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# THE SAUDI POPULATION'S KNOWLEDGE AND AWARENESS OF THE WARNING SIGNS AND SYMPTOMS OF STROKE AMONG GENERAL POPULATION.

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**Abstract:**

**Background:** Stroke, or cerebrovascular accident (CVA), is a major public health problem as a leading cause of disability and death worldwide. Although stroke symptoms and risk factors are prevalent, many populations, such as Saudi Arabia, remain poorly aware of these. Time and better outcomes depend on recognizing the signs of a stroke. The objective of this study was to assess knowledge and stroke warning sign and symptom awareness among Saudi population.
**Methods:** In this cross-sectional study, we conducted a study using structured questionnaire by surveying Saudi adults aged 20 years and older from July to November 2024. With convenience sampling, 1,139 participants were recruited across various regions. We run data analysis using SPSS (version 25) with a confidence level of 95%.
**Results:** Participants were aged 35.5±10.8 years, and 57% were female, 92.4% were of Saudi nationality. On hearing of stroke, a majority had heard of its term (95.7%) but only 56.5% could give an alternative term. However, awareness of other vital risk factors was low; 85.9% recognized hypertension as a primary risk factor. High knowledge levels were observed only in only 26.1% of participants who were also classified as low knowledge about stroke in 36% of them. Stroke symptoms were known by, 73.4% recognized trouble speaking and 31% recognized continued left shoulder pain as symptom. Importantly, however, 43.1% of respondents were unaware of current treatment options though 90.2% agreed that stroke is a medical emergency.

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**Conclusion:** This study revealed how the Saudi population has a high level of awareness of the foundations of stroke. Most of participants understood the term 'stroke,' only 26.1% demonstrated high knowledge about its characteristics and risks. A majority answered key symptoms, such as sudden numbness and speech difficulties, correctly, but misconceptions about onset of symptoms and treatment awareness remain of concern Gaps in addressing these should improve timely intervention and potentially decrease stroke related morbidity and mortality in Saudi Arabia.

**Keywords**: Stroke, Knowledge, Awareness, Warning signs, Saudi.

## Introduction:

A stroke, or Cerebrovascular accident (CVA), is an abrupt cessation of blood supply to the brain resulting in a vascular lesion [1,2]. Interrupted blood supply can be due to either embolic or thrombotic incidents causing lasting damage to brain tissue from a shortage of oxygen supply [3,4]. It is a widespread illness that typically ends with fatalities or leaves survivors with severe, life-standing neurological impairments [5]. Stroke can be manifested as speech difficulties, loss of vision, limb weakness or numbness, or imbalance [6]. Statically speaking, stroke is the second most common cause of disability and death worldwide [7]. In 2019, there were 12.2 million incident strokes and 101 million prevalent strokes, according to the Global Burden of Disease (GBD) 2019 Stroke Collaborators [8]. A study conducted in Saudi Arabia showed that the prevalence of stroke is about 43.8 per 100,000 [9]. In 2023 in Saudi Arabia, a study was conducted to assess public awareness regarding warning signs and risk factors for stroke. A significant association was observed between the awareness scores for strokes and various demographic factors, including age, marital status, and residence region. In terms of symptoms, 26.7% of participants said that stroke symptoms appear gradually. Furthermore, 63.3% of respondents correctly identified numbness on a particular side of the body, 45.8% identified sudden dizziness, 44.8% connected sudden headache to stroke, and 73.4% correctly indicated trouble speaking as an indication of a stroke. Furthermore, 30.5% reported having a stiff neck, 31% reported having continuous left shoulder discomfort, and 32.3% reported experiencing vomiting as a possible stroke symptom [10]. In Riyadh, Saudi Arabia, a study conducted in 2020 found that the majority of participants (59.3%) could accurately identify five or more stroke risk factors. The most often reported symptoms of stroke were slurred speech, followed by abrupt weakness in the muscles of the face, arms, or legs, and abrupt tingling or lack of feeling on one side of the body (61.8, 54.5, and 53.8%, correspondingly) [11]. "Sudden impairment in communicating or comprehending speech" and "sudden loss of consciousness" were the most often reported warning symptoms, according to a study that was conducted in Saudi Arabia in 2023 (79.9% and 74.0%, respectively). Merely 1.5% of the subjects acknowledged every risk factor and every symptom, and 1.8% listed every potential stroke result [12]. So, we conducted this research because, in earlier researches, there was a variation in the sample size and final results, as well as because an insignificant number of researches related to our topic, particularly in Saudi Arabia. This article focuses on evaluating people's knowledge and awareness about stroke and its warning signs and symptoms in Saudi Arabia.

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Methodology**:**

**Study Design and Setting:**

This study is cross-sectional, based on a structured questionnaire. Conducted between July - November 2024 in the Kingdom of Saudi Arabia. The study's population consisted of Saudi adults over the age of 20, participants were recruited from people receiving the questionnaire.

**Inclusion and Exclusion Criteria:**

Inclusion criteria were made up of Saudi citizens, both male and female, beyond the age of 20 (≥ 20), residing in all provinces within the Kingdom of Saudi Arabia. The exclusion criteria were male and female individuals under the age of 20 (< 20).

**Sample size:**

The sample size was estimated using the Qualtrics calculator with a confidence level of 95%, a standard deviation of 0.5, and a margin of error of 5%. Resulting in a minimum sample size of 384. This estimation was conducted to ensure statistical reliability across various regions in Saudi Arabia.

**Method for data collection, instrument, and scoring system:**

Instruments

The primary instrument used for data collection in this study is a structured questionnaire. The questionnaire is adapted from relevant studies conducted in Saudi Arabia to ensure its relevance and accuracy [10,13]. It is divided into three main sections: **Demographic Data**: This section collects basic information about the participants, including gender, age, nationality, marital status, geographical region, education level, and employment status. These variables are crucial for analyzing the demographic influences on stroke awareness and knowledge. **Stroke Knowledge**: This section consists of questions designed to assess the participants' general knowledge about stroke. It includes questions on the definition of stroke, risk factors, symptoms, and prevention measures. The questions are formatted as multiple-choice, checkbox and yes/no to facilitate easy and quick responses. **Stroke Awareness**: This section focuses on the participants' awareness of stroke warning signs and symptoms. It includes questions about personal or familial experiences with stroke, high-risk groups, available treatments, and appropriate emergency responses.

Scoring system

The questionnaire utilizes a scoring system to quantify participants' knowledge and awareness levels. The maximum score was 36 and divided as follows: the original Bloom's cut of points, 80.0%-100.0%, 60.0%-79.0%, and 59.0%, the participants divided into three groups based on their scores. The scores are divided into two main categories: knowledge score and awareness score.

**Knowledge score**

The knowledge section consists of fifteen statements related to stroke. Each correct answer is awarded one point, while incorrect answers or "I don't know" responses receive zero points. The total knowledge score ranges from 0 to 25 points. Based on their scores, participants are categorized as follows: those with scores below 15 points (< 15) were classified as having a **low level of awareness**, those with a score between 15 and 19 points were classified as having a **medium level of awareness**, and those with scores above 19 points (> 19) were classified as having a **high level of awareness**.

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**Awareness score**

The awareness section includes nine questions related to stroke warning signs and symptoms. Similar to the knowledge section, each correct answer is awarded one point, and incorrect answers or "I don't know" responses receive zero points. The total awareness score ranges from 0 to 10 points. Participants are categorized based on their scores as follows: those with scores below 6 points (< 6) were classified as having a **low level of awareness**, those with a score between 6 and 8 points were classified as having a **medium level of awareness**, and those with scores above 8 points (> 8) were classified as having a **high level of awareness**.

**Pilot test**:

17 people were given the questionnaire and asked to complete it. This was done to assess the study's viability and the ease of use of the questionnaire. The pilot study's results were not included in the study's final analysis.

**Analyzes and entry method:**

The data were entered using a survey on a computer using Microsoft Excel for Windows. Subsequently, the data were transferred to the statistical software package SPSS (version 25). Statistical significance was accepted at a confidence level of 95%, with statistical significance defined as a p-value less than 0.05.

**Results:**

Table (1) displays various demographic parameters of the participants with a total number of (1139). Overall, participants have a mean age of 35.5 years; however, those less than 35 years old (31.4%) are outweighed by the 27.6% in the 36–50 age range, overrepresented in a demographic that should be more engaged in health related and stroke related discussions due to the increased risk with aging. The gender distribution is asymmetric amongst females 57%, which may signal implications for women health specifically. Our results indicate that almost a significant majority of participants (92.4%) are Saudi nationals, which may reflect culturally based perceptions and knowledge of stroke related information. Within the educational class, 62.6% of the participants have a bachelor's degree, which implies a substantial educational structure that could possibly be related to the awareness of and understanding of the health concerns. In addition, the internet is the main source of information (68.2%) which indicates the transition to virtual channels of health education.

***Table (1): Sociodemographic characteristics of participants (n=1139)***

| ***Parameter*** | | ***No.*** | ***Percent (%)*** |
|---|---|---|---|
| ***Age (Mean: 35.5, STD:13.9)*** | 21 or less | 147 | 12.9 |
| | 22 to 23 | 164 | 14.4 |
| | 24 to 26 | 163 | 14.3 |
| | 27 to 35 | 166 | 14.6 |
| | 36 to 50 | 314 | 27.6 |

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| | | | |
|---|---|---|---|
| | More than 50 years | 185 | 16.2 |
| ***Gender*** | Female | 649 | 57.0 |
| | Male | 490 | 43.0 |
| ***Nationality*** | Saudi | 1052 | 92.4 |
| | Non-Saudi | 87 | 7.6 |
| ***Marital status*** | Single | 521 | 45.7 |
| | Married | 563 | 49.4 |
| | Divorced | 40 | 3.5 |
| | Widowed | 15 | 1.3 |
| ***Occupational status*** | Employed full-time | 481 | 42.2 |
| | Employed part-time | 27 | 2.4 |
| | Unemployed | 166 | 14.6 |
| | Student | 309 | 27.1 |
| | Retired | 128 | 11.2 |
| | Freelance business | 28 | 2.5 |
| ***Region of residence*** | Northern region | 178 | 15.6 |
| | Southern region | 229 | 20.1 |
| | Central region | 171 | 15.0 |
| | Eastern region | 186 | 16.3 |
| | Western region | 375 | 32.9 |
| ***Education level*** | Middle school | 8 | .7 |
| | High school | 149 | 13.1 |
| | Diploma | 124 | 10.9 |
| | Bachelor's degree | 713 | 62.6 |
| | Postgraduate degree | 143 | 12.6 |
| | Uneducated | 2 | .2 |
| ***What is your source of information regarding stroke? (you can choose multiple answers) **** | TV\Radio | 229 | 20.1 |
| | Internet | 777 | 68.2 |
| | School\University | 419 | 36.8 |
| | Parents\Frends | 236 | 20.7 |
| | Educational campaigns | 253 | 22.2 |
| | Social worker | 217 | 19.1 |

***Results may overlap***

As shown in figure 1, The resulting data illustrates important findings pertaining to the contribution of family history to incidence of stroke within a 1,139 sized sample. A substantial (49.0%, 554) number of respondents reported a familial history of stroke, suggesting a hereditary predisposition. In contrast, 25.3% (288) lacked a known family history of ischemic stroke and 25.3% (288) did not have known

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family history of heart disease. Additionally, of note, 26.1 percent (297) of participants were uncertain about their family history of stroke.

***Figure (1): Illustrates whether family history effect on stroke among participants.***

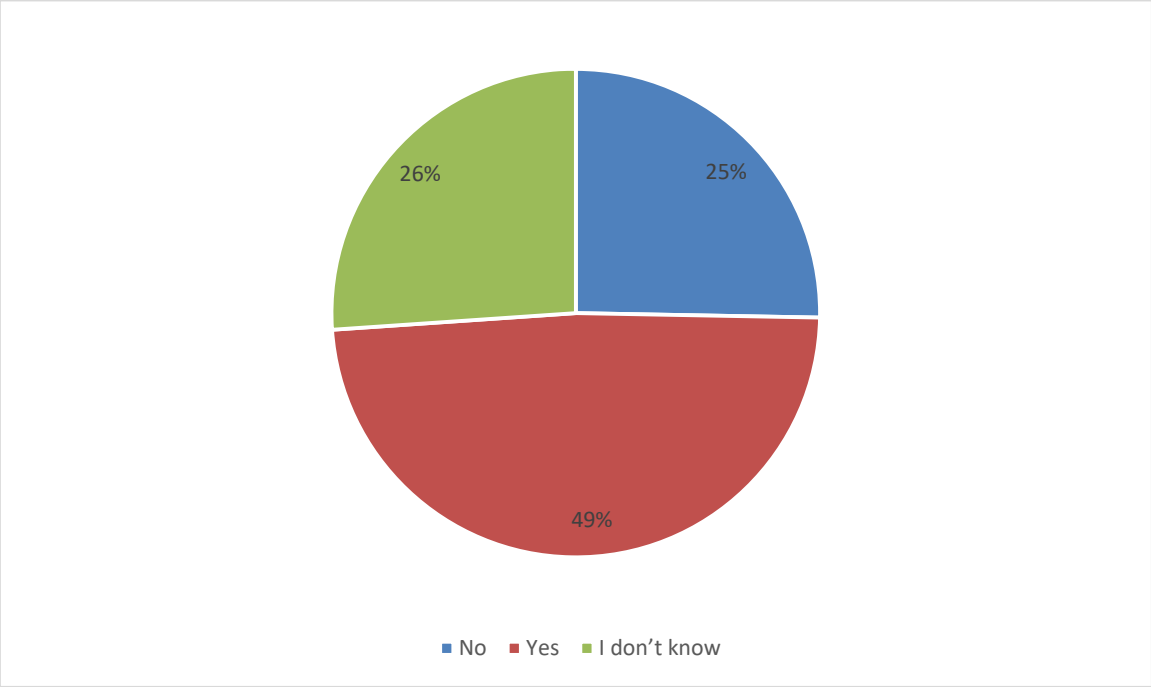


Table 2 presents the data for the awareness and understanding of stroke among a diverse group of participants (n = 1139). It's worth noting that hardly any percentage is higher than 95.7% in terms of the respondents hearing of stroke — this is an incredibly strong foundational awareness within the community. However, the database on its nomenclature and classification appears weak; only 56.5% know other terms for stroke, and a substantial 69.3% agree that there are different types of strokes. In fact, while a majority (85.9%) get high blood pressure as a leading risk factor for stroke, other major risk factors such as smoking and diabetes are also understood by a large majority of respondents (77.9% and 52.9%) respectively. What's interesting is that 63.5 percent of respondents believe that complete recovery from stroke is possible if treatment is begun early, indicating an optimistic view of how well treatment works.

***Table (2): Parameters related to stroke knowledge among participants (n=1139).***

| ***Parameter*** | | ***No.*** | ***Percent (%)*** |
|---|---|---|---|
| ***Have you ever heard about stroke?*** | No | 49 | 4.3 |
| | Yes | 1090 | 95.7 |
| ***Do you think there are other names for stroke?*** | No | 104 | 9.1 |
| | Yes | 644 | 56.5 |

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| | | | |
|---|---|---|---|
| | I don't know | 391 | 34.3 |
| ***Do you think there are various types of strokes?*** | No | 79 | 6.9 |
| | Yes | 789 | 69.3 |
| | I don't know | 271 | 23.8 |
| ***Which of the following do you believe is the best way to describe a stroke? (you can choose multiple options) **** | When a thrombus obstructs the blood flow in the brain. | 946 | 83.1 |
| | When the brain's supply of oxygen is stopped because the heart stops pumping. | 465 | 40.8 |
| | The rupture of a blood vessel causes bleeding into the brain. | 354 | 31.1 |
| | Attack of seizures. | 62 | 5.4 |
| ***Family history can cause stroke.*** | No | 288 | 25.3 |
| | Yes | 554 | 48.6 |
| | I don't know | 297 | 26.1 |
| ***The incidence of stroke increases mostly in people under the age of 65.*** | No | 557 | 48.9 |
| | Yes | 220 | 19.3 |
| | I don't know | 362 | 31.8 |
| ***Do you think that diabetic patients are at risk of stroke?*** | No | 176 | 15.5 |
| | Yes | 602 | 52.9 |
| | I don't know | 361 | 31.7 |
| ***Do you think that being a man can be a risk factor of developing stroke?*** | No | 206 | 18.1 |
| | Yes | 566 | 49.7 |
| | I don't know | 367 | 32.2 |
| ***Do you think that high blood pressure could lead to stroke?*** | No | 40 | 3.5 |
| | Yes | 978 | 85.9 |
| | I don't know | 121 | 10.6 |
| ***Do you think that smoking can be one of the risk factors for stroke?*** | No | 88 | 7.7 |
| | Yes | 887 | 77.9 |
| | I don't know | 164 | 14.4 |
| ***The symptoms of stroke usually appear:*** | Suddenly | 673 | 59.1 |
| | Gradually | 321 | 28.2 |
| | I don't know | 145 | 12.7 |
| ***Do you think that it is possible to completely cure a stroke when arriving at the hospital early?*** | No | 172 | 15.1 |
| | Yes | 723 | 63.5 |
| | I don't know | 244 | 21.4 |
| ***Which of these factors are considered as a risk factor for stroke? (you can*** | Obesity | 714 | 62.7 |
| | Smoking | 798 | 70.1 |

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| | | | |
|---|---|---|---|
| ***choose multiple options) **** | Hypertension | 1020 | 89.6 |
| | Diabetes | 589 | 51.7 |
| | Heart diseases | 787 | 69.1 |
| ***Do you think that reducing risk factors helps prevent stroke?*** | No | 67 | 5.9 |
| | Yes | 961 | 84.4 |
| | I don't know | 111 | 9.7 |
| ***What are the warning signs and symptoms of stroke? (you can choose multiple options) **** | Slurred speech | 898 | 78.8 |
| | Sudden weakness in face muscles/ arms or legs | 780 | 68.5 |
| | Sudden tingling or loss of sensation in 1 side of the body | 830 | 72.9 |
| | Sudden confusion and trouble understanding speech | 554 | 48.6 |
| | Sudden severe headache | 625 | 54.9 |
| | Trouble seeing | 544 | 47.8 |
| | Trouble walking | 523 | 45.9 |
| | Sudden fever | 144 | 12.6 |
| | Constant pain in the left shoulder | 279 | 24.5 |
| | Neck stiffness | 235 | 20.6 |
| | Vomiting | 248 | 21.8 |

***Results may overlap***

As shown in figure (2), With data based on a sample of 1,139 respondents, the findings revolve around the construct of stroke recovery chances upon early hospital arrival; however, this construct is noticed as perceived by most respondents. Specifically, 723 out of 1,126 (63.5%) believe that complete cure is possible and have an optimistic view regarding early medical intervention. However, 172 respondents, about 15.1%, presumed that there will not be complete recovery. Furthermore, 21.4 per cent, 244 persons, are unsure.

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***Figure (2): Illustrates the effect of early hospital admission and curing stroke among participants.***

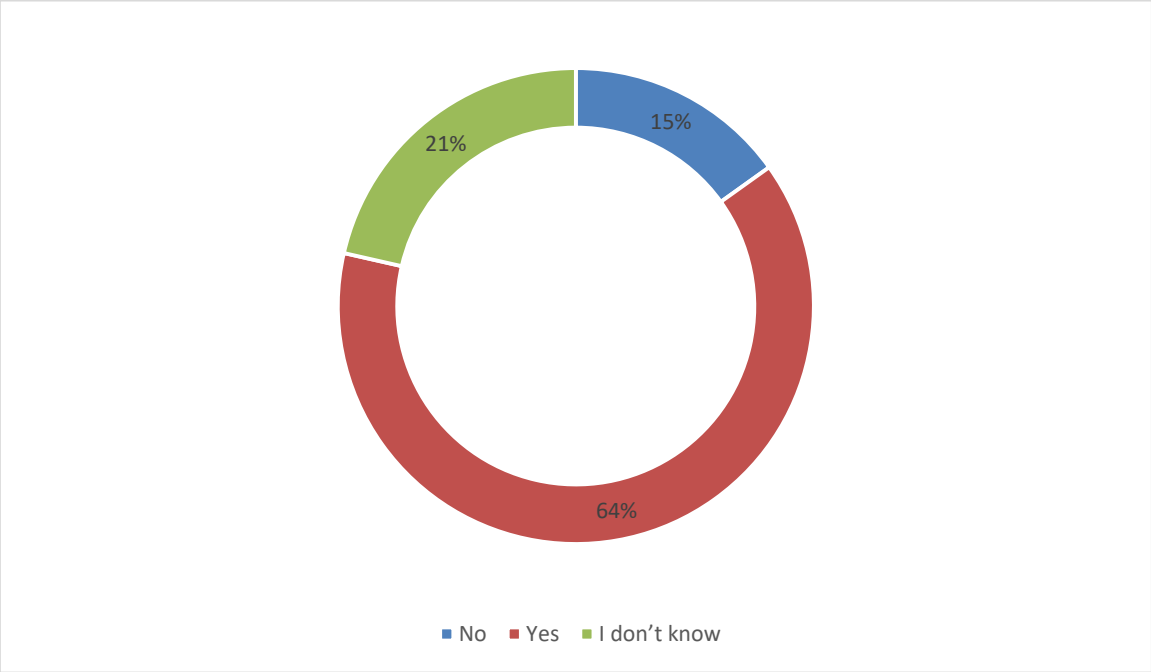


Table 3 shows the valuable insights into stroke awareness of a sample of 1,139 participants, revealing how big the gaps and how much they are the strengths of understanding of stroke risk factors, treatment options and urgency of response among the public. We noticed that stroke vulnerability was broadly misunderstood since only 17.7 % of those surveyed had experienced a stroke themselves or in their families, with a majority, 65.5 %, correctly identifying the elderly as at higher risk but only 0.8 % acknowledging stroke risk in children and teenagers. Of great concern was that 43.1 percent of respondents did not know about current treatment options, while 90.2 percent did recognize stroke to be a medical emergency, and as such need better education in order to be aware of timely intervention. Additionally, the majority (76.0%) equates the belief that strokes are preventable with a key opportunity for focused health interventions.

***Table (3): participants stroke awareness among participants (n=1139).***

| ***Parameter*** | | ***No.*** | ***Percent (%)*** |
|---|---|---|---|
| ***Have you or one of your family members ever had stroke?*** | No | 937 | 82.3 |
| | Yes | 202 | 17.7 |
| ***Who is at high risk for stroke?*** | Children and teenagers under 18 years | 9 | .8 |
| | Youth and adults between 18 and 65 years | 384 | 33.7 |

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| | | | |
|---|---|---|---|
| | Elderly above 65 years | 746 | 65.5 |
| ***Is there any current stroke treatment?*** | No | 235 | 20.6 |
| | Yes | 413 | 36.3 |
| | I don't know | 491 | 43.1 |
| ***What is the time frame to initiate thrombolysis in acute ischemic stroke?*** | Within 2 hours | 504 | 44.2 |
| | Within 3 hours | 89 | 7.8 |
| | Within 3.5 hours | 45 | 4.0 |
| | Within 4.5 hours | 99 | 8.7 |
| | I don't know | 402 | 35.3 |
| ***Do you think stroke is one of the leading causes of death?*** | No | 31 | 2.7 |
| | Yes | 1022 | 89.7 |
| | I don't know | 86 | 7.6 |
| ***Is stroke preventable?*** | No | 45 | 4.0 |
| | Yes | 866 | 76.0 |
| | I don't know | 228 | 20.0 |
| ***Stroke is a medical emergency*** | No | 37 | 3.2 |
| | Yes | 1027 | 90.2 |
| | I don't know | 75 | 6.6 |
| ***What is the best behavior to do when you suspect a stroke? (you can choose multiple options) **** | Go to ER | 925 | 81.2 |
| | Call the ambulance | 814 | 71.5 |
| | Stay at home | 38 | 3.3 |
| | Use alternative medicine (like: antihypertensive) | 91 | 7.9 |
| | I don't know | 54 | 4.7 |
| ***Within what time you should go to the hospital after suspecting a stroke?*** | After 4 hours | 73 | 6.4 |
| | Within 4 hours | 930 | 81.7 |
| | I don't know | 136 | 11.9 |

***Results may overlap***

Table 4 presents the data of the distribution of the participants knowledge on stroke, which looks increasingly alarming. Importantly, 26.1% of the participants attained a high knowledge level, 31.1% took the intermediate knowledge path, and 36.0% ended up in the low knowledge category. That means over one third of the participants mightily be unaware of the significance of stroke and can be very significant judgment for preventive strategy's and health education campaigns.

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***Table (4): Shows knowledge about stroke among participants score results.***

| | **Frequency** | **Percent** |
|---|---|---|
| High knowledge Level | 297 | 26.1 |
| Moderate knowledge | 432 | 37.9 |
| Low knowledge Level | 410 | 36.0 |
| Total | 1139 | 100.0 |

Table 5 shows the levels of awareness of the stroke amongst participants, and there was a great variation in knowledge between the surveyed population. Despite this, only 5.8% of participants have high awareness where a large section remains under supervised regarding the essential components of stroke recognition and prevention. But a majority in the 64.6 per cent have a moderate level of awareness, establishing some but with possible insufficiency in the education realm, which can be filled in through specific awareness programs. Nearby, 29.6% of participants had low awareness.

***Table (5): Shows awareness about stroke among participants score results.***

| | **Frequency** | **Percent** |
|---|---|---|
| High awareness level | 66 | 5.8 |
| Moderate awareness | 736 | 64.6 |
| Low awareness level | 337 | 29.6 |
| Total | 1139 | 100.0 |

Table (6) shows that knowledge level about stroke has statistically significant relation to gender (P value=0.002), age (P value=0.017), marital status (P value=0.007), occupational status (P value=0.0001), residential region (P value=0.015), and educational level (P value=0.0001). It also shows statistically insignificant relation to nationality.

***Table (6): Relation between knowledge level about stroke and sociodemographic characteristics.***

| ***Parameters*** | | ***Knowledge level*** | | ***Total (N=1139)*** | ***P value**** |
|---|---|---|---|---|---|
| | | **High or moderate knowledge** | **Low knowledge Level** | | |
| ***Gender*** | Female | 440 | 209 | 649 | 0.002 |
| | | 60.4% | 51.0% | 57.0% | |
| | Male | 289 | 201 | 490 | |
| | | 39.6% | 49.0% | 43.0% | |

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| | | | | | |
|---|---|---|---|---|---|
| ***Age*** | 21 or less | 104 | 43 | 147 | 0.017 |
| | | 14.3% | 10.5% | 12.9% | |
| | 22 to 23 | 114 | 50 | 164 | |
| | | 15.6% | 12.2% | 14.4% | |
| | 24 to 26 | 115 | 48 | 163 | |
| | | 15.8% | 11.7% | 14.3% | |
| | 27 to 35 | 99 | 67 | 166 | |
| | | 13.6% | 16.3% | 14.6% | |
| | 36 to 50 | 187 | 127 | 314 | |
| | | 25.7% | 31.0% | 27.6% | |
| | More than 50 years | 110 | 75 | 185 | |
| | | 15.1% | 18.3% | 16.2% | |
| ***Nationality*** | Saudi | 674 | 378 | 1052 | 0.874 |
| | | 92.5% | 92.2% | 92.4% | |
| | Non-Saudi | 55 | 32 | 87 | |
| | | 7.5% | 7.8% | 7.6% | |
| ***Marital status*** | Single | 355 | 166 | 521 | 0.007 |
| | | 48.7% | 40.5% | 45.7% | |
| | Married | 345 | 218 | 563 | |
| | | 47.3% | 53.2% | 49.4% | |
| | Divorced | 24 | 16 | 40 | |
| | | 3.3% | 3.9% | 3.5% | |
| | Widowed | 5 | 10 | 15 | |
| | | 0.7% | 2.4% | 1.3% | |
| ***Occupational status*** | Employed full-time | 298 | 183 | 481 | 0.0001 |
| | | 40.9% | 44.6% | 42.2% | |
| | Employed part-time | 15 | 12 | 27 | |
| | | 2.1% | 2.9% | 2.4% | |
| | Unemployed | 91 | 75 | 166 | |
| | | 12.5% | 18.3% | 14.6% | |
| | Student | 238 | 71 | 309 | |
| | | 32.6% | 17.3% | 27.1% | |
| | Retired | 74 | 54 | 128 | |
| | | 10.2% | 13.2% | 11.2% | |
| | Freelance business | 13 | 15 | 28 | |
| | | 1.8% | 3.7% | 2.5% | |
| ***Residential region*** | Northern region | 122 | 56 | 178 | 0.015 |
| | | 16.7% | 13.7% | 15.6% | |

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| | | | | | |
|---|---|---|---|---|---|
| | Southern region | 135 | 94 | 229 | |
| | | 18.5% | 22.9% | 20.1% | |
| | Central region | 107 | 64 | 171 | |
| | | 14.7% | 15.6% | 15.0% | |
| | Eastern region | 136 | 50 | 186 | |
| | | 18.7% | 12.2% | 16.3% | |
| | Western region | 229 | 146 | 375 | |
| | | 31.4% | 35.6% | 32.9% | |
| ***Educational level*** | Middle school | 2 | 6 | 8 | 0.0001 |
| | | 0.3% | 1.5% | 0.7% | |
| | High school | 96 | 53 | 149 | |
| | | 13.2% | 12.9% | 13.1% | |
| | Diploma | 61 | 63 | 124 | |
| | | 8.4% | 15.4% | 10.9% | |
| | Bachelor's degree | 464 | 249 | 713 | |
| | | 63.6% | 60.7% | 62.6% | |
| | Postgraduate degree | 106 | 37 | 143 | |
| | | 14.5% | 9.0% | 12.6% | |
| | Uneducated | 0 | 2 | 2 | |
| | | 0.0% | 0.5% | 0.2% | |

****P value was considered significant if ≤ 0.05.***

Table (7) shows that awareness level about stroke has statistically significant relation to gender (P value=0.026), and educational level (P value=0.003). It also shows statistically insignificant relation to age, nationality, marital status, occupational status, and residential region.

***Table (7): Awareness level of stroke in association with sociodemographic characteristics.***

| ***Parameters*** | | ***Awareness level*** | | ***Total (N=1139)*** | ***P value**** |
|---|---|---|---|---|---|
| | | **High or moderate awareness level** | **Low awareness level** | | |
| ***Gender*** | Female | 474 | 175 | 649 | 0.026 |
| | | 59.1% | 51.9% | 57.0% | |
| | Male | 328 | 162 | 490 | |
| | | 40.9% | 48.1% | 43.0% | |
| ***Age*** | 21 or less | 100 | 47 | 147 | 0.671 |
| | | 12.5% | 13.9% | 12.9% | |
| | 22 to 23 | 122 | 42 | 164 | |
| | | 15.2% | 12.5% | 14.4% | |

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| | | | | | |
|---|---|---|---|---|---|
| | 24 to 26 | 117 | 46 | 163 | |
| | | 14.6% | 13.6% | 14.3% | |
| | 27 to 35 | 121 | 45 | 166 | |
| | | 15.1% | 13.4% | 14.6% | |
| | 36 to 50 | 214 | 100 | 314 | |
| | | 26.7% | 29.7% | 27.6% | |
| | More than 50 years | 128 | 57 | 185 | |
| | | 16.0% | 16.9% | 16.2% | |
| ***Nationality*** | Saudi | 746 | 306 | 1052 | 0.199 |
| | | 93.0% | 90.8% | 92.4% | |
| | Non-Saudi | 56 | 31 | 87 | |
| | | 7.0% | 9.2% | 7.6% | |
| ***Marital status*** | Single | 376 | 145 | 521 | 0.328 |
| | | 46.9% | 43.0% | 45.7% | |
| | Married | 386 | 177 | 563 | |
| | | 48.1% | 52.5% | 49.4% | |
| | Divorced | 31 | 9 | 40 | |
| | | 3.9% | 2.7% | 3.5% | |
| | Widowed | 9 | 6 | 15 | |
| | | 1.1% | 1.8% | 1.3% | |
| ***Occupational status*** | Employed full-time | 338 | 143 | 481 | 0.120 |
| | | 42.1% | 42.4% | 42.2% | |
| | Employed part-time | 18 | 9 | 27 | |
| | | 2.2% | 2.7% | 2.4% | |
| | Unemployed | 104 | 62 | 166 | |
| | | 13.0% | 18.4% | 14.6% | |
| | Student | 231 | 78 | 309 | |
| | | 28.8% | 23.1% | 27.1% | |
| | Retired | 89 | 39 | 128 | |
| | | 11.1% | 11.6% | 11.2% | |
| | Freelance business | 22 | 6 | 28 | |
| | | 2.7% | 1.8% | 2.5% | |
| ***Residential region*** | Northern region | 123 | 55 | 178 | 0.493 |
| | | 15.3% | 16.3% | 15.6% | |
| | Southern region | 164 | 65 | 229 | |
| | | 20.4% | 19.3% | 20.1% | |
| | Central region | 126 | 45 | 171 | |
| | | 15.7% | 13.4% | 15.0% | |

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| | | | | | |
|---|---|---|---|---|---|
| | Eastern region | 136 | 50 | 186 | |
| | | 17.0% | 14.8% | 16.3% | |
| | Western region | 253 | 122 | 375 | |
| | | 31.5% | 36.2% | 32.9% | |
| ***Educational level*** | Middle school | 4 | 4 | 8 | 0.003 |
| | | 0.5% | 1.2% | 0.7% | |
| | High school | 107 | 42 | 149 | |
| | | 13.3% | 12.5% | 13.1% | |
| | Diploma | 75 | 49 | 124 | |
| | | 9.4% | 14.5% | 10.9% | |
| | Bachelor's degree | 502 | 211 | 713 | |
| | | 62.6% | 62.6% | 62.6% | |
| | Postgraduate degree | 114 | 29 | 143 | |
| | | 14.2% | 8.6% | 12.6% | |
| | Uneducated | 0 | 2 | 2 | |
| | | 0.0% | 0.6% | 0.2% | |

***P value was considered significant if ≤ 0.05.***

**Discussion:**

Stroke is the third leading cause of disability and the second leading cause of death around the world. In addition to its high mortality, stroke is a very important cause of morbidity, responsible for up to 50% of long-term disabilities. As a result, stroke is described as a non-communicable disease with important economic and social implications which imposes major public health burden [14]. As the populations of developing countries continue to age, as well as make lifestyle changes, the burden of stroke on public health will grow in the next decades. Stroke was responsible for more than 14,000 deaths in Saudi Arabia in 2012, and it ranked as number two cause of death in the country [15]. In addition, projections show that by 2030, the country will double the incidence of stroke and its mortality rate. Partly this is due to insufficient community awareness of stroke risk factors. Other cardiovascular conditions such as smoking, hypertension, diabetes mellitus, dyslipidemia and other lifestyle elements such as poor diet fall within these risk factors [16]. Also, stroke early warning signs must be identified so that it can be treated early to guide timely intervention and improved treatment outcomes [17]. So this study aimed to assess the knowledge and awareness level about stroke in the Saudi population.

A review of our study's finding with previous stroke awareness and knowledge research indicates consistent trends, and disparate findings driven among different populations. As visualised in our study, 95.7% of participants already knew about stroke, while knowledge of its exact definitions was limited, as 56.5% were familiar with other terms for stroke and 69.3% identified different kinds of stroke. A variability and these findings are in contrast to previous finding conducted in Riyadh, Saudi Arabia, which showed that 76, 66 % of participants are aware of stroke factors vs our 85.9 % are aware of primary risk factor (high blood pressure) and strong awareness of other factors like smoking (77.9%)

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and diabetes (52.9%) [18]. In addition, a recent study from Abha, Saudi Arabia found a large gap in knowledge regarding acute stroke warning symptoms and the appropriate response [19] indicating that even if overall awareness is high as in our findings, the depth of knowledge regarding action responses is still low. This agrees somewhat with the findings of Gupta et al. [20], where 86% elderly respondents agreed that stroke is caused by brain damage, while at the same time we identified a gap in complete understanding, notably with regards to treatment awareness, where 43.1 percent of participants did not know of any treatment options for stroke, but still 90.2 percent had an understanding of the seriousness of the condition. Mohammed A Al Shafaee et al. further underlines the disparity in knowledge when it only revealed that 35% of the subjects knew the brain was the organ affected by a stroke and 68% were able to identify at least one symptom, which shows that although some awareness exists, there is very little specific knowledge both concerning the brain and stroke symptoms [21]. Echoing similar findings, in Jeddah 81.46% identified stroke, yet only 59.2% correctly identified associated symptoms [22]. In our study, we also noted the reflective awareness of risk factors, including hypertension as recognition rates over 75% were apparent across several Saudi populations in a previous study [23]. Our results also extended as we found that only 26.1% had high knowledge about stroke, while 36.0% had low knowledge. This adds weight to a study of students at Jazan University that found disparities in understanding old age as a stroke risk factor, with only 60.4% of the survey participants [24]. More generally, our findings are consistent with research conducted in Lebanon observing that more than 80% identified hypertension and psychological stress as crucial contributors to stroke in the broad sense [25] and fortify the thesis that there is a widespread recognition of hypertension as a primary risk factor. Furthermore, in Chongqing the level of recognition of stroke warning symptoms varied from 30.7% to 75.6% [26], showing that even when awareness might exist, it is not uniformly inclusive across such diverse demographic groups. Further supporting our conclusion that there is a critical need for targeted stroke education programs that consider sociodemographic influences, we found significant correlation between knowledge levels and sociodemographic factors, including age, gender marital status, occupational status, residential region and educational level but not any correlation with nationality, which may indicate incongruence in stroke awareness in the world. But while our study shows a high level of awareness of stroke compared with previous studies, it also highlights considerable gaps in people's knowledge of stroke signs and symptoms, and treatments. Also a study conducted in 2011 in Saudi Arabia showed that 87% of the participants perceived the need to go to urgent care in case of acute stroke [27].

**Conclusion:**

Finally, this study highlights that although the Saudi population has awareness of stroke, there remain large gaps in knowledge related to its warning signs, symptoms and treatment options. Although 95.7% of participants understood the term 'stroke,' only 26.1% demonstrated high knowledge about its characteristics and risks. A majority answered key symptoms, such as sudden numbness and speech difficulties, correctly, but misconceptions about onset of symptoms and treatment awareness remain of concern. The data imply a crucial need for targeted educational interventions focused on educating younger people, those with a lower educational background, about stroke and contributing to rapidly

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seeking medical assistance. If we can expand public understanding of the time and risk factors of stroke, we may be able to reduce its incidence and impact to the population. Community education is an essential required to increase capability and facilitate early intervention and hence significantly better health outcomes of stroke in Saudi.

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**Ethical approval:**

An informed consent was obtained from each participant after explaining the study in full and clarifying that participation is voluntary. Data collected were securely saved and used for research purposes only.

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There was no external funding for this study.

**Conflict of interests:**

The authors declare no conflict of interest.

**Informed consent:**

Written informed consent was acquired from each individual study participant.

**Data and materials availability:**

All data associated with this study are present in the paper.

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