

Stroke knowledge among middle and high school students

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Abstract

Objective: To determine the awareness of stroke symptoms and risk factors in middle and high school students at a single institution.

Methods: An 11-question multiple-choice stroke awareness survey was administered to students in grades 7 to 12 at City High Middle School in Grand Rapids, Michigan, United States. Summary statistics were calculated.

Results: A total of 603/608 surveys were analyzed. Only 8% of respondents correctly identified stroke as the fifth leading cause of death in the United States. Half (50.1%) recognized that a stroke occurred in the brain. Sixty-seven students (11.1%) correctly identified all 11 stroke risk factors. Only 5.1% correctly selected all four correct stroke symptoms. Two-thirds (64.5%) recognized stroke as an immediate medical emergency. Slightly more than half (55.9%) knew the acronym FAST (face, arms, speech, time).

Conclusions: Most students in our study were unaware of all the risk factors and symptoms related to stroke. Although this study was limited because data were collected from only one school, the findings suggest a need to educate middle and high school students about stroke risk factors, symptoms and acute interventions.

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Keywords

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Introduction

Stroke is the fifth leading cause of death and a leading cause of adult disability in the United States.¹ Most strokes (87%) are ischemic. This type of stroke is treated acutely by administering intravenous recombinant tissue plasminogen activator (rt-PA) therapy, the only intravenous treatment approved by the US Food and Drug Administration. There are restricted time windows in which the treatment interventions of rt-PA and mechanical thrombectomy can be considered for acute stroke patients; these include 4.5 hours and 24 hours, respectively, from when the patient was last seen well.² Therefore, an important aspect of stroke care is timing, or what has been termed ‘time is brain’. If treatment is delayed, rt-PA potency and the beneficial effects of mechanical thrombectomy are substantially reduced. If untreated, a patient experiencing an ischemic stroke may lose 1.9 million neurons each minute.³ Most stroke patients do not reach hospital in a timely manner and thus are not eligible for rt-PA treatment.⁴ One reason for delayed hospital arrival time of stroke patients is inadequate stroke knowledge.⁵

Public awareness and identification of basic stroke symptoms, particularly by family and friends or bystanders, is imperative to help ensure that proper, timely acute stroke treatment is received. Many studies have evaluated stroke knowledge in adult populations using interviews and surveys; however, youth and adolescent populations are typically not represented in stroke research. Some national and international

studies have investigated stroke knowledge among adolescents, but more data are needed, particularly for urban samples. Therefore, we conducted a study to assess stroke knowledge among grade 7 to 12 middle and high school students from an urban public school in Grand Rapids, Michigan, USA. A secondary study aim was to compare stroke knowledge between grade levels, gender, race, body mass index (BMI) and parental education.^{6–10}

Methods

Study permission

The study was approved by the regulatory office of City High Middle School in Grand Rapids, MI. No subject consent was required because no identifiable data were collected.

Study design and survey administration

This cross-sectional study used a convenience sample of high school students in an urban setting. The research team members were trained to conduct the stroke survey by local stroke study experts in Grand Rapids. All grade 7 to 12 students present on April 19, 2018, at City High Middle School were surveyed. The school is an International Baccalaureate public high school; hence, some of the curriculum taught at City High Middle School does not correspond to traditional public school education. Each classroom was monitored by a member of the research team who introduced the survey and answered questions

about the study before administration (Appendix A). Each classroom took approximately 10 to 15 minutes to complete the survey; however, students who required more time were allowed to stay until they had completed their questionnaire. Surveys were collected by the supervising investigator immediately after completion.

Survey design

The questionnaire included items to assess demographic information, general stroke knowledge, risk factors and symptoms, and emergency response information (Appendix A). Questions 1 to 7 were designed to test basic knowledge and understanding of stroke; for example, if there is another name for stroke (brain attack), which part of the body is affected by stroke, if pain is associated with stroke, if stroke is a leading cause of death in the USA and how stroke affects women as compared with breast cancer. Question 8 was designed to test awareness of stroke risk factors. Respondents were asked to select all the stroke risk factors they recognized from a list of 20 potential factors. This question was scored by assigning 0.5 points to each correct risk factor response. Incorrect or missed risk factor responses did not count against the respondent's score. To limit response bias, surveys on which all 20 risk factors had been selected as correct received zero points for this question. The inclusion of pseudo-risk factors (e.g. energy drinks, long distance running, lead poisoning) also tested response bias. American Heart Association and American Stroke Association guidelines¹¹ were used to generate the following 11 genuine risk factors: high blood pressure, high blood glucose, high cholesterol, smoking, narrowing of neck vessels, abnormal heart rhythm, a diet rich in cholesterol (e.g. fast foods), being overweight or obese, sedentary

lifestyle/inactivity/lack of exercise, excessive use of alcohol and excessive use of recreational drugs. The maximum possible score for this question was 5.5 (11 possible correct answers).

Question 9 tested stroke symptom knowledge. This question was assessed in the same way as question 8 in terms of point distribution and bias control. Of the possible symptom choices, only four were correct: sudden trouble seeing in one or both eyes, drooping on one side of the face, sudden slurred speech or confusion, and sudden headache with no known cause. The maximum possible score for this question was 2 because each correct response was worth 0.5 points.

Question 10 tested the ability to recognize stroke as a medical emergency. To receive a point for this question, the respondent was required to select option 3, 'Call 911'. Selection of any other response was considered incorrect. Question 11 tested the respondents' ability to identify the FAST (facial droop, arm weakness, speech difficulty, time) acronym, which is used as a mnemonic device to identify the initial stroke signs.

Statistical analysis

Summary statistics were calculated for the sample data. Quantitative data are shown as the mean \pm standard deviation. Nominal data are shown as percentages. The relationship between age and stroke knowledge score was assessed using the Pearson correlation coefficient. One-way analysis of variance (ANOVA) was used to determine differences in stroke knowledge by grade level, gender, race, BMI and parental education. If the ANOVA analysis was significant, pairwise comparisons were performed using Tukey's test. Significance was assessed at $P < 0.05$. All analyses were performed using IBM SPSS

Statistics, Version 23 (IBM Corp., Armonk, NY, USA).

Results

A total of 608 surveys were collected, of which 5 had missing data on stroke knowledge. The 608 surveys accounted for 69.9% of the school’s population because there were 863 enrolled grade 7 to 12 students at the time of the survey. Respondent characteristics for the 603 surveys that were

analyzed are described in Table 1. The percentage of stroke-based knowledge questions with one correct response is shown in Table 2. The average score on the stroke-based knowledge portion of the questionnaire was 8.6 ± 2.5 points. Only 8% of respondents correctly identified stroke as the fifth leading cause of death in the United States. Half of students (50.1%) recognized that a stroke occurred in the brain. Sixty-seven students (11.1%) correctly identified all 11 stroke risk factors, but only 5.1% correctly selected all four correct stroke symptoms. Two-thirds (64.5%) recognized stroke as an immediate medical emergency. Slightly more than half of participants (55.9%) knew the acronym FAST. Notably, there was a statistically significant, although weak, positive correlation between age and stroke knowledge scores ($P < 0.001$; $r = 0.18$).

Table 1. Respondent characteristics.

Age (years)*	14.8 ± 1.7
Gender	
Male	273/592 (46.1%)
Female	297/592 (50.2%)
Other	22/592 (3.7%)
Race	
Caucasian	280/587 (47.7%)
Hispanic	115/587 (19.6%)
Black or African American	48/587 (8.2%)
Asian	40/587 (6.8%)
Multiracial	94/587 (16.0%)
Other	10/587 (1.7%)
Parental education – some college education or above	
Mother	386/582 (66.3%)
Father	313/581 (53.9%)

*Data are means ± standard deviations.

Subanalyses

Table 3 shows comparisons of stroke knowledge scores for gender, race, BMI, grade level and parental education levels. No significant differences were observed for gender, BMI or father’s education level.

Table 2. Respondent stroke-based knowledge.

Stroke-based knowledge	% Correct
Stroke occurs in the brain	302/603 (50.1%)
Another name for stroke is ‘brain attack’	185/603 (30.7)
Women are more likely to die from breast cancer than from stroke (False)	315/603 (52.2%)
Pain is the most common symptom of stroke (False)	409/603 (67.8%)
Stroke is the 5th leading cause of death in the USA	48/603 (8.0%)
Heart disease causes more deaths than stroke	329/603 (54.6%)
Children, teens, adults and seniors are all at risk of stroke	282/603 (46.8%)
Stroke is an emergency and you should call 911 when you see someone having a stroke	389/603 (64.5%)
Awareness of the acronym FAST	337/603 (55.9%)

Table 3. Subgroup survey score comparisons*.

Variable	n	Score [^]	P-value
Gender			
Male	273	8.7 ± 2.4	0.49 [†]
Female	297	8.5 ± 2.5	
Other	22	8.1 ± 3.1	
Race			
Asian	40	8.9 ± 2.6	<0.001 ^a
Black or African American	48	8.4 ± 2.7	
Caucasian	280	9.0 ± 2.6 ^a	
Hispanic	115	7.7 ± 2.1 ^a	
Multiracial	94	8.5 ± 2.3	
Other	10	8.1 ± 3.3	
BMI category (kg/m²)			
Underweight (<18.5)	127	8.8 ± 2.3	0.37 [†]
Normal weight (18.5 to <25)	309	8.5 ± 2.4	
Overweight (25 to <30)	64	8.6 ± 2.7	
Obese (≥30)	26	9.3 ± 2.0	
Grade			
7th	66	8.0 ± 2.1 ^{a,b}	0.04 ^a , 0.001 ^b , 0.006 ^c , <0.001 ^d , 0.004 ^e
8th	150	8.0 ± 2.1 ^{c,d}	
9th	113	8.3 ± 3.0 ^e	
10th	110	9.1 ± 2.3 ^{a,c}	
11th	84	9.5 ± 2.3 ^{b,d,e}	
12th	72	8.9 ± 2.6	
Father's education			
Did not complete high school	77	8.0 ± 2.4	0.158 [†]
High school/GED	76	8.4 ± 2.3	
Some college	70	8.7 ± 2.8	
Bachelor's degree	108	9.1 ± 2.4	
Master's degree	96	8.5 ± 2.8	
Advanced grad work/PHD	39	8.6 ± 2.4	
Not sure	115	8.4 ± 2.2	
Mother's education			
Did not complete high school	52	7.5 ± 2.5 ^{a,b}	0.015 ^a , 0.028 ^b
High School/GED	59	8.6 ± 2.3	
Some college	76	9.0 ± 2.4 ^a	
Bachelor's degree	134	8.8 ± 2.6 ^b	
Master's degree	107	8.3 ± 2.6	
Advanced grad work/PHD	49	8.8 ± 2.7	
Not sure	105	8.7 ± 2.2	

*Data are mean ± standard deviations. BMI: body mass index; GED: General Education Development.

[^]A letter shared by two groups denotes significant differences between those groups; all other comparisons, $P > 0.05$.

[†]Overall P-value for ANOVA; pairwise comparisons were not performed.

Race

Caucasian students scored significantly higher than Hispanic students on overall stroke knowledge ($P < 0.001$). Similar scores were noted across other race categories.

Grade level

The 7th grade students scored significantly lower than 10th graders ($P = 0.04$) and 11th graders ($P = 0.001$). The 8th grade students scored significantly lower than 10th graders ($P = 0.006$) and 11th graders ($P < 0.001$). The 9th grade students scored significantly lower than 11th grade students ($P = 0.004$). No other significant differences between grade levels were noted.

Parental education level

Students whose mothers did not complete high school scored on average significantly lower than those whose mothers had a bachelor's degree ($P = 0.028$) or some college education ($P = 0.015$). No other significant differences were noted.

Discussion

Our results suggest that stroke knowledge among middle school and high school students is relatively lower than reported for other studies from different countries.^{6,7,12} This lack of knowledge of stroke risk factors and symptoms is a major public health challenge because stroke is common and may present as a medical emergency. Of our respondents, 64.5% reported that they would call 911 in case of a stroke and only 55.9% were aware of the acronym FAST. Therefore, there is a potential need to educate adolescents about stroke. The relatively high recognition of the acronym FAST was probably a result of increased awareness of the term created by the medical club members during stroke awareness month,

which preceded the questionnaire administration.

The establishment of a healthier lifestyle during adolescence is potentially important for decreasing the occurrence of stroke in later life. Overall knowledge of stroke symptoms and risk factors is low in youths and adolescents. However, youths can be educated about stroke risk factors and how to respond to a medical emergency by increasing awareness of stroke and its risk factors and symptoms. A stroke educational program in Texas, which educated 325,000 children about the symptoms of stroke and importance of early treatment, helped to increase the number of stroke patients treated with t-PA in the local area.⁸ A study of Korean high school students showed a significant increase (33%) in recognition of stroke risk factors immediately after a 50-minute lecture.⁹ The results of 'Hip-Hop Stroke', a New York school-based stroke communication intervention and stroke literacy program, suggest that educating 5th and 6th grade public school students about stroke is an effective way to increase their parents' awareness of stroke.¹³ A study from Portugal involving 8th grade students and one of their parents in seven public schools showed that school-based interventions may improve stroke knowledge in middle school students and their parents.¹⁰

Various educational campaigns could be implemented, not only in school curricula, but also at public events. Educating groups of students through seminars may help to improve stroke knowledge. The use of posters, television and radio advertisements, and the distribution of flyers could also improve stroke knowledge. Proper cardiovascular and stroke education is important for adolescents because their future cardiovascular and brain health may be based on current habits and behaviors.

Our data showed little difference in stroke knowledge and awareness between

high school age boys and girls. In contrast, several previous studies indicate that women may have better recognition of stroke risk factors and symptoms and better general stroke knowledge.^{14,15} However, our study population comprised students with very comparable education levels, which may explain the lack of difference between boys and girls. Similar findings were reported in a study of high school students in Nepal;⁶ a non-significant correlation was reported for knowledge and gender, although boys were able to identify stroke risk factors and symptoms slightly better than girls.⁶

Our study participants were asked to select from the following racial group choices: Caucasian, Black or African American, Asian American, Native American, Hispanic, and Asian. The question also had an 'Other' option, which allowed students to add their given race if not listed. Those who selected more than one category were combined into a multiracial group. Hispanics achieved the lowest average scores whereas Caucasians achieved the highest average scores. A study that analyzed data collected from various Spanish-speaking populations in South America, Latin America and Spain identified a problem with participants' understanding of the term 'ictus', which is the word for 'stroke' in Spanish.¹⁶ Almost none of the respondents in this previous study associated 'ictus' with stroke; the closest term to 'stroke' was 'embolia' (embolism), which was recognized by a larger portion of the Spanish-speaking participants.¹⁶ This language barrier may partly explain why our Hispanic participants had less knowledge of stroke, assuming that they grew up speaking Spanish. This is a major concern because Hispanics may have a higher risk of stroke because they tend to have higher rates of obesity and diabetes mellitus, and are less physically active.¹⁷ As in other studies,¹⁸ we found

that African American participants had lower stroke knowledge than other ethnic groups, especially Caucasians (although they scored higher than Hispanic students).

Diet is another factor linked to stroke risk. There is a relationship between an unhealthy diet and a poor metabolic profile.¹⁹ A study of Nigerian secondary school students found that students considered obese had less knowledge of stroke risk factors and symptoms.¹² This pattern was not observed in our study; obese students had a better understanding of stroke risk factors and stroke signs and symptoms than normal weight and underweight students. This could be because primary care physicians emphasize stroke risk factors to individuals with poor diets and sedentary lifestyles.

Socioeconomic status is a primary predictor of health. According to one survey of approximately 2,400 adults, educational level, income, employment status and health are independent predictors of stroke knowledge.²⁰ In our survey, we used the surrogate measure of parental education level to assess the contribution of socioeconomic status to stroke knowledge. When surveyed, parents with a higher education level tended to have better awareness of stroke.²¹ Therefore, students' awareness of stroke may be linked to the education level of their parents. We found no relationship between survey scores and father's level of education. However, there was a significant association, although no real trends, between survey scores and mother's level of education.

There are several study limitations. A main limitation is that the results were drawn from a specialized student base from one school, which raises the possibility of selection bias. Furthermore, the academic rigor and the relatively high diversity at our school mean that the findings may not be generalizable to many middle schools and high schools in the USA. These

characteristics of the school may contribute to the relatively high level of stroke knowledge found. Because there was no comparison population, the data may not be fully representative of all high school and middle school students in Michigan or nationwide.

We attempted to limit patterned responses for questions 8 and 9 by including non-stroke risk factors and symptoms. Previous studies show that closed-ended surveys such as used here produce higher scores than open-ended surveys. The responses to open-ended questions reveal exactly what the respondent knows. In contrast, closed-ended questions make it easier for respondents to guess the correct answer. Response bias may also have affected the present results. To limit this, future studies should add an 'unsure' option to the 'yes' and 'no' options.

Conclusion

Data from studies such as this provide information about awareness of stroke among youths; however, additional studies in different school systems and states are warranted. Our next step is to conduct a similar study after educating the City High Middle School students about which interventions may be effective for educating youths about stroke risk factors and signs and symptoms.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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APPENDIX A

Study ID _____

Hello everyone! Thank you for taking the time to help City High’s Medical Club conduct this survey. In front of you, there is a survey/questionnaire that consists of questions about awareness of stroke symptoms and risk factors. Your responses are anonymous, so please don’t write your name on the survey. It is very important that you take this survey seriously and answer the questions to the best of your ability. The information will be valuable to the community as it will allow the City High Medical Club to spread awareness about stroke, to potentially save lives by preventing stroke, and to possibly help stroke victims. If you have any questions, raise your hand and we will be happy to address them.

1. In what part(s) of the body does a stroke occur? (Circle all that apply)

Heart Lungs Brain Kidneys Stomach

2. What is another name for stroke? (Circle all that apply)

Heart attack Seizure Brain attack Hay fever Pneumonia

3. Women are more likely to die from breast cancer than from stroke. (Circle only one)

True False

4. The most common sign of a stroke is pain. (Circle only one)

True False

5. Stroke is which leading cause of death in the USA? (Circle only one)

1st 2nd 3rd 4th 5th 6th

6. Stroke causes more deaths than heart disease in the USA. (Circle only one)

True False

7. Who is affected by stroke? (Check all that apply)

Children & Infants _____

Teens & Young Adults _____

Adults _____

Seniors _____

8. Which of the following are known to increase the risk of stroke? (Check all that apply)

I. High blood pressure _____

II. Energy drinks _____

III. Recreational drugs such as cocaine _____

IV. Long distance running _____

V. High blood sugar _____

VI. Concussion _____

VII. High cholesterol _____

VIII. Smoking _____

IX. Narrowing of neck vessels _____

X. Abnormal heart rhythm _____

XI. A diet rich in cholesterol (e.g. fast foods) _____

XII. Excessive use of fish _____

XIII. A diet rich in salt _____

XIV. Being overweight or obese _____

XV. Sedentary life style, inactivity and lack of exercise _____

XVI. Excessive use of alcohol _____

XVII. Lead poisoning _____

XVIII. Snoring _____

XIX. Playing videos games for more than 1 hour a day _____

XX. Less than 6 hours of sleep in 24 hours _____

9. Which of the following are common signs/symptoms of stroke? (Check all that apply)

- I. Sudden trouble seeing in one or both eyes _____
- II. One side of the face may droop _____
- III. Sudden slurred speech or confusion _____
- IV. Sudden headache with no known cause _____
- V. Sudden numbness involving the whole body _____

10. What should you do if you think someone is having a stroke? (Check only one)

- I. Tell them to lie down and take a nap _____
- II. Call the family doctor to make an appointment _____
- III. Call 911 _____
- IV. Tell them to drink lots of water _____
- V. Tell them to take aspirin _____

11. What does the acronym FAST stand for? (Check only one)

- I. Fluctuating consciousness – Altered thinking – Speech difficulties – Tinnitus (ear ringing) _____
- II. Facial drooping – Arm Weakness – Speech difficulties – Time _____
- III. Facial drooping – Altered thinking – Stuttering – Time _____
- IV. Fluctuating consciousness – Altered thinking – Speech difficulties – Time _____
- V. Flickering vision – Altered taste sensation – Stuttering – Tinnitus (ear ringing) _____

That's all the stroke questions. Now, please tell us a bit about yourself _____

Age _____

Current Grade _____

Gender: ♦ Male ♦ Female ♦ Other (Circle only one)

Race/Ethnicity: (Circle all that apply)

Caucasian, Black or African American, Asian American, Hispanic, Native American, Asian, Other

Height feet _____ inches _____

Approximate weight _____

What is the highest level of education completed by your father? (Check only one)

- Did not complete high school _____
- High school/GED _____
- Some college _____
- Bachelor's degree _____
- Master's degree _____
- Advanced graduate work or PhD _____
- Not sure _____

What is the highest level of education completed by your mother? (Check only one)

- Did not complete high school ____
- High school/GED ____
- Some college _____
- Bachelor's degree _____
- Master's degree _____
- Advanced graduate work or PhD _____
- Not sure _____

How many people live in your house on a regular basis?:

Do you smoke cigarettes? Yes No (Circle only one)

Do you drink alcohol on a regular basis? Yes No (Circle only one)

Thank you! If you have any questions regarding stroke, please raise your hand.