

## ORIGINAL RESEARCH

## PERIOPERATIVE MEDICINE

# Awareness among the general public about the risk factors of heart attack and stroke, and the actions to be taken

Khalid A. Alnemer <sup>1\*</sup>, Abdulaziz Taher Hejazi <sup>2</sup>, Faris Taher Hejazi <sup>2</sup>, Fahad Hamdan Almutairi <sup>2</sup>

**Authors' affiliation:**

1. Khalid A. Alnemer, Department of Internal Medicine, College of Medicine, Imam Mohammad Ibn Saud Islamic University (IMSIU), Riyadh, Saudi Arabia; Email: [Kaalnemer@imamu.edu.sa](mailto:Kaalnemer@imamu.edu.sa)
2. Abdulaziz Taher Hejazi, College of Medicine, Imam Mohammad Ibn Saud Islamic University (IMSIU), Riyadh 13317, Saudi Arabia; Email: [442018950@sm.imamu.edu.sa](mailto:442018950@sm.imamu.edu.sa)
3. Faris Taher Hejazi, College of Medicine, Imam Mohammad Ibn Saud Islamic University (IMSIU), Riyadh 13317, Saudi Arabia; Email: [445007363@sm.imamu.edu.sa](mailto:445007363@sm.imamu.edu.sa)
4. Fahad Hamdan Almutairi, College of Medicine, Imam Mohammad Ibn Saud Islamic University (IMSIU), Riyadh 13317, Saudi Arabia; Email: [442021575@sm.imamu.edu.sa](mailto:442021575@sm.imamu.edu.sa)

**Corresponding author:** Dr. Khalid A. Alnemer, Email: [Kaalnemer@imamu.edu.sa](mailto:Kaalnemer@imamu.edu.sa)

## ABSTRACT

**Background:** Cardiovascular diseases (CVDs) are among the most common diseases that lead to death. Awareness of the symptoms of CVDs and the resulting complications remains below the required levels. This study aims to understand and measure the level of awareness and attitudes among the general public regarding the risks and symptoms of heart attacks and strokes.

**Methodology:** This was an online cross-sectional survey conducted in Saudi Arabia between April and May 2025. A previously validated questionnaire was utilized in this research to examine awareness and actions taken around symptoms and risk factors of heart attack and stroke among patients with CVDs in Saudi Arabia. The influencing factors for heart attack and stroke knowledge were identified using logistic regression.

**Results:** A total of 404 participants were included in the study. The majority of participants (n = 371, 91.8%) had heard about heart attacks, and just over half (n = 209, 57.2%) had received information related to heart attacks. Most participants (n = 358, 88.6%) had heard of strokes, though only 34.4% (n = 139) knew someone who had experienced one. Individuals aged 20-30 years had significantly higher odds of having a higher stroke knowledge score compared to those under 20 (Odds ratio (OR) = 2.14, 95% CI: 1.03–4.44, P = 0.042). Males showed a slightly lower likelihood of having heart attack knowledge compared to females (OR = 0.63, 95% CI: 0.39–1.00, P = 0.05). Higher educational levels, especially PhDs, were strongly associated with higher stroke knowledge scores (OR = 13.13, 95% CI: 1.81–95.26, P = 0.011).

**Conclusion:** Although participants were typically aware of heart attacks and strokes, their personal exposure and detailed knowledge varied. Younger adults (20–30 years) exhibited substantially superior stroke knowledge in comparison to those under the age of 20. Males exhibited marginally lower levels of awareness about heart attacks than females. Notably, there was a significant correlation between higher educational attainment, particularly at the PhD level, and better stroke knowledge.

**Abbreviation:** AHA: American Heart Association. CVD: Cardiovascular diseases,

**Keywords:** Awareness; Cardiovascular diseases; Heart attack; Knowledge; Population; Questionnaire; Stroke;

**Citation:** Alnemer KA, Hejazi AT, Hejazi FT, Almutairi FH. Awareness among the general public about the risk factors of heart attack and stroke, and the actions to be taken. *Anaesth. pain intensive care* 2025;29(6):505-512. **DOI:** [10.35975/apic.v29i6.2899](https://doi.org/10.35975/apic.v29i6.2899)

**Received:** May 09, 2024; **Revised:** October 26, 2024; **Accepted:** January 01, 2025

## 1. INTRODUCTION

Cardiovascular diseases (CVDs) are among the most common diseases that lead to mortality in the United States of America (USA), with heart attacks and strokes being among the most closely linked to the increasing number of deaths worldwide. According to statistics collected by the American Heart Association (AHA), in 2022, heart attacks and strokes caused approximately 600,000 and 160,000 deaths per year, respectively.<sup>1</sup> Heart attacks occur when the oxygen carried through the blood stops reaching the heart muscle due to the blockage of blood vessels caused by the accumulation of platelets in the arteries. When the components of these platelets leak into the blood, a heart attack occurs.<sup>1</sup> The second most common disease, a stroke, occurs when blood and oxygen are respectively occluded and obstructed from reaching the brain, leading to damage to nerve tissue. The complications range from paralysis to death.<sup>2</sup> There are many factors associated with an increased incidence of heart attacks and strokes, including patients' failure to adhere to a prescribed diet, lack of physical activity, smoking, anxiety, and stress resulting in poor sleep habits, excess fat and lipids, hypertension, and diabetes.<sup>3</sup>

The community awareness of the symptoms of heart attacks and strokes contributes to an increase in life expectancy, as prompt action improves long-term outcomes, reduces complications of heart tissue damage, and reduces the burden on the patient and on healthcare institutions.<sup>4,5</sup> It is important to check patients' health-related knowledge, especially those with conditions that lead to an increased incidence of heart disease. Cardiac disorders, especially heart attacks and strokes, are among the biggest problems that cause an increase in the number of deaths globally.<sup>6</sup> Therefore, people's awareness of the risks of these diseases must be increased, and they should be encouraged to follow certain guidelines, such as quitting smoking, following a healthy diet, increasing physical activity, and reducing alcohol consumption.<sup>7</sup>

Despite the awareness campaigns conducted by CVD organisations regarding these diseases, their symptoms, and their complications, awareness remains below the required level to avoid contracting these diseases. This is because most people do not adhere to the guidelines set by these organisations, which places a burden on these organisations to treat these diseases.<sup>8,9</sup> Therefore, to

understand the increase in these disease cases, this study aims to understand and measure the level of awareness and attitudes among the general public regarding the risks and symptoms of heart attacks and strokes, despite the presence of awareness campaigns.

## 2. METHODOLOGY

This was an online cross-sectional survey study that was conducted in Saudi Arabia between April and May 2025. The Institutional Review Board of Al-Imam Muhammad Ibn Saud Islamic University granted ethical sanction for this research (Project number: 807/2025). Participants were advised that their completion of the questionnaire constituted informed consent for participation.

Patients aged 18 years or older and residing in Saudi Arabia, who had been diagnosed with CVD were included in the study. This study included both male and female participants, without any exclusion criteria regarding their sociodemographic characteristics.

### 2.1. Questionnaire tool

A previously validated questionnaire was utilized in this research to examine awareness and actions taken regarding symptoms and risk factors of heart attack and stroke among patients with CVD in Saudi Arabia.<sup>10</sup> The original questionnaire tool was developed based on literature in English. This questionnaire tool was based on literature from different countries and ethnicities.<sup>10</sup> The questionnaire tool consisted of 14 questions: eight questions on awareness and action taken regarding symptoms and risk factors of heart attacks, and six questions on awareness and actions taken regarding symptoms and risk factors of strokes. Six items were used to estimate participants knowledge of heart attack. Similarly, six items were used to estimate participants knowledge of stroke. The higher the score the more knowledgeable the participant. Information regarding demographic characteristics was also gathered (age, gender, residency, marital status, educational level, and occupation). The face and content validity of the questionnaire tool was confirmed by five professionals in this field.

### 2.2. Original questionnaire development and validation

The questionnaire was completed by the general public, with the community of CVD patients solicited through a convenience sampling strategy. The recruitment and invitation of study participants were conducted through social media platforms, including Facebook and WhatsApp. Patients from a variety of demographic backgrounds are represented on social media platforms.

The original questionnaire consisted of 18 items: 11 concerning awareness and responses to heart attack symptoms and risk factors, and seven concerning awareness and responses to stroke symptoms and risk factors.<sup>10</sup> The final questionnaire consisted of 14 items. The final version of the questionnaire was produced after being reviewed by five experts in the subject, who assessed it for face and content validity.<sup>10</sup> Essential modifications were implemented following the incorporation of expert recommendations. Cronbach's alpha for internal consistency was 0.79 and 0.83, indicating good reliability. The examination of the pre-test and post-test reliability over two weeks involving ten participants demonstrated satisfactory reliability and stability, evidenced by a Spearman's rank correlation coefficient of 0.775 ( $P=0.008$ ) for awareness and responses regarding heart attack symptoms and risk factors, and 0.954 ( $P=0.00$ ) for awareness and responses concerning stroke symptoms and risk factors.<sup>10</sup>

### 2.3. Data analysis

The frequency and percentage of the sample's demographic characteristics, which included gender, education level, occupation, and residency area, were presented. The mean and standard deviation (SD) were used to present continuous data, including scores for knowledge of the symptoms of both heart attack and stroke. The Kolmogorov-Smirnov test was used to evaluate the normality of the data. Subsequently, the independent sample t-test and the analysis of variance (ANOVA) tests were implemented when applicable, as the data satisfied the parametric assumptions. The Tukey post-hoc test was used for multiple group comparisons, and the outcomes were assessed accordingly. The scale was categorized based on the median knowledge score of 2 for heart attacks and strokes. The influencing factor for each score was identified using logistic regression. Odds ratios (OR) and 95% confidence intervals (CI) were displayed. For all analyses, a p-value of less than 0.05 was regarded as statistically significant. SPSS software version 29 was used to conduct all analyses.

## 3. RESULTS

A total of 404 participants were included in the study. Most were aged 20-30 years ( $n=179$ , 44.3%). Females

**Table 1: Sociodemographic characteristics of study participants on stroke and heart attack knowledge**

Sociodemographic characteristics		N (%)
Age (years)	Less than 20	50 (12.4)
	20-30	179 (44.3)
	31-40	86 (21.3)
	41-50	60 (14.9)
	50 and older	29 (7.2)
Gender	Female	231(57.2)
	Male	173 (42.8)
Residency	Village	28 (6.9)
	City	376 (93.1)
Marital status	Single	215 (53.2)
	Married	173 (42.8)
	Divorced	12 (3.0)
	Widowed	4 (1.0)
Educational level	Not educated	3 (0.7)
	Primary	18 (4.5)
	High school	98 (24.3)
	Diploma	25 (6.2)
	University	248 (61.4)
	PhD	12 (3.0)
Occupation	Not working	86 (21.3)
	Student	164 (40.6)
	Employee	140 (34.7)
	Retired	14 (3.5)

represented the majority ( $n=231$ , 57.2%). The vast majority resided in cities ( $n=376$ , 93.1%). More than half were single ( $n = 215$ , 53.2%). In terms of education, most had a university degree ( $n= 248$ , 61.4%), as seen in Table 1.

The majority of participants ( $n =371$ , 91.8%) had heard about attacks, and just over half ( $n =209$ , 57.2%) had received information related to heart attacks. Commonly recognized symptoms included chest pain or discomfort ( $n =263$ , 65.1%) and shortness of breath ( $n =206$ , 51.0%), while fewer participants identified symptoms like dizziness (28.7%). Most respondents believed the appropriate first action during a heart attack was to call an ambulance ( $n =223$ , 55.2%). A high percentage ( $n =360$ , 89.1%) agreed that a heart attack requires prompt treatment. As for risk factors, smoking (78.2%), obesity (67.3%), cholesterol (55.0%), and lifestyle (55.4%) were most widely recognized, as shown in Table 2.

**Table 2: Participants' knowledge of heart attack symptoms, risk factors and emergency response**

Participants' knowledge of heart attack symptoms, risk factors and emergency response		N (%)
Have you ever heard about heart attacks?		371 (91.8)
Do you know anyone who had a heart attack before?		209 (51.7)
Have you ever received any information related to heart attacks?		231 (57.2)
How do you identify the symptoms of a heart attack?		
• Sudden shortness of breath*		206 (51.0)
• Sudden pain or discomfort in the chest*		263 (65.1)
• Pain or discomfort in the jaw, neck, or back*		118 (29.2)
• Sudden disturbance of vision in one or both eyes*		75 (18.6)
• Weakness or dizziness*		116 (28.7)
• Sudden pain or discomfort in the arms or shoulders*		137 (33.9)
• I don't know		75 (18.6)
If someone shows signs and symptoms of a heart attack, What do you think should be done first?	• I don't know	19 (4.7)
	• Hospital	151 (37.4)
	• Police	1 (0.2)
	• Doctor	8 (2.0)
	• Ambulance	223 (55.2)
	• Family	2 (0.5)
Does a sudden heart attack require prompt treatment?		360 (89.1)
Do you know the phone number to call an ambulance service?		354 (87.6)
Have you heard about the risk factors for a heart attack?		
• Smoking		316 (78.2)
• Obesity		272 (67.3)
• Diabetes mellitus		200 (49.5)
• Genetic		123 (30.4)
• Cholesterol		222 (55.0)
• Diet		207 (51.2)
• Alcohol		161 (39.9)
• Stress		203 (50.2)
• Lifestyle		224 (55.4)
• I don't know		43 (10.6)
* Knowledge scored items		

(39.4%), trouble seeing (31.4%), and a severe headache (29.2%), as shown in Table 3.

For knowledge of stroke symptoms, participants aged 20-30 had a higher mean score ( $2.36 \pm 2.03$ ) compared to those under 20 ( $1.56 \pm 1.67$ ,  $P = 0.02$ ). Education level showed a significant difference, those with PhD had the

highest knowledge of strokes ( $3.17 \pm 2.41$ ) and heart attacks ( $2.58 \pm 1.88$ ), while participants with only a primary degree had the lowest ( $1.06 \pm 1.16$ ) and ( $1.78 \pm 1.56$ ) respectively ( $P = 0.005$  and  $P = 0.003$ , respectively). More detail is presented in Table 4.

Most participants ( $n = 358$ , 88.6%) had heard of strokes, though only 34.4% ( $n = 139$ ) knew someone who had experienced one. A large majority ( $n = 345$ , 85.4%) believed strokes require prompt treatment.

Individuals aged 20-30 years were more likely to have a higher stroke knowledge score compared to those under 20 ( $OR = 2.14$ , 95%  $CI: 1.03-4.44$ ,  $P = 0.042$ ). Males, on average, showed slightly lower heart attack knowledge compared to females ( $OR = 0.63$ , 95%  $CI: 0.39-1.00$ ,  $P = 0.05$ ). Higher educational levels, especially PhD holders, were strongly associated with higher stroke knowledge score ( $OR = 13.13$ , 95%  $CI: 1.81-95.26$ ,  $P = 0.011$ ).

#### 4. DISCUSSION

This study examined the knowledge and actions taken by the public regarding two common cardiac conditions, heart attacks and strokes, and their symptoms and risk factors. In this study, the majority of participants ( $n = 371$ , 91.8%) had heard about heart attacks, and just over half ( $n = 209$ , 57.2%) had received information related to heart attacks. A heart attack, or as it is called in medical half identified smoking (48.8%) as a risk factor, fewer recognized others, such as obesity (40.3%), diabetes (39.4%), and stress (39.9%). Regarding emergency response, 47.3% ( $n = 191$ ) would call an ambulance if stroke symptoms

appeared. Commonly identified warning signs included sudden numbness or weakness. A myocardial infarction (MI), occurs as a result of a blockage in one of the arteries that is important in pumping blood to the heart, which results in preventing the most important element, which is oxygen, from reaching the heart, and thus the heart fails. There are two types of myocardial infarction, one of which causes a complete closure of the

coronary artery, and another, which causes a partial closure of the blood flow through this artery.<sup>11</sup> Another study in Saudi Arabia on citizens found that when asked if they had knowledge of the term ‘heart attack’, more than 90% answered that they were aware of this disease. Less than 50% of the sample in the same study indicated that they had not received enough details about the disease. The sources of this information included internet platforms, TV, and physicians.<sup>6</sup>

Our study revealed that commonly recognized symptoms included chest pain or discomfort (n =263, 65.1%) and shortness of breath (n =206, 51.0%), while fewer participants identified symptoms such as dizziness

(28.7%). Many people diagnosed with MI suffer from symptoms such as pain in the chest area, especially in the center. This pain then extends to the upper area of the body, including the arm, back, neck, and jaw. Some patients also complain of difficulty breathing, as it requires a lot of effort to catch their breath. There are some symptoms related to the digestive system, such as nausea, vomiting, and others reported, that they had an irregular heartbeat, and a feeling of general fatigue.<sup>12</sup> This finding was consistent with two studies conducted in the United States and Malaysia, where people in both studies confirmed that chest tightness and difficulty in breathing were among the signs indicating that the patient was having a heart attack. Regarding dizziness, a small percentage of people were aware of this sign.<sup>13,14</sup> Moreover, most respondents believed the appropriate first action during a heart attack was to call an ambulance (n =223, 55.2%). A high percentage (n =360, 89.1%) agreed that a heart attack requires prompt treatment. Participants in Saudi Arabia and the United States agreed that a heart attack is an emergency condition that requires immediate treatment and most of participants agreed that calling an ambulance is one of the most important initial steps to control the symptoms of an attack. They were also able to identify the ambulance phone number during the interviews.<sup>15,16</sup>

On the risk factors for heart attacks, smoking (78.2%), obesity (67.3%), cholesterol (55.0%), and lifestyle

(55.4%) were most widely recognized. Many factors increase the likelihood of MI, including the unhealthy lifestyles that patients follow, such as not adhering to appropriate nutrition for the diseases they suffer from, as well as a lack of exercise and smoking. Additionally, some diseases are directly linked to an increased risk of developing MI, such as high blood pressure, diabetes, and high fat in the body.<sup>17</sup> Moreover, these findings were in agreement with a study in Ethiopia that aimed to

**Table 3: Participants' knowledge of stroke symptoms, risk factors and emergency response**

Questions asked	N (%)	
Have you heard of the term stroke?	358 (88.6)	
Do you know anyone who has had a stroke?	139 (34.4)	
Do you think strokes require prompt treatment?	• Yes	345 (85.4)
	• Don't know	45 (11.1)
Do you identify these as risk factors for a stroke?		
• Smoking	197 (48.8)	
• Obesity	163 (40.3)	
• Diabetes Mellitus	159 (39.4)	
• Genetic	105 (26.0)	
• Cholesterol	138 (34.2)	
• Diet	144 (35.6)	
• Alcohol	136 (33.7)	
• Stress	161 (39.9)	
• Lifestyle	142 (35.1)	
• I don't know	122 (30.2)	
If someone shows signs and symptoms of a stroke, what do you think you should do first?	• Don't know	49 (12.1)
	• Aspirin	44 (10.9)
	• Ambulance	191 (47.3)
	• HCP	5 (1.2)
	• Hospital	112 (27.7)
	• Family	3 (0.7)
Do you identify these as warning signs and symptoms of a stroke?		
• Sudden, severe headache*	118 (29.2)	
• Sudden trouble seeing in one or both eyes*	127 (31.4)	
• Sudden numbness/weakness of the face, arm/leg*	159 (39.4)	
• Sudden nosebleed*	82 (20.3)	
• Sudden confusion, trouble speaking or understanding speech*	191 (47.3)	
• Dizziness or loss of balance*	150 (37.1)	
• I don't know	150 (37.1)	
* Knowledge scored items		

Table 4: Heart attack and stroke knowledge scores by sociodemographic characteristics					
Variables		Heart attack knowledge score		Stroke knowledge score	
		Mean $\pm$ SD	P value	Mean $\pm$ SD	P value
<b>Age (years)</b>	Less than 20	2.10 $\pm$ 1.82	0.18	1.56 $\pm$ 1.67	0.02
	20-30	2.50 $\pm$ 1.71		2.36 $\pm$ 2.03	
	31-40	2.08 $\pm$ 1.57		1.73 $\pm$ 1.87	
	41-50	2.13 $\pm$ 1.65		2.17 $\pm$ 2.09	
	50 and older	1.93 $\pm$ 2.00		1.66 $\pm$ 2.27	
<b>Gender</b>	Female	2.27 $\pm$ 1.66	0.96	2.01 $\pm$ 1.96	0.65
	Male	2.26 $\pm$ 1.79		2.10 $\pm$ 2.05	
<b>Residency</b>	Village	2.04 $\pm$ 1.67	0.46	1.86 $\pm$ 1.88	0.6
	City	2.28 $\pm$ 1.72		2.06 $\pm$ 2.01	
<b>Marital status</b>	Single	2.40 $\pm$ 1.73	0.36	2.19 $\pm$ 1.99	0.48
	Married	2.13 $\pm$ 1.66		1.88 $\pm$ 2.00	
	Divorced	1.92 $\pm$ 1.68		2.08 $\pm$ 1.93	
	Widowed	1.75 $\pm$ 2.87		1.50 $\pm$ 3.00	
<b>Educational level</b>	Not educated	0.33 $\pm$ 0.58	0.003	-	0.005
	Primary	1.78 $\pm$ 1.56		1.06 $\pm$ 1.16	
	High school	1.88 $\pm$ 1.69		1.70 $\pm$ 1.86	
	Diploma	1.80 $\pm$ 1.66		1.92 $\pm$ 2.16	
	University	2.51 $\pm$ 1.69		2.24 $\pm$ 2.03	
	PhD	2.58 $\pm$ 1.88		3.17 $\pm$ 2.41	
<b>Occupation</b>	Not working	1.73 $\pm$ 1.54	0.01	1.37 $\pm$ 1.62	0.003
	Student	2.48 $\pm$ 1.76		2.34 $\pm$ 2.04	
	Employee	2.32 $\pm$ 1.65		2.12 $\pm$ 2.05	
	Retired	2.50 $\pm$ 2.28		2.00 $\pm$ 2.42	

determine the knowledge among participants related to the risk factors associated with MI. Most of the participants identified that being overweight, a smoker, and having hypertension were factors correlated with an increased risk of a heart attack, while a limited number of participants agreed that high lipids and cholesterol levels in the body are risk factors for this disease.<sup>18</sup> In the current study, most participants (n = 358, 88.6%) had heard of strokes, though only 34.4% (n = 139) knew someone who had experienced one. Strokes are a common disease worldwide, with millions of cases being recorded around the world. This health condition contributes to a significant number of deaths, especially in low-income countries.<sup>19</sup> The result from the current study is consistent with a study in Sudan, in which participants were asked about their awareness of strokes. The majority of participants (more than 90% of them), confirmed that they had heard about them, and a significant majority of them were able to identify the symptoms.<sup>20</sup> In an Indian study that aimed to assess

stroke awareness, most participants reported having knowledge of this health condition, while some others reported that they had a relative or family member who had had a stroke before.<sup>21</sup>

A large majority in our study (n = 345, 85.4%) believed strokes require prompt treatment. A stroke is an emergency that requires immediate action to protect the patient from the risk of complications. Therefore, the initial assessment process, treatment provided, and managing this condition directly within an hour of the patient's arrival at the hospital are important matters that healthcare providers must pay attention to.<sup>22</sup> This is what was observed from a study on Australians, where more than half of them said that they were taken by ambulance only for experiencing the symptoms of a stroke, which include blurred vision and the inability to speak, etc.<sup>23</sup> In this study, while nearly half identified smoking (48.8%) as a risk factor for stroke, fewer recognized others, such as obesity (40.3%), diabetes (39.4%), and

**Table 5: Multivariate logistic regression of sociodemographic factors associated with higher heart attack and stroke knowledge scores**

Variables		Heart attack score		Stroke score	
		OR (95% CI)	P-value	OR (95% CI)	P-value
<b>Age (years)</b>	Less than 20	Reference			
	20-30	1.28 (0.63–2.61)	0.489	2.14 (1.03–4.44)	0.042
	31-40	1.05 (0.40–2.74)	0.919	1.74 (0.64–4.72)	0.279
	41-50	0.86 (0.30–2.46)	0.777	2.89 (0.98–8.50)	0.054
	50 and older	0.81 (0.23–2.82)	0.736	1.18 (0.30–4.60)	0.811
<b>Gender</b>	Female	Reference			
	Male	0.63 (0.39–1.00)	0.050	0.72 (0.45–1.17)	0.185
<b>Residency</b>	Village	Reference			
	City	1.03 (0.43–2.47)	0.943	1.36 (0.52–3.54)	0.533
<b>Marital status</b>	Single	Reference			
	Married	1.23 (0.61–2.48)	0.566	1.36 (0.65–2.84)	0.417
	Divorced	1.34 (0.34–5.32)	0.679	1.55 (0.35–6.84)	0.561
	Widowed	0.94 (0.08–11.78)	0.964	1.34 (0.10–18.55)	0.827
<b>Education</b>	Primary or uneducated	Reference			
	High school	1.24 (0.41–3.78)	0.701	4.06 (0.83–19.79)	0.083
	Diploma	1.06 (0.28–4.07)	0.933	5.04 (0.90–28.36)	0.067
	University	2.11 (0.71–6.24)	0.180	5.80 (1.22–27.65)	0.027
	PhD	2.51 (0.50–12.54)	0.262	13.13 (1.81–95.26)	0.011
<b>Occupation</b>	Not working	Reference			
	Student	2.48 (1.08–5.69)	0.032	3.97 (1.66–9.45)	0.002
	Employee	1.52 (0.80–2.90)	0.201	1.47 (0.75–2.88)	0.260
	Retired	2.31 (0.65–8.22)	0.197	3.06 (0.80–11.75)	0.103

stress (39.9%). Australian patients in a previous study also demonstrated similar knowledge of risk factors associated with strokes, as many of them confirmed that smoking and stress were among the most significant risk factors for strokes. For other risk factors, such as not having a healthy diet, obesity, high blood pressure, and others, only a small number of participants knew them.<sup>24,25</sup> Regarding emergency response to a stroke, 47.3% (n = 191) would call an ambulance if stroke symptoms appeared. This is in line with two studies in Australia and Ireland, in which less than 50% of participants stated that they would call an ambulance when experiencing stroke symptoms.<sup>26,27</sup>

In this study, commonly identified warning signs for stroke included sudden numbness or weakness (39.4%), trouble seeing (31.4%), and severe headaches (29.2%). When a person is exposed to a stroke, there are some common signs across men and women, such as changes in the face as the skin sags, and the patient becomes unable to move their arm or to speak. There are also

some other symptoms, such as lack of sensation in the limbs, difficulty speaking, blurred vision, lack of balance when walking, and severe headaches.<sup>28</sup> In a study conducted in Saudi Arabia, participants' responses regarding the signs related to stroke were ranked, first were some visual and physical changes, then some changes in the heart, and finally changes in the nervous system, with some confirming they had some changes in sensation, chest pain, and weakness in the extremities.<sup>29</sup> In this study, individuals aged 20-30 years had a significantly higher chance of having a higher stroke knowledge score compared to those under 20 (OR = 2.14, 95% CI: 1.03–4.44, p = 0.042). Males showed a slightly lower likelihood of heart attack knowledge compared to females (OR = 0.63, 95% CI: 0.39–1.00, p = 0.05). In Saudi Arabia, a study was performed looking at the relationship between age and knowledge. The results contradicted our study, as older participants had more knowledge about stroke symptoms. In addition, males reported greater

knowledge of these symptoms than females, which is inconsistent with the current study.<sup>30</sup> Higher educational levels, especially PhD holders, were strongly associated with higher stroke knowledge scores (OR = 13.13, 95% CI: 1.81–95.26,  $p = 0.011$ ). This result aligned with a study on Jordanian citizens, which showed a direct relationship between educational level and knowledge about strokes.<sup>31</sup>

## 5. LIMITATIONS

This study has limitations. The cross-sectional survey study design does not allow the examination of causality among the study variables. The online survey study design using a convenience sampling technique introduces selection bias and restricts the generalizability of the study findings as not all the targeted study population are users of social media platforms. Additionally, this study is prone to reporting bias. CVD diagnosis was self-reported by the study participants and not confirmed by specialised healthcare professionals. Therefore, the study findings should be interpreted carefully.

## 6. Future Direction

Future longitudinal studies should examine the awareness and attitudes of CVD patients. Future research should confirm the clinical diagnosis by reviewing medical records or through healthcare professionals. Furthermore, future research should examine the impact of CVD types and duration on awareness levels. Random sampling techniques should be applied to enhance the generalizability of future research findings.

## 7. CONCLUSION

Although participants were typically aware of heart attacks and strokes, their personal exposure and detailed knowledge varied. Younger adults (20–30 years) exhibited substantially superior stroke knowledge in comparison to those under the age of 20. Males exhibited marginally lower levels of awareness about heart attacks than females. Notably, there was a significant correlation between increased stroke knowledge and higher educational attainment, particularly at the PhD level.

## 8. Data availability

The numerical data generated during this research are available from the authors. All authors declare that there was no conflict of interest.

## 9. Funding

The study utilized the hospital resources only, and no external or industry funding was involved.

## 10. Authors' contribution

KAA: Conceptualization, investigation, methodology, resources, validation, writing- original draft, writing – review and editing.

ATH, FTH, FHA: investigation, resources, writing- original draft, writing – review and editing

## 11. REFERENCES

1. American Heart Association. 2025 Heart Disease and Stroke Statistics Update Fact Sheet. Dallas: AHA; 2025. Available from: <https://www.heart.org/en/healthy-living/healthy-lifestyle/lifes-essential-8>. Accessed May 25, 2025.
2. American Stroke Association. hablemos sobre Ataque o derrame cerebral, AIT y señales de aviso. Dallas: ASA; 2025. Available from: <https://www.stroke.org/-/media/stroke-files/spanish-resources/ltas-stroke-tia-and-warning-signs.pdf>
3. American Heart Association. Life's Essential 8™: Your checklist for lifelong good health. Dallas: AHA; 2025. Available from: <https://www.heart.org/en/healthy-living/healthy-lifestyle/lifes-essential-8>. Accessed May 25, 2025.
4. Alshakarah A, Muriyah D, Alsaghir F, Alanzi R, Almalki S, Alsadan S, et al. Awareness and Knowledge of Cardiovascular Diseases and Its Risk Factors Among Women of Reproductive Age: A Scoping Review. *Cureus*. 2023;15(12):e49839. [PubMed] DOI: 10.7759/cureus.49839
5. Alaamri S, Naser AY. Knowledge, attitude, and practice regarding cardiovascular diseases in Saudi Arabia: A cross-sectional study. *Medicine*. 2025;104(9):e41597. [PubMed] DOI: 10.1097/MD.00000000000041597
6. American Heart Association. What Is a Heart Attack? Dallas: AHA; 2025. Available from: <https://www.heart.org/en/health-topics/heart-attack/about-heart-attacks>
7. World Health Organization. Cardiovascular diseases (CVDs). Geneva: WHO; 2021. Available from: [https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-\(cvds\)](https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)). Accessed May 25, 2025.
8. American Heart Association. A Decade of Lost Ground in the Awareness of Heart Disease Symptoms in Women: A Call to Action. Dallas: AHA; 2024. Available from: <https://professional.heart.org/en/science-news/ten-year-differences-in-womens-awareness-related-to-coronary-heart-disease/Commentary>. Accessed May 25, 2025.
9. Hemmo SI, Naser AY, Alwafi H, Mansour MM, Alanazi AFR, Jalal Z, et al. Hospital Admissions Due to Ischemic Heart Diseases and Prescriptions of Cardiovascular Diseases Medications in England and Wales in the Past Two Decades. *Int J Environ Res Public Health*. 2021;18(13). [PubMed] DOI: 10.3390/ijerph18137041

10. Ahmed AAA, Al-Shami AM, Jamshed S, Fata Nahas AR. Development of questionnaire on awareness and action towards symptoms and risk factors of heart attack and stroke among a Malaysian population. *BMC Public Health*. 2019;19(1):1300. [PubMed]
11. American Heart Association. Diagnosing a Heart Attack. Dallas: AHA; 2025. Available from: <https://www.heart.org/en/health-topics/heart-attack/warning-signs-of-a-heart-attack>
12. American Heart Association. Warning Signs of a Heart Attack. Dallas: AHA; 2025. Available from: <https://www.heart.org/en/health-topics/heart-attack/warning-signs-of-a-heart-attack>
13. Abdo Ahmed AA, Mohammed Al-Shami A, Jamshed S, Fata Nahas AR, Mohamed Ibrahim MI. Public Awareness of and Action towards Heart Attack Symptoms: An Exploratory Study. *Int J Environ Res Public Health*. 2020;17(23). [PubMed]
14. Kim SJ. Global Awareness of Myocardial Infarction Symptoms in General Population. *Korean Circ J*. 2021;51(12):997-1000. [PubMed] DOI: 10.4070/kcj.2021.0320
15. Fang J, Luncheon C, Ayala C, Odom E, Loustalot F. Awareness of Heart Attack Symptoms and Response Among Adults - United States, 2008, 2014, and 2017. *MMWR Morb Mortal Wkly Rep*. 2019;68(5):101-6. [PubMed] DOI: 10.15585/mmwr.mm6805a2
16. Serafi A, Alotibi F, Bamerdah S, Dahlawi M, Batarfi R, Tariq S. Awareness Of Heart Attack Symptoms and Action Toward It Among General Population In Saudi Arabia: A Cross Sectional Study. 2022.
17. National Heart, Lung, and Blood Institute. Heart Attack: Causes and Risk Factors. Bethesda: NHLBI; 2022. Available from: <https://www.nhlbi.nih.gov/health/heart-attack/causes>. Accessed June 14, 2025.
18. Negesa LB, Magarey J, Rasmussen P, Hendriks JML. Patients' knowledge on cardiovascular risk factors and associated lifestyle behaviour in Ethiopia in 2018: A cross-sectional study. *PLoS One*. 2020;15(6):e0234198. [PubMed] DOI: 10.1371/journal.pone.0234198
19. He Q, Wang W, Zhang Y, Xiong Y, Tao C, Ma L, et al. Global, Regional, and National Burden of Stroke, 1990-2021: A Systematic Analysis for Global Burden of Disease 2021. *Stroke*. 2024;55(12):2815-24. [PubMed] DOI: 10.1161/STROKEAHA.124.048033
20. Eltayib EM, Jirjees F, Suliman D, AlObaidi H, Ahmed M, Kharaba ZJ, et al. Stroke awareness and knowledge in Sudan: a cross-sectional analysis of public perceptions and understanding. *Front Public Health*. 2024;12:1362979. [PubMed] DOI: 10.3389/fpubh.2024.1362979
21. Sirisha S, Jala S, Vooturi S, Yada PK, Kaul S. Awareness, Recognition, and Response to Stroke among the General Public-An Observational Study. *J Neurosci Rural Pract*. 2021;12(4):704-10. [PubMed] DOI: 10.1055/s-0041-1735822
22. Powers WJ, Rabinstein AA, Ackerson T, Adeoye OM, Bambakidis NC, Becker K, et al. Guidelines for the Early Management of Patients With Acute Ischemic Stroke: 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. *Stroke*. 2019;50(12):e344-e418. [PubMed] DOI: 10.1161/STR.0000000000000211
23. Grady A, Carey M, Sanson-Fisher R. Assessing awareness of appropriate responses to symptoms of stroke. *Patient Educ Couns*. 2014;95(3):400-5. [PubMed] DOI: 10.1016/j.pec.2014.03.007
24. Qadus S, Naser AY, Ofori-Asenso R, Ademi Z, Al Awawdeh S, Liew D. Adherence and Discontinuation of Disease-Specific Therapies for Pulmonary Arterial Hypertension: A Systematic Review and Meta-Analysis. *Am J Cardiovasc Drugs*. 2023;23(1):19-33. [PubMed] DOI: 10.1007/s40256-022-00553-6
25. Sug Yoon S, Heller RF, Levi C, Wiggers J, Fitzgerald PE. Knowledge of stroke risk factors, warning symptoms, and treatment among an Australian urban population. *Stroke*. 2001;32(8):1926-30. [PubMed] DOI: 10.1161/01.str.32.8.1926
26. Hickey A, Holly D, McGee H, Conroy R, Shelley E. Knowledge of stroke risk factors and warning signs in Ireland: development and application of the Stroke Awareness Questionnaire (SAQ). *Int J Stroke*. 2012;7(4):298-306. [PubMed] DOI: 10.1111/j.1747-4949.2011.00698.x
27. Mosley I, Nicol M, Donnan G, Patrick I, Dewey H. Stroke symptoms and the decision to call for an ambulance. *Stroke*. 2007;38(2):361-6. [PubMed] DOI: 10.1161/01.STR.0000254528.17405.cc
28. American Heart Association. Stroke Symptoms. Dallas: AHA; 2025. Available from: <https://www.stroke.org/en/about-stroke/stroke-symptoms>. Accessed June 14, 2025.
29. Mubarak AA, Alqahtani AS, Almalki AA, Almalki AH, Alamri HM, Aburass MK, et al. Stroke Knowledge and Response Among the General Population in Saudi Arabia: A Population-Based Survey. *Cureus*. 2024;16(7):e65587. [PubMed] DOI: 10.7759/cureus.65587
30. Mubarak AA, Alqahtani AS, Almalki AA, Almalki AH, Alamri HM, Aburass MK, et al. Public knowledge and awareness of stroke among the adult population in Taif city, Saudi Arabia. *Neurosciences*. 2021;26(4):339-45. [PubMed] DOI: 10.17712/nsj.2021.4.20210057
31. Barakat M, AlSalamat H, Jirjees F, Al-Obaidi H, K Hussain Z, El Hadidi S, et al. Factors Associated with Knowledge and Awareness of Stroke Among the Jordanian Population: A Cross-Sectional Study. *F1000Res*. 2021;10:1242. [PubMed] DOI: 10.12688/f1000research.74492.2