
70–79	277 (13.6)
≥80	131 (6.4)
Gender	
Female	1063 (52.3)
Male	971 (47.7)
Nationality	
Non-Saudi	420 (20.6)
Saudi	1614 (79.4)
Marital status	
Married	1735 (85.5)
Single	180 (8.9)
Divorced	43 (2.1)
Widowed	72 (3.5)
Smoking	
Smoker	331 (16.3)
Ex-smoker	147 (7.2)
Non-smoker	1556 (76.5)
BMI in kg/m^2, median (IQR)	29 (25.8–33)
BMI in kg/m^2	
Underweight	15 (0.7)
Normal weight	362 (17.8)
Overweight	775 (38.1)
Obese	882 (43.4)
Stroke type	
Ischemic	33 (91.7)
Hemorrhagic	3 (8.3)
Morbidities	
Family history of stroke	6 (0.5)
Hypertension	1020 (50.2)
Diabetes mellitus	1042 (51.2)
Transient ischemic attack	15 (0.7)
Hyperlipidemia	969 (47.6)
Atrial fibrillation	33 (1.6)
Cardiomyopathy	14 (0.7)
Ischemic heart disease	140 (6.9)
Peripheral artery disease	4 (0.2)
Brain aneurysm	2 (0.1)
Carotid artery disease	9 (0.4)
Coagulation disorders	16 (0.8)
Sickle cell disease	5 (0.2)

BMI: body mass index; IQR: interquartile range

Table 2: Correlations between stroke and patient demographics

Variables	Stroke		*P*
	No (*n*=1998)	Yes (*n*=36)	
Age in years, median (IQR)	60 (55–67)	72 (65–83)	<0.001
Age in years			<0.001
50–59	958 (47.95)	5 (13.89)	
60–69	653 (32.68)	10 (27.78)	
70–79	268 (13.41)	9 (25)	
≥80	119 (5.96)	12 (33.33)	
Gender			0.001
Female	1054 (52.75)	9 (25)	
Male	944 (47.25)	27 (75)	
Nationality			0.001*
Non-Saudi	420 (21.02)	0 (0)	
Saudi	1578 (78.98)	36 (100)	
Marital status			0.809*
Married	1704 (85.45)	31 (86.11)	
Single	177 (8.88)	3 (8.33)	
Divorced	43 (2.16)	0 (0)	
Widowed	70 (3.51)	2 (5.56)	
Smoking			0.059
Smoker	328 (16.42)	3 (8.33)	
Ex-smoker	141 (7.06)	6 (16.67)	
Non-smoker	1529 (76.53)	27 (75)	
BMI in kg/m^2, median (IQR)	29 (25.8–33)	28.05 (25.11–31.2)	0.261
BMI in kg/m^2			0.005*
Underweight	12 (0.6)	3 (8.33)	
Normal weight	357 (17.87)	5 (13.89)	
Overweight	760 (38.04)	15 (41.67)	
Obese	869 (43.49)	13 (36.11)	
Family history of stroke			0.004*
No	1994 (99.8)	34 (94.44)	
Yes	4 (0.2)	2 (5.56)	
Hypertension			<0.001*
No	1010 (50.55)	4 (11.11)	
Yes	988 (49.45)	32 (88.89)	
Diabetes mellitus			0.062
No	980 (49.05)	12 (33.33)	
Yes	1018 (50.95)	24 (66.67)	
Transient ischemic attack			0.028*
No	1985 (99.35)	34 (94.44)	
Yes	13 (0.65)	2 (5.56)	
Hyperlipidemia			0.195
No	1050 (52.55)	15 (41.67)	
Yes	948 (47.45)	21 (58.33)	
Atrial fibrillation			0.448*
No	1966 (98.4)	35 (97.22)	
Yes	32 (1.6)	1 (2.78)	
Cardiomyopathy			0.222
No	1985 (99.35)	35 (97.22)	
Yes	13 (0.65)	1 (2.78)	
Ischemic heart disease			0.003
No	1865 (93.34)	29 (80.56)	
Yes	133 (6.66)	7 (19.44)	
Peripheral artery disease			1
No	1994 (66.8)	36 (100)	
Yes	4 (0.2)	0 (0)	
Brain aneurysm			0.035*
No	1997 (99.95)	35 (97.22)	
Yes	1 (0.05)	1 (2.78)	
Carotid artery disease			0.010*
No	1991 (99.65)	34 (94.44)	
Yes	7 (0.35)	2 (5.56)	
Coagulation disorders			0.249
No	1983 (99.25)	35 (97.22)	
Yes	15 (0.75)	1 (2.78)	
Sickle cell disease			1*
No	1993 (99.75)	36 (100)	
Yes	5 (0.25)	0 (0)	

BMI: Body mass index; IQR: Interquartile range. *For categorical variables, *P* value was calculated according to Fischer's exact test; otherwise, Chi-square test was used.

$P < 0.0001$), having a family history of stroke (OR = 29.324, $P < 0.0001$), hypertension (OR = 8.178, $P < 0.0001$), transient ischemic attack (OR = 8.982, $P = 0.005$), ischemic heart disease (OR = 3.385, $P = 0.005$), brain aneurysm (OR = 57.057, $P = 0.005$), and carotid artery disease (OR = 16.731, $P = 0.001$). The multivariable analysis identified several significant risk factors for stroke. Older age category (≥80 years, OR = 8.949, $P = 0.013$), male gender (OR = 5.980, $P = 0.010$), and underweight (OR = 50.873, $P = 0.005$) remained significant risk factors for stroke. Having a family history of stroke (OR = 12.603, $P = 0.040$) and hypertension (OR = 7.984, $P = 0.009$) also showed significant associations with stroke occurrence. Other variables did not show statistically significant associations with stroke in the multivariable analysis.

Discussion

This study aimed to retrospectively report on the prevalence and risk factors of stroke among patients aged 50 years and older in Riyadh, the capital city of Saudi Arabia. A total of 2034 patients were analyzed, among whom 36 (1.8%) were diagnosed with stroke, with ischemic stroke being the most common type (33 out of 36 cases, 91.7%). The study identified several correlations between stroke occurrence and specific demographics, including advanced age, male gender, family history of stroke, and coexisting hypertension. These factors remained significant risk factors for stroke in the multivariable analysis. Interestingly, obesity, smoking, hyperlipidemia, and diabetes mellitus did not show statistically significant correlations with stroke occurrence.

The prevalence of stroke in our study was 18 strokes per 100,000 individuals per year. This figure aligns fairly with published single-center studies from various cities in Saudi Arabia reporting prevalence rates of 15.1,[15] 29.8,[17] and 43.8[12] cases per 100,000 people. Furthermore, our findings are relatively consistent with a recent meta-analysis of five individual cohort studies, which reported a prevalence of 29 cases per 100,000 people in Saudi

Table 3: Logistic regression analyses to examine the relationship between patient demographics and the odds of stroke occurring

Variable	Univariate analysis				Multivariate analysis			
	OR	LL 95% CI	UL 95% CI	*P*	OR	LL 95% CI	UL 95% CI	*P*
Age in years (category)								
50–59		Reference				Reference		
60–69	2.934	0.998	8.624	0.05	2.170	0.481	9.801	0.314
70–79	6.434	2.138	19.360	0.001	3.138	0.584	16.866	0.183
≥80	19.321	6.690	55.797	<0.0001	8.949	1.581	50.650	0.013
Gender								
Female		Reference				Reference		
Male	3.350	1.567	7.159	0.002	5.980	1.528	23.402	0.010
Marital status								
Married		Reference				Reference		
Single	0.932	0.282	3.078	0.908	1.542	0.250	9.502	0.640
Divorced	1.000				1.000			
Widowed	1.571	0.368	6.694	0.542	1.000			
Smoking								
Non-smoker		Reference				Reference		
Smoker	0.518	0.156	1.718	0.282	0.282	0.033	2.434	0.250
Ex-smoker	2.409	0.979	5.935	0.056	0.489	0.089	2.694	0.411
BMI in kg/m^2 (category)								
Underweight	17.85	3.817	83.481	<0.0001	50.873	3.289	786.892	0.005
Normal weight		Reference				Reference		
Overweight	1.409	0.508	3.908	0.510	1.558	0.399	6.081	0.523
Obese	1.068	0.378	3.018	0.901	1.666	0.406	6.832	0.479
Family history of stroke	29.324	5.194	165.552	<0.0001	12.603	1.117	142.222	0.040
Hypertension	8.178	2.882	23.210	<0.0001	7.984	1.685	37.832	0.009
Diabetes mellitus	1.925	0.958	3.871	0.066	0.692	0.241	1.989	0.495
Transient ischemic attack	8.982	1.951	41.348	0.005	0.287	0.000	195.126	0.707
Hyperlipidemia	1.551	0.795	3.025	0.198	0.769	0.280	2.114	0.610
Atrial fibrillation	1.755	0.233	13.209	0.585	5.100	0.455	57.101	0.186
Cardiomyopathy	4.363	0.555	34.271	0.161	1.000			
Ischemic heart disease	3.385	1.456	7.871	0.005	1.594	0.398	6.392	0.510
Brain aneurysm	57.057	3.498	930.697	0.005	65.705	0.088	49292.92	0.215
Carotid artery disease	16.731	3.352	83.503	0.001	6.359	0.545	74.124	0.140
Coagulation disorders	3.777	0.485	29.389	0.204	1.000			

BMI: Body mass index; CI: Confidence interval; LL: Lower limit; OR: Odds ratio; UL: Upper limit

Arabia.[7] It is crucial to recognize that regional and temporal factors within Saudi Arabia, such as demographic changes, advancements in healthcare, and variations in risk factors among populations, can contribute to the disparities in prevalence rates.[18] On the other hand, the 2019 GBD study estimates a prevalence of 158 to 175.8 cases per 100,000 people in Saudi Arabia.[3] This notable discrepancy in stroke prevalence figure can be attributed to variations in study populations, methodologies, and definitions of stroke. Differences in healthcare access, diagnostic criteria, and reporting practices also play significant roles in the variability of prevalence rates. Most importantly, the prevalence figure was derived at a broader national level across Saudi Arabia, rather than being limited to a single-center hospital and specific age group (≥50 years) as in our study. All in all, standardizing approaches and implementing rigorous data collection methods are crucial steps towards improving the accuracy and comparability of stroke prevalence data across various studies and regions in Saudi Arabia.

Stroke risk factors can be clustered into two groups: modifiable and nonmodifiable. Nonmodifiable risk factors include advanced age, male gender, and Black African ethnicity.[4,5] The first two were identified in our study and are consistent with the 2019 GBD findings.[3] Stroke, to a larger degree, is a disease of ageing (>65 years). In fact, advanced age is the most substantial nonmodifiable predisposing factor for ischemic stroke, with older stroke patients experiencing higher death and morbidity rates, as well as poorer functional recovery compared to younger individuals.[19] There are two primary reasons that could explain why stroke rates are higher in males. First, neurovascular risk factors, such as cigarette smoking, are more prevalent and severe among males compared to females.[20] Second, variations in sex steroid hormones contribute; estrogen in females exerts strong vasodilatory effects on blood vessels and improves circulation, while testosterone in males promotes vasoconstriction and diminishes blood flow.[21] Regarding ethnicity, in Saudi Arabia, nearly all Saudi and non-Saudi citizens are of Arab descent.

Emerging evidence indicates that individuals of Black ethnicity exhibit an increased odd of developing stroke contrasted to those of White ethnicity.[22,23]

High blood pressure, smoking, suboptimal diet, and obesity are among the primary modifiable predisposing factors for stroke documented in the literature.[4,5] According to the 2019 GBD study, the five most prevalent risk factors in descending order were hypertension, obesity, diabetes mellitus, airborne pollution, and smoking.[3] In our study, the statistically significant risk factor associated with stroke was hypertension, with an alarming prevalence of nearly 50% among our sampled individuals. A recent pooled analysis of 29 studies, involving close to 280,000 individuals, reported a collective frequency of hypertension at 22.7% with 95% CI ranging from 18.95 to 26.60 in Saudi Arabia.[24] Indeed, hypertension stands as the foremost modifiable predisposing factor for stroke, characterized by a robust, direct, and linear correlation between systolic blood pressure levels and stroke hazard.[25] Additionally, the prevalence rates of hyperlipidemia and diabetes mellitus were high, each affecting nearly 50% of our sampled research subjects. Higher low-density lipoprotein cholesterol and total cholesterol levels are linked to an amplified hazard of ischemic stroke, while elevated high-density lipoprotein cholesterol levels are connected to a decreased (protective) risk of ischemic stroke.[26] Diabetes is a well-acknowledged predisposing factor for stroke, associating with a 1.5 to 2 times greater likelihood of stroke compared to individuals without the condition.[27] More than 80% of our sampled population were classified as overweight or obese. The specific mechanisms by which overweight and obesity increase stroke risk are still under debate. However, a pooled analysis involving 1.8 million research subjects from nearly 100 cohort investigations yielded that 76% of the impact of BMI on stroke hazard is facilitated by blood pressure as well as glucose and lipid concentrations.[28] The prevalence rate of smoking in our study was low at roughly 12%. It has been estimated that 25% of stroke cases can be attributed to smoking, and smoking independently increases the risk of stroke by threefold.[29] In our analysis, surprisingly, hyperlipidemia, diabetes mellitus, obesity, and smoking did not emerge as significant risk factors for stroke. This outcome can likely be attributed to statistical concerns stemming from the small number of patients with stroke compared to those without stroke.

While stroke risk factors are largely similar worldwide,[3-5] it is yet important to recognize that they can vary significantly across populations due to diverse genetic backgrounds, environmental factors, and varying lifestyle habits. Therefore, understanding these factors within specific populations is crucial for developing precise preventive strategies and interventions. Systematic reviews conducted exclusively among Iranian and Chinese populations have underscored the significance of tailored approaches, demonstrating how specific genetic predispositions, coexisting comorbidities, environmental exposures, lifestyle habits, and cultural practices can impact stroke susceptibility and outcomes.[30-32] Similar research should be done in Saudi Arabia. By delving deeper into these nuances, researchers can advance our global understanding of stroke epidemiology and refine healthcare strategies that cater to the diverse needs of populations worldwide.

Al-Senani and colleagues developed an epidemiological model to forecast the incidence of first strokes in Saudi Arabia over a 10-year span.[6] The model projected a population growth of 12.8% during this period. The projected sum of first strokes was approximated to expand by 57% to 67%.[6] It can be assumed that Saudi Arabia anticipates a significant rise in the sum of first strokes in the next 10-year period. These findings advocate the necessity to expand stroke care services to maintain high-quality care and emphasize the importance of stroke prevention strategies in alleviating this increasing burden. Moreover, it is advisable to establish a nationwide stroke registry to monitor and enhance healthcare services for stroke survivors.

Our study has several strengths. Notably, we provide the first report on the frequency of stroke and its linked risk factors from King Faisal Specialist Hospital and Research Centre in the capital city of Riyadh, a major healthcare hub in the region and country. With a sample size exceeding 2000 participants, significantly larger than previous studies, we have increased confidence in our reported results. We conducted a comprehensive analysis of a wide range of stroke risk factors and assessed their independent effects using a robust multivariable regression model.

However, our study also has several limitations that warrant consideration. We did not perform a sample size calculation, which may have led to underpowered findings. The relatively small number of stroke patients in our sample could have introduced heterogeneity and impacted our ability to detect statistically significant and clinically meaningful differences. A key methodological limitation includes the lack of specifying the type of stroke in the analyses. Furthermore, as a retrospective study, our research is susceptible to selection bias in participant sampling, potential inaccuracies in data due to recall bias, and limitations in establishing causation, focusing instead on identifying associations between variables observed retrospectively. These limitations emphasize the importance of interpreting our findings cautiously. Future research should include prospective studies to validate our results and establish stronger causal relationships.

Future research could explore various avenues to enhance our understanding of stroke epidemiology and risk factors. Studies on larger, more diverse populations across Saudi Arabia could broaden insights into stroke prevalence and its regional variations. Further research might examine the frequency and risk factors of stroke, distinguishing between ischemic and hemorrhagic types. Investigating genetic predispositions and biomarkers could inform personalized prevention strategies. Longitudinal studies on lifestyle factors like diet, physical activity, and stress could reveal their long-term effects on stroke risk. Research

into emerging risk factors such as air pollution, sleep disorders, and mental health is also warranted. Comparative studies on healthcare interventions could help improve policies and clinical practices. Additionally, advancing technologies like artificial intelligence and wearable devices could enhance stroke prediction and early detection. Integrating these technologies into research could transform stroke prevention and management.

Conclusion

Stroke is a prevalent condition in our sampled population in Riyadh, with a prevalence rate of 18 per 100,000 individuals. Advanced age, male gender, and hypertension emerged as significant risk factors for stroke. Further well-controlled prospective research is essential to establish causal relationships between these risk factors and stroke. Both pharmacological and non-pharmacological interventions to mitigate stroke and reduce associated mortality are strongly warranted.

Ethics statement

Research Advisory Committee (RAC) at King Faisal Specialist Hospital and Research Centre issued approval 2191290. The research project was conducted by the ethical principles contained in the Declaration of Helsinki (2000), the WHO Operational Guidelines for Ethical Committees that review Biomedical research (2000), the International Ethical Guidelines for biomedical research involving human subjects (2002) and the policies of the Research Advisory Committee (RAC) at King Faisal Specialist Hospital and Research Centre, as well as the laws of the Kingdom of Saudi Arabia. This study proposes no additional interventions for patients. This study primarily collected data and no clinical interventions were done. This study poses no risk to patients; we consider the risk-benefit ratio very favorable. The information is entirely anonymous.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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