Impact of a Visual-Auditory-Kinesthetic Model-Based Educational Package on Knowledge Regarding Stroke Among Security Guards in a Tertiary Care Teaching Hospital

Parul[1], Latha Venkatesan[1], Achal Srivastava[2], Manju AK Rajora[1]

[1]College of Nursing, All India Institute of Medical Sciences, New Delhi, [2]Department of Neurology, All India Institute of Medical Sciences, New Delhi, India

Abstract

Background: Stroke is a fatal disease with huge burden worldwide. Nonetheless, it is preventable, provided risk factors are controlled. Modifiable risk factors are associated with 90% of attributable risk for stroke. The growing burden of stroke indicates that the current stroke prevention strategies are either not used properly or insufficiently effective. The study aimed to assess the prevalence of risk factors of stroke and to assess the impact of a VAK (visual-auditory-kinesthetic) model-based educational program on knowledge of stroke among security guards. **Materials and Methods:** The data were collected in two phases. In the first phase, prevalence of risk factors of stroke among security guards was assessed. In the second phase, the security guards who were found to have high risk of stroke were given the educational package employing the VAK model. The educational package included researcher-developed videos on risk factors and management of stroke, a poster on Act FAST, and a card game on symptoms of stroke. Paired t-test was used to compare the means of knowledge score before and after intervention. **Result:** The security guards had risk factors for stroke including hypertension (12.7%), smoking (59%), and obesity (29.4%). The security guards showed improvement in knowledge score regarding stroke from a mean score of 9.2 ± 1.9 to a mean score of 16.3 ± 1.2 ($P < 0.001$) after the educational intervention. **Conclusion:** Hypertension, smoking, and obesity were the most common risk factors of stroke among security guards. The VAK model-based educational package was effective in improving knowledge of security guards regarding signs, symptoms, risk factors, and action to be taken on any sign of stroke.

Keywords: Act FAST, knowledge, risk factors, security guards, stroke, VAK model

BACKGROUND

Stroke is a huge burden worldwide, with 10·3 million new strokes cases and 113 million disability adjusted life years (DALYs) per year.[1] The global stroke incidence in the past 3 decades has increased by 70%, its mortality has increased by 43%, and DALYs has increased by 32%. In India, the incidence rate of stroke is reported to be 119–145 persons per lakh population.[2]

Act FAST is one of the educational tools given by AHA-ASA which helps individuals to recognize signs of stroke and respond to stroke well in time. Act FAST helps the people to identify facial drop, arm weakness or numbness, slurred speech as signs of stroke, and time as in to immediately call 9-1-1 at any sign of stroke.[3]

The VAK model of learning was designed by Walter Burke Barbe and later developed by Neil Fleming. It is an acronym for visual (V), auditory (A), and kinesthetic (K) sensory modalities and is one of the effective learning styles by using three main senses, that is, seeing, hearing, and touching/doing.[4] Visual learning is a teaching and learning style in which ideas, concepts, data, and other information represented through images. The person takes information primarily by seeing it through pictures, diagrams, demonstrations, displays, handouts, films, flipchart, and so on. Auditory learning is all about the sense of hearing. Auditory learners absorb information best by hearing it. It involves the transfer

Address for correspondence: Dr. Manju AK Rajora,
College of Nursing, AIIMS, New Delhi, India.
E-mail: manjuakrajora@aiims.edu

Access this article online

Quick Response Code:

Website:
www.ijcm.org.in

DOI:
10.4103/ijcm.ijcm_306_23

of information through listening: to the spoken word, of self or others, of sounds and noises.[5] Kinesthetic learning is most closely associated with the sense of touch. It involves physical experience – touching, feeling, holding, doing, and practical hands-on experiences, rather than listening and watching.[6] Hardiana *et al*. (2018)[7] and Kusumawarti *et al*. (2020)[8] have reported that the VAK model is the effective learning style than the conventional learning.

India has five times as many private security guards than police officers.[9] Security guards have high prevalence of traditional risk factors as well as occupation specific risk factors for cardiovascular diseases. Their work is highly stressful due to many reasons including sudden physical exertion, acute and chronic psychological stress, shift work, and noise.[10] This high level of work-related stress leads to risk factors for cardiovascular disease which further can cause stroke.[11] Hence, it is very important to educate this major population of the country about stroke. Furthermore, security guards are the frontline workers and act as a first gatekeeper of patients' safety. Hence, training them would be of greater value to the society overall. Additionally, guards, who are themselves at high risk of stroke, are in more need of such educational intervention so that they would be able to modify their lifestyle and reduce the risk of stroke. Apart from this, there were no studies available on stoke educational programs in India, particularly among security personnel. This study would serve a purpose of community service through screening security personnel for stroke risk factors and prepare them for an appropriate response in stroke conditions. Hence, the current study aims to estimate the prevalence of risk factors of stroke among security guards and investigate the impact of VAK model-based educational intervention on stroke knowledge (identification of signs, symptoms, and response to stroke). Additionally, security guards were asked to rate their satisfaction toward the intervention.

Materials and Methods

The study was done in two phases. For phase I, cross-sectional design was employed, which included the screening of security guards for stroke risk factors. For phase II, one group pre-test post-test design was employed to assess the impact of VAK model-based educational programs and the security guards who were at high risk were purposively selected for the phase II due to limited time duration of the study.

The tertiary care teaching hospital has an enormous campus secured by around 2071 of security guards with the majority of them serving as a first entry point into the hospital and as a gatekeeper of patient safety. Study participants were selected from different departments of the institution like trauma centers, Plastic, reconstructive and burn surgery centers, student hostels, control rooms, dental education and research centers, and various outpatient departments. Security guards aged more than 18 years old working in the institution who were able to read, write, and understand Hindi were included in the study for screening of stroke risk factors. The sampling

technique used to screen the security guards was convenient sampling. The sample size calculation was done using one sample proportion formula.[12]

$$n = Z\,1{-}\beta\,[\,p1\,(1{-}p1)] + Z\,1{-}\alpha/2[po\,(1{-}po)\,2]/(p1{-}Po)\,2$$

where P1 is the anticipated proportion, that is, 0.28; Z 1–β is the desired power of study.

Z 1-α/2 is the desired level of significance

Po is the null hypothesis value or actual proportion.

p1– po is the difference between proportions.

Hence, with a power of 80% and a confidence interval of 95%, the sample size calculated was 310. However, the experts during pilot study suggested to include as many subjects possible as it included prevalence assessment. Hence, 737 security guards were enrolled in the given time duration of the study.

Intervention

VAK model-based educational intervention refers to an educational program incorporating three components, namely, risk factors, Act FAST, and management of stroke based on the VAK model. The detailed description is given in Table 1. Security guards in a group of 10–15 were given VAK model-based educational intervention on stroke. The VAK method involves the use of three senses by seeing, hearing, and touching. The visual and auditory components were implemented through a video and a poster. The kinesthetic and visual components were implemented by a card game. A 4-minute video was developed and designed with technical help from the Medical Education and Technology cell, which included overview of stroke, types of strokes, modifiable and nonmodifiable risk factors of stroke, and signs and symptoms of stroke. The video was made in Hindi language and was validated for content by five subject experts (the link of the video is given in Supplementary File 1).

A poster of size 5"3 inch was prepared with guidance from technologists of the Medical Education and Technology cell. The poster included a title in Hindi "जब STROKE का हो आघात, Act FAST से दे मात" along with pictures indicating the mnemonic FAST. The poster was validated by five subject experts.

The card game was part of VAK intervention, and it focused on visual and kinesthetic components where the security guards would identify the appropriate signs suggestive of stroke by touching, shuffling, and picking correct cards involving the movements of their hands. The participants were able to pick up the correct card because they were recalling correctly which relates to the first level of knowledge according to Bloom's taxonomy of level of learning.[13] The card game was played by each participant. Each card (total 10 cards) contained a picture of signs and symptoms of anonymous diseases and stroke as well. Each participant was asked to pick the cards which are related to signs of stroke, especially about Act FAST. The participant who picked three correct cards was declared

Table 1: Detailed description of intervention

S.N.	Educational Intervention	Media/Description	Time	No. of Security Guards
1.	Overview and risk factors of stroke	Video	4 min.	10-15 security guards at each session and a total of 6-7 sessions were conducted for all the groups.
2.	Recognition of signs and Act FAST ("जब STROKE का हो आघात, Act FAST से दे मात")	Poster (5"3 inch)	5 min.	
3.	Activity on Act FAST	Card game (Total cards=10) Each participant was asked to pick the cards which are related to signs of stroke especially about Act FAST. 3 correct cards=win Not able to pick correct cards=lose	10 min.	

as a winner. The participant who was not able to pick three correct cards lost the game. The card game was validated by five subject experts [Supplementary File 1].

Psychometrics

A stroke risk scorecard [Picture 1] is a standardized tool adapted from National Stroke Association.[14] It was used to assess the prevalence of risk factors of stroke through screening of all the security guards. The stroke risk scorecard includes a list of risk factors such as blood pressure, atrial fibrillation, smoking, cholesterol, diabetes, physical activity, weight, and stroke in family. The tool categorizes the individual into high risk, at caution, and low risk. Each box that applied to the individual is equal to 1 mark. The score is totalled at each column, and an individual person is compared for the stroke risk factors. If the score in the red column is ≥3, then the individual is at high risk for stroke; if the score in the yellow column is between 4 and 6, then the individual is at caution for stroke, and if the score in the green column is between 6 and 8, then the individual is at low risk for stroke. The interrater reliability with an intra-class correlation coefficient of the tool was 0.82.[15]

A structured stroke knowledge questionnaire was employed to assess the knowledge regarding stroke. The knowledge questionnaire had subdomains of signs, symptoms, management, and risk factors of stroke. The questionnaire was divided into two parts. The first part contained questions on signs, symptoms, and management of stroke and contained eight multiple choice questions. The second part containing questions on risk factors contained 12 (YES/NO) questions. The maximum score is 20, and the minimum is 0. This questionnaire was developed in English and was translated in Hindi by experts. The reliability of the tool was established by the test–retest method, and it was found to be 0.71. The tool was validated by seven experts in nursing and neurology.

To assess the satisfaction regarding VAK model-based educational programs, a structured satisfaction questionnaire was applied at the end of the study. The questionnaire consists of three components of the VAK model, that is, video, poster, and card game. The security guards rated the satisfaction toward the VAK model on a 5-point Likert scale. The questionnaire was developed in English and was translated in Hindi by experts. The reliability of the tool was established

Picture 1: Stroke Risk Scorecard

by the test–retest method (r = 0.76). The tool was validated by seven experts in nursing and neurology.

A standardized weighing machine and a standardized stadiometer were used to assess the weight and height of security guards. A digital BP apparatus was used to assess the blood pressure.

Procedure of data collection

The study was conducted from September 2022 to November 2022. The study approval was obtained from the Institutional Ethics Committee, and informed consent was taken from the security guards who agreed to participate after explaining the purpose and important details of the study. Written permission was taken from the chief security officer to collect data from security guards. Screening was done in areas where the attendance of security guards takes place near their check post in the above-mentioned departments. The screening was done when all security guards of new shift gather for the parade usually in the morning between 6.30 am and 7.30 am and in the night between 9.30 pm and 10.30 pm. Security guards were screened for risk factors of stroke by using stroke risk scorecards. After screening for 737 security guards, 94 security guards were found at high risk for stroke, 377 were at caution, and 266 were at low risk of having stroke. These 94 security guards were eligible for the VAK model-based Act FAST intervention. High-risk security guards were advised to consult the physician as well.

Pre-test on the knowledge regarding risk factors, signs, and symptoms and management of stroke using the self-structured knowledge questionnaire was taken from the security guards. The intervention was given in a group of 10–15 security guards during the similar timings as screening. The video and poster were shown to them in the group, and after that, the card game was played by security guards individually. Post-test was conducted after 15 days of VAK model-based Act FAST intervention [Supplementary File 2].

Data analysis

Data were collected and tabulated, and statistical analysis was done using SPSS version 26. Frequency, percentage, mean, and standard deviation were calculated in descriptive statistics to summarize the data. Paired t-test was applied to compare the means of before and after intervention. A p-value of <0.05 was considered significant. Shapiro–Wilk`s test was used to check the normal distribution of data.

RESULT

Phase I

Out of 737 security guards working in AIIMS New Delhi, 94 security guards were at high risk for stroke, 377 were at caution of stroke, and 266 guards were at low risk of stroke risk factors.

Table 2 shows that out of 737, half (50.6%) of security guards were pre-hypertensive, 8.5% were at hypertension stage I, and very few (4.2%) were at hypertension stage II. Around 59% security guards were smokers. Very few security guards (4.48%) reported irregular pulse. Most of the security guards (61.74%) were doing low physical activity, that is,

1–2 times a week. Among 737 security guards, 11.13% reported diabetes. Around 25.64% security guards were slightly overweight with BMI of 25–29.9, and 3.80% were overweight with BMI of >30. Very few security guards (3.12%) reported family history of stroke.

Phase II

Out of 737 security guards, 94 high-risk security guards were delivered VAK model-based educational programs. Table 3 shows that the mean age of high-risk security guards was 44.07 years. Most of the security guards (88.3%) were males. Most of the security guards (94.7%) were married. Around 92.6% security guards had secondary education. None of the security guards had health insurance. The majority (89%) of them had a monthly family income between 6,175 and 18,496 Indian rupees. Half of the security guards (51.1%) were working in this job as a security guard for more than 5 years.

On comparison of mean total scores of knowledge before and after VAK model-based educational programs, there was an increase in the knowledge score from baseline (9.20 ± 1.9 vs 16.32 ± 1.2). This difference was statistically significant ($P < 0.001$) [Table 4].

As shown in Table 4a, all three domains of knowledge demonstrate an increase in knowledge of security guards for signs and symptoms (46.16% vs 85.76) before and after intervention. Likewise for management of stroke, before intervention, 39.36% security guards gave correct responses, and after intervention, it increased to 89%. For risk factors of stroke, before intervention, 47.60% security guards gave correct responses, and after intervention, it increased to 93.72%. Around 80.9% security guards were able to remember Act FAST mnemonic, that is, facial drooping, arms weakness, slurred speech, and time to call. The percentage of security guards who could name stroke risk factors correctly such as high blood pressure, smoking, diabetes, high cholesterol, obesity, sedentary living, and stress after intervention was

Table 2: Prevalence of risk factors of stroke among security guards at AIIMS New Delhi n=737

S.N.	Risk Factor		Frequency (%)
1.	Age (years)	>50 years	81 (11%)
		<50 years	656 (89%)
2.	Gender	Male	673 (91.3%)
		Female	64 (8.7%)
3.	Blood Pressure (mm hg)	Normal	270 (36.6%)
		Pre HTN	373 (50.6%)
		HTN Stage I	63 (8.5%)
		HTN Stage II	31 (4.2%)
4.	Smoking	Yes	437 (59.2%)
		No	300 (40.7%)
5.	Atrial Fibrillation	Regular	704 (95.5%)
		Irregular	33 (4.4%)
6.	Physical Activity	Low	455 (61.7%)
		Moderate	282 (38.2%)
7.	Diabetes	Yes	82 (11.1%)
		No	655 (88.8%)
8.	Weight (kg)	Normal	520 (70.5%)
		Slightly overweight	189 (25.6%)
		Overweight	28 (3.8%)
7.	Stroke in Family	Yes	23 (3.1%)
		No	714 (96.8%)

Table 3: Demographic characteristics of the sample for VAK model Act FAST intervention (high risk security guards) n=94

S.N.	Demographic Variables		Frequency (%)
1.	Age (years), mean±SD	44.07±8.57	
2.	Gender	Male	83 (88.3)
		Female	11 (11.70)
3.	Marital status	Married	89 (94.7)
		Unmarried	2 (2.1)
		Widow	3 (3.2)
4.	Education	Secondary	87 (92.6)
		Tertiary UG	7 (7.4)
5.	Health insurance	No	94 (100)
6.	Family income (Rupees)	18,497-30,830	5 (5.32)
		06,175-18,496	89 (94.68)
7.	Duration of service (years)	<1 year	15 (16)
		1-5 years	31 (33)
		>5 years	48 (51.1)

Table 4: Knowledge score of security guards about stroke knowledge n=94

Variables	Before intervention	After Intervention	Diff (95%CI)	p-value	t-value
Knowledge score	9.20±1.91	16.32±1.26	7.12 (6.6-7.5)	<0.001	-32.6

*Data expressed as mean±SD
*p value < 0.05 is significant

Table 4a: Subdomains of stroke knowledge (i.e., sign, symptoms, management, and risk factors of stroke) n=94

S.N.	Subdomains of stroke knowledge	Pretest correct responses (%)	Post-test correct responses (%)
	Signs and symptoms		
1.	Which of the following is the sign of stroke?	78.7	88.3
2.	Stroke is caused by	58.5	96.8
3.	Sudden trouble walking, dizziness, or loss of balance is a symptom of	39.4	85.1
4.	FAST stands for	17	80.9
5.	Thunderclap headache with no known cause is a symptom of ?	37.2	77.7
		46.16	85.76
	Management		
6.	If you thought someone was having a stroke, what is the first thing you would do?	23.4	79.8
7.	Golden hour to reach the hospital after stroke?	54.3	88.3
8.	Do you think stroke is treatable?	40.4	98.9
		39.36	89
	Risk Factors		
9.	Is smoking a risk factor for stroke?	60.6	96.8
10.	Are food items high in saturated fats, cholesterol, and salt risk factor of stroke?	56.4	76.6
11.	Is sedentary lifestyle a risk factor of stroke?	60.6	81.9
12.	Is obesity a risk factor of stroke?	52.1	81.9
13.	Is stress a risk factor of stroke?	41.5	90.4
14.	Is high cholesterol a risk factor of stroke?	54.3	88.3
15.	Is any history for heart disease a risk factor of stroke?	52.1	73.4
16.	Is high blood pressure (hypertension) a risk factor of stroke?	57.4	92.6
17.	Is high blood sugar (diabetes) a risk factor of stroke?	40.4	79.8
18.	Is swimming a risk factor of stroke?	38.3	63.8
19.	Is eating too much risk factor of stroke?	33	51.1
20.	Is sleeping a risk factor of stroke?	24.5	60.6
		47.60	93.72

92.6%, 96.8%, 79.8%, 88.3%, 81.9%, 81.9%, and 90.4%, respectively. There was no significant association between demographics of high-risk security guards and their level of knowledge regarding stroke.

Followed by visual and auditory learning components, kinesthetic and visual components were delivered by card game. The result of the card game showed that 82 security guards out of 94 were able to identify 3 right cards out of 10 cards. Apart from improvement in knowledge score of security guards regarding stroke, their satisfaction toward VAK model-based educational programs, that is, video, poster, and card game, was also good. All the security guards were satisfied with the VAK model-based educational program.

DISCUSSION

The risk factors of stroke are of two types, which are modifiable risk factors and nonmodifiable risk factors of stroke. Modifiable risk factors include hypertension, obesity, sedentary lifestyle, diabetes, smoking, alcohol, high cholesterol, and heart disease. The nonmodifiable risk factors of stroke are age, gender, ethnicity, race, and family history.

The present study demonstrated that risk factors of stroke were prevalent among security guards. Thirteen percent security guards were at high risk, 36% were at caution, and 51% guards were at low risk. The findings were in agreement to A. Mangum *et al*. (2003),[16] wherein 26% community dwellers were at mild risk of stroke, 32% were at moderate risk of stroke, and 38% were at high risk of stroke.

There are many risk factors of stroke including old age, unhealthy dietary habits, hypertension, diabetes mellitus, obesity, high cholesterol, smoking, low physical activity, and atrial fibrillation.[12] In the present study, all these risk factors were screened for and the most common risk factors were smoking (59%), hypertension (44.5%), and obesity (29.5%). These risk factors are modifiable (except hypertension), which are alarming in an individual; fortunately, preventive

measures (primary and secondary) can be employed through screening, health education, and clinical approach for this population. In line with the present study, O`Donnell *et al*. (2010)[17] reported hypertension as a significant risk factor for all types of stroke. Ram *et al*. (2021)[18] reported hypertension and diabetes mellitus among the commonest risk factors of stroke. A large-scale study by Jukka Putaala *et al*. (2012)[19] reported that the three most common risk factors of stroke were current smoking (48.7%), abnormal lipid levels (45.8%), and hypertension (35.9%) among a cohort from three different regions of Europe. Furthermore, Hussain *et al*.[20] (2016) reported that smoking (64.9%) was the most common risk factor of stroke in male population, followed by high cholesterol, hypertension, obesity, and diabetes. These results were consistent with the result of present study where smoking followed by hypertension and obesity were the most common risk factors for stroke.

Worldwide, around 25.1% women and 24.7% men experience the lifetime risk of stroke.[21] In the current study, male security guards (n = 674) outnumbered the female security guards (n = 64). The majority of the (83, 88.3%) males out of 674 were at high risk of stroke, and (11, 11.7%) females out of 64 were at high risk of stroke and were given the VAK-based educational intervention. Similarly, an epidemiological study[19] also reported more men (n = 2231) compared to women (n = 1713). Apart from this, gender-specific risk factors were not explored in this study; nonetheless, no gender-specific differences emerged in stroke risk factors.[19] Hypertension, atrial fibrillation, smoking, dyslipidemia, diabetes, obesity, sedentary lifestyle, and mental stress are the commonest gender-nonspecific risk factors. Furthermore, the risk factors of stroke distinctive to women are age at menarche, hormonal imbalance, gestational period, gestational diabetes mellitus, preeclampsia, oral contraceptives, and hormone replacement therapy,[22] whereas diastolic blood pressure is specific to males for stroke risk factor.[23] The understanding of gender-specific risk factors may be helpful to the health care professionals in accurate stroke risk assessment for high-risk patients.[23]

As the age increases, there is accumulation of risk factors which ultimately increases the probability for stroke occurrence.[24] In the present study also, the mean age of high-risk security guards was more (44.0 years) than the mean age of low-risk (36.9 years) and at-caution (38.7 years) security guards, indicating that with age, the risk of stroke increases. On the contrary, similarly, Jukka Putaala *et al*. (2012)[19] reported that young women less than 34 years of age had stroke risk factors, whereas men preponderated after 34 years of age up to 49 years of age for stroke risk factors. The male: female ratio was 1:7 in patients aged 45 to 49 years. In the present study, most of the security guards were male and the mean age of high-risk security guards was 44.07 years and the men-to-women ratio was 7:5 among security guards (11 males were below 34 years, and 72 males were above 34 years; only one was female below 34 years, and 10 females were above 34 years of age).

High alcohol consumption is related to high risk of ischemic stroke. Alcohol consumption increases with the age, particularly in the male population. Alcohol increases the risk of acute ventricular and supraventricular cardiac arrhythmias, including atrial fibrillations, which ultimately lead to stroke. Von Sarnowski *et al*. (2013)[24] reported that short sleep duration was more common in male population, particularly in older male adults, which may be associated with higher prevalence of ischemic stroke. The present study did not include alcohol and sleep factors, which contribute to risk of stroke.

Act FAST is one of the educational tools given by AHA-ASA and is known to improve the knowledge about stroke recognition and response to stroke in the various populations. The present study demonstrated that the education provided to security guards incorporating Act FAST educational program improved the knowledge of security guards regarding stroke recognition and response to stroke. The knowledge score of security guards was significantly improved from 9.20 to 16.32. The findings were consistent with Phan *et al*. (2017).[3] They reported an increase in knowledge of signs, symptoms, and management of stroke among community people. From this study, researchers concluded that the Act FAST educational intervention may have positive impact on preparedness and knowledge of primary prevention of stroke.

Tatsuo Amano *et al*.[25] (2014) findings also support the findings that Act FAST improves knowledge regarding stroke recognition and response to stroke. The study demonstrated that the knowledge score of students for facial palsy, speech disturbance, numbness on one side of body, and weakness on one side of body was significantly improved from the baseline. Olajide Williams *et al*. (2008)[26] revealed that FAST stroke symptoms (facial droop and slurred speech) were better learned and retained than non-FAST symptoms like headache and blurred vision. The mass media campaign for stroke has positive impact on awareness and early action to signs of stroke.[27] Hickey *et al*. (2012)[28] revealed that adults in Ireland had poor awareness about warning signs of stroke and the need to call emergency services at the time of stroke.

In India, many people who have stroke fail to reach the hospitals because of multiple reasons including less awareness about signs, symptoms and management of stroke, more distance from the site to hospital, lack of hospital services (ambulance, staff etc.), the availability of nonhospital therapies, and lack of money to bear the cost of care.[29-31]

The VAK learning style is generally used for students of different courses or for language preparation. The aim is to provide the education attuned with his/her way of learning to maximize the retention and learning.[32] Present study had included three sensory components to teach about Act FAST through VAK model. The health care professionals or educators should be sensitive toward the learning needs of learners, whether it is a student, patient, or general population. Giuse NB *et al*.[33] demonstrated that patients learn more about hypertension if they are given optimized health care based on their learning style preferences and their educational level. In line with this, the VAK model included a video, poster,

and a card game, which can be helpful to the security guards to retain the FAST message and the intervention. Similarly, Olajide Williams *et al.* (2008)[26] reported that including cultural elements like hip hop music improved retention of stroke knowledge among elementary school children. Hill *et al.* (2017)[34] support the use of DVD to educate children as well as adults about stroke signs and symptoms, the need for early response, and risk reduction.

The present study had a few strengths. To begin with, high-risk participants were identified by doing screening of security guards. Then, for the intervention, three teaching methods were used, that is, video, poster, and card game, as part of VAK model. There were no dropouts for the follow-up, and 100% response rate was there for educational intervention. This study was first of its kind to educate the security cards about stroke considering their learning style preference.

The study had various limitations. The first is design; that is, one group pre-test post-test was one of the major limitations of this study. This design limited the internal validity as there were threats like history, pre-testing sensitization, and social interaction. Convenient sampling was another limitation of the study for prevalence assessment due to time constraints. Only self-reported information of having diabetes and high cholesterol was taken; objectives measures could have given better information about the same; however, self-reporting itself was able to identify 94 high-risk stroke participants. Furthermore, blood test could have been performed for serum values of cholesterol, glucose, etc., for objective evaluation of risk factors; however, it was not feasible due to lack of funding. Card games could have been played before and after intervention to find out the gain in knowledge score. Furthermore, kinesthetics components of VAK learning style could have been applied with more active participation by security guards through role play to have more retention of knowledge; however, due to strict duty timing of guards, it was not possible. Nonetheless, the knowledge gain was evident through the post-test knowledge score with significant improvement. High-risk guards were told to consult the physicians, which could have led to a gain in knowledge of security guards. Formal methods could have been applied to ascertain whether they made the visit to consultants and what was the outcome; however, that was beyond the scope of study due to a short period of study duration. The knowledge questionnaire mostly had true/false and yes/no questions, which was a limitation of tool. The satisfaction tool did not include all the perspectives, for instance, appropriateness, relevance, timeliness, etc., and hence could not exactly derive the satisfaction level from study participants. In addition, we did not study the relationship of variables such as sleep, alcohol, etc., to risk of stroke among security guards.

Conclusion and Recommendations

This study demonstrates the impact of VAK model educational programs for security guards. This intervention significantly improved the participants' knowledge about signs, symptoms, and immediate management of stroke. They gained more knowledge about stroke prevention by receiving education on behavioral modifications in lifestyle decisions and modifiable risk factors such diabetes, hypertension, and hyperlipidaemia. The improvement in knowledge gaps and the creation of an effective method for stroke prevention will result from educational initiatives by nursing students to reach larger communities. The study can be done at various settings in different populations including policemen, traffic police, community people, and schools. They can be screened for risk factors and education should be provided to them to prevent stroke.

Conflicts of interest
There are no conflicts of interest.

References

1. Pandian JD, Gall SL, Kate MP, Silva GS, Akinyemi RO, Ovbiagele BI, *et al*. Prevention of stroke: A global perspective. Lancet 2018;392:1269–78.
2. Pandian JD, Sudhan P. Stroke epidemiology and stroke care services in India. J Stroke 2013;15:128–34.
3. Phan Vo L, Souksavong JH, Tran A, Chang J, Lor KB. Impact of the Act FAST stroke campaign delivered by student pharmacists on the primary prevention of stroke. J Am Pharm Assoc 2017;57:326-32.e6.
4. Ramadian OD, Cahyono BY, Suryati N. The implementation of visual, auditory, kinesthetic (VAK) learning model in improving students' achievement in writing descriptive texts. Engl Lang Teach Educ J 2020;2:142.
5. VAK Learning Styles Self Assessment. Available from: https://www.businessballs.com/self-awareness/vak-learning-styles/. [Last accessed on 2024 Feb 29].
6. S K SN, Tay C. Styles of learning VAK. IJIRMGF 2017;3:17–25.
7. Hardiana MTAN, Suyata P. The Effectiveness of VAK (Visual, Auditory, Kinesthetic) model in learning of summary writing. Int J Res Rev 2018;5:43–9.
8. Kusumawarti E, Subiyantoro S, Rukayah. The effectiveness of visualization, auditory, kinesthetic (VAK) model toward writing narrative: Linguistic intelligence perspective. Int J Instr 2020;13:677–94.
9. DATA STORY: India has the world's largest number of private security workers, industry to double by 2020. Available from: https://www.moneycontrol.com/news/business/data-story-india-has-the-worlds-largest-number-of-private-security-workers-industry-to-double-by-2020-2390933.html. [Last accessed on 2022 Feb 02].
10. Zimmerman FH. Cardiovascular disease and risk factors in law enforcement personnel: A comprehensive review. Cardiol Rev 2012;20:159–66.
11. Ramey SL, Perkhounkova Y, Downing NR, Culp KR. Relationship of cardiovascular disease to stress and vital exhaustion in an urban, midwestern police department. AAOHN J 2011;59:221–7.
12. Ruhl C. Bloom's Taxonomy of Learning [Internet]. Simply Psychology 2024. Available from: https://www.simplypsychology.org/blooms-taxonomy.html. [Last accessed on 2024 Feb 05].
13. Bloom's Taxonomy of Learning | Domain Levels Explained. 2022. Available from: https://www.simplypsychology.org/blooms-taxonomy.html. [Last accessed on 2023 Sep 25].
14. Gorelick PB, Sacco RL, Smith DB, Alberts M, Mustone-Alexander L, Rader D, et al. Prevention of a first stroke: a review of guidelines

and a multidisciplinary consensus statement from the National Stroke Association. JAMA 1999;281:1112-20. doi: 10.1001/jama.281.12.1112.

15. RiskStrokeScorecard_Eng.pdf. Available from: https://www.floyd. org/medical-services/Stroke/Documents/RiskStrokeScorecard_Eng. pdf. [Last accessed on 2023 Sep 17].

16. Mangum SA, Kraenow KR, Narducci WA. Identifying at-risk patients through community pharmacy-based hypertension and stroke prevention screening projects. J Am Pharm Assoc Wash DC 1996 2003;43:50–5.

17. O'Donnell MJ, Xavier D, Liu L, Zhang H, Chin SL, Rao-Melacini P, *et al*. Risk factors for ischaemic and intracerebral haemorrhagic stroke in 22 countries (the INTERSTROKE study): A case-control study. Lancet Lond Engl 2010;376:112–23.

18. Ram CVS, Kumar S, Renjen PN, Kumar GP, Swaminathan J, Reddy CR, *et al*. Risk factors predisposing to acute stroke in India: A prospective study. J Hypertens 2021;39:2183-9.

19. Putaala J, Yesilot N, Waje-Andreassen U, Pitkäniemi J, Vassilopoulou S, Nardi K, *et al*. Demographic and geographic vascular risk factor differences in European young adults with ischemic stroke. Stroke 2012;43:2624–30.

20. Hussain MA, Al Mamun A, Peters SA, Woodward M, Huxley RR. The burden of cardiovascular disease attributable to major modifiable risk factors in Indonesia. J Epidemiol 2016;26:515–21.

21. GBD 2016 Lifetime Risk of Stroke Collaborators; Feigin VL, Nguyen G, Cercy K, Johnson CO, Alam T, *et al*. Global, regional, and country-specific lifetime risks of stroke, 1990 and 2016. N Engl J Med 2018;379:2429–37.

22. Poli D, Antonucci E, Grifoni E, Abbate R, Gensini GF, Prisco D. Gender differences in stroke risk of atrial fibrillation patients on oral anticoagulant treatment. Thromb Haemost 2009;101:938–42.

23. Pang H, Fu Q, Cao Q, Hao L, Zong Z. Sex differences in risk factors for stroke in patients with hypertension and hyperhomocysteinemia. Sci Rep 2019;9:14313.

24. von Sarnowski B, Putaala J, Grittner U, Gaertner B, Schminke U, Curtze S, *et al*. Lifestyle risk factors for ischemic stroke and transient ischemic attack in young adults in the stroke in young fabry patients study. Stroke 2013;44:119–25.

25. Amano T, Yokota C, Sakamoto Y, Shigehatake Y, Inoue Y, Ishigami A, *et al*. Stroke education program of act FAST for junior high school students and their parents. J Stroke Cerebrovasc Dis 2014;23:1040–5.

26. Williams O, Noble JM. "Hip-hop" stroke: A stroke educational program for elementary school children living in a high-risk community. Stroke 2008;39:2809–16.

27. Dombrowski SU, Mackintosh JE, Sniehotta FF, Araujo-Soares V, Rodgers H, Thomson RG, *et al*. The impact of the UK "Act FAST" stroke awareness campaign: content analysis of patients, witness and primary care clinicians' perceptions. BMC Public Health 2013;13:915.

28. 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;7:298–306.

29. Sridharan SE, Unnikrishnan JP, Sukumaran S, Sylaja PN, Nayak SD, Sarma PS, *et al*. Incidence, types, risk factors, and outcome of stroke in a developing country: The Trivandrum Stroke Registry. Stroke 2009;40:1212–8.

30. Padma Srivastava MV, Bhatia R, Vishnu VY, Goyal M**.** Essential workflow and performance measures for optimizing acute ischemic stroke treatment in India. Stroke 2020;7:1969–77.

31. Banerjee TK, Das SK. Fifty years of stroke researches in India. Ann Indian Acad Neurol 2016;19:1–8.

32. Buşan AM. Learning styles of medical students-implications in education. Curr Health Sci J 2014;40:104–10.

33. Giuse NB, Koonce TY, Storrow AB, Kusnoor SV, Ye F. Using health literacy and learning style preferences to optimize the delivery of health information. J Health Commun 2012;17(Suppl 3):122–40.

34. Hill ME, Bodnar P, Fenton R, Mason B, Bandoh G. Teach our children: Stroke education for indigenous children, First Nations, Ontario, Canada, 2009-2012. Prev Chronic Dis 2017;14:E68.

Poster material, video link and other visual aid (cards),

Poster: A poster of size 5"3 inch is prepared. Poster include a title in Hindi "जब STROKE का हो आघात, Act FAST से दे मात" along with pictures indicating the mnemonic FAST as shown in figure no .1.

Figure 1: Poster for Act FAST

Video: Video was developed and designed by the researcher with technical help from Centre for Medical Education Technology (CMET) which is including overview of stroke, types of stroke, modifiable and non-modifiable risk factors of stroke and signs and symptoms of stroke. Duration of the video is 4 minutes. Video is made in Hindi language.
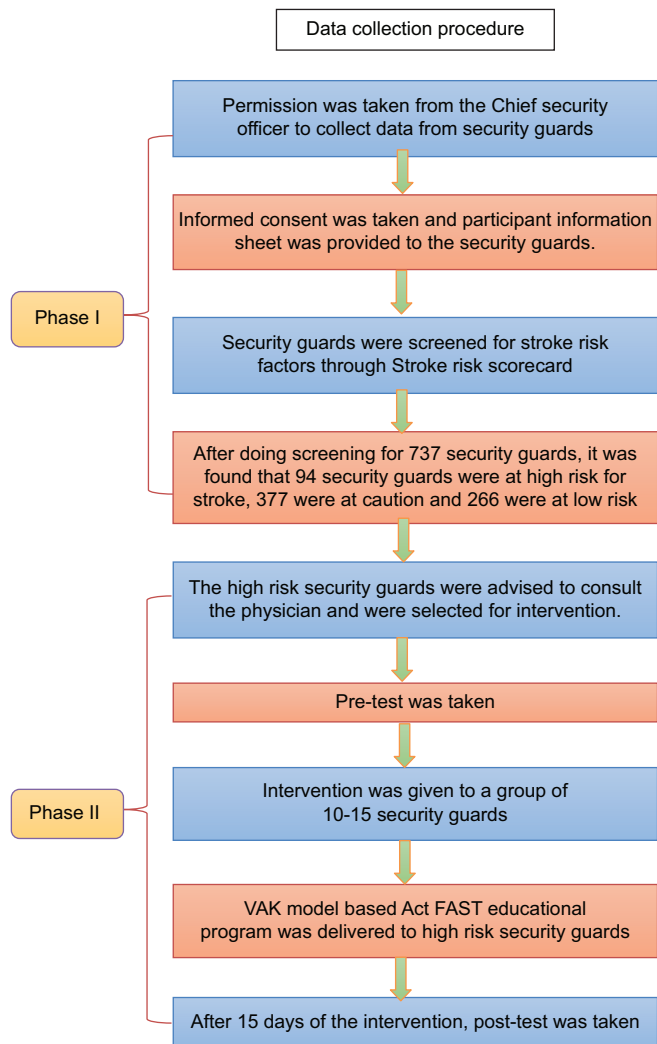
Link of video is given below

https://drive.google.com/file/d/1vSxxr1eVre149L9bz6GA Cuvzo4A3LqlN/view?usp=drivesdk

Card Game: The game is part of VAK intervention and it is focused on kinesthetic component where the security guards would touch and identify the appropriate signs suggestive of stroke. Card game was played by each participant. Each card (total 10 cards) containing picture of signs and symptoms of anonymous diseases and stroke as well. Each participant was asked to pick up the cards which are related to signs of stroke especially about Act FAST. Participant who were able to pick 3 correct cards were declared as winner. Participants who were not able to pick 3 correct cards would lose the game.

Figure 2: Cards for Kinesthetic component

Data collection procedure

Phase I

Permission was taken from the Chief security officer to collect data from security guards

Informed consent was taken and participant information sheet was provided to the security guards.

Security guards were screened for stroke risk factors through Stroke risk scorecard

After doing screening for 737 security guards, it was found that 94 security guards were at high risk for stroke, 377 were at caution and 266 were at low risk

Phase II

The high risk security guards were advised to consult the physician and were selected for intervention.

Pre-test was taken

Intervention was given to a group of 10-15 security guards

VAK model based Act FAST educational program was delivered to high risk security guards

After 15 days of the intervention, post-test was taken

Flow diagram of data collection procedure