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Awareness and Knowledge of Five Most Common Neurological Diseases among Family Medicine Physicians in PHC, Riyadh, Saudi Arabia

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Abstract

Numerous neurological illnesses include epilepsy and seizure disorders, which affect 20-40% of individuals with many primary neurological conditions. These illnesses are caused by a variety of pathophysiology, including traumatic central nervous system damage, neurodegeneration disorders, and neuroinflammation, and studying the etiology of pain in these conditions provides a chance to gain new insights into pain processing. Whether pain originates in the central or peripheral neural systems, it typically gets centralized due to maladaptive reactions within the central nervous system, which can dramatically affect brain systems and, as a result, behavior (e.g. depression). **Project Objectives:** To describe most common known sign and symptoms about the five most common neurological diseases in Saudi Arabia, to describe least known sign and symptoms about the five most common neurological diseases in Saudi Arabia, to measure the relationship between the level of the residency program and the level of the knowledge. **Subjects and methods:** cross-sectional research was carried out on family medicine physicians working at PHC in Saudi Arabia to investigate their Awareness and knowledge of five most common neurological diseases. **Results:** A total of 89 participant were involved in this study**.** The majority were males at 54.65%**.** The majority were the group that consisted of individuals between 24 years to 35 years, this were the majority 94.19% of the total population. Based on the chi-square test results shown above, there is sufficient evidence to fail to reject the null hypothesis with a level of confidence of 95%. This is due to the fact that all of the p-values are greater than the alpha value of 0.05. This suggests that there is no relationship between the level of the residency program and the amount of knowledge that is possessed by the individual. **Conclusion:** According to the findings of this study, the family physicians of Prince Sultan Military Medical City in Riyadh has moderately quite some significant awareness of neurological disorders. The majority of the participants were aware of the most prevalent neurological illnesses, as well as the warning signals and treatment options. Furthermore, the tests chi-square test of association conducted above indicated that there is no relationship between the level of the residency program and the level of the knowledge.

Background

Neurological diseases are common to be seen in primary care clinics, and since initial diagnosis and investigations are made by a family physician, it is crucial to find out if there is any deficit in making the differential diagnosis, the investigations which the physician will order or do, and finally the most appropriate diagnose for the patient. By identifying the deficit and trying to figure out solutions, we can save lives, time and resources.

After reviewing of published papers on PubMed and Google scholar it ends up with the five most common neurological diseases in Saud I Arabia which are epilepsy and seizure disorders, headaches, stroke, multiple sclerosis, cervical and lumbosacral radiculopathy these are the neurological disease which will be target in this paper.

Review of published paper on PubMed a Google scholar did not show any locally published studies on the level and the degree regarding knowledge and awareness about the five most common neurological diseases. The aim of this paper is to find out most common known sign and symptoms about the five most common n neurological diseases in Saudi Arabia, to find out least known sign and symptoms about five most common neurological diseases in Saudi Arabia, and to figure out the relationship between the level of the residency program and the level of the knowledge.

In this study we will try to estimate the level and the degree regarding knowledge and awareness about the five most common neurological diseases, which are epilepsy and seizure disorders, headaches, stroke, multiple sclerosis, cervical and lumbosacral radiculopathy, among family medicine physician in Prince Sultan Military Medical City in Riyadh. The study will as well describe the most common known signs and symptoms of the five most common neurological diseases, the least known signs and symptoms of the five most common neurological diseases and finally, the study will try to measure the relationship between the level of the residency program and the level of the knowledge. By identifying both the knowledge and awareness we will be able to find out do FM physician know about the five most common neurological diseases in Saudi Arabia or not, what are the Signs and symptoms, the management, the initial investigation, and are they able to diagnose. We will try to find out is there a relationship between the level of the residency program and the level of the knowledge.

Project Objectives

1. To describe most common known sign and symptoms about the five most common neurological diseases in Saudi Arabia

2. To describe least known sign and symptoms about the five most common neurological diseases in Saudi Arabia

3. To measure the relationship between the level of the residency program and the level of the knowledge

Hypothesis testing:

Null hypothesis: there is no relationship between the level of the residency program and the level of the knowledge

Alternative Hypothesis: there is a relationship between the level of the residency program and the level of the knowledge.

The study is being conducted at 95% level of confidence.

Literature Review

Casabella, et al. in 1995 undertaken a study to evaluate the family and community medicine training programs are valid for neurologic care reported that GPs from PHC who didn't participate in a training program had inadequate knowledge in neurology while the ones who received training had sufficient knowledge in neurology [1]. A survey on GPs perception and knowledge of neurology conducted by Angela M Loftus et al. 2016 found that neurology was reported to be as interesting as other medical specialties. GPs also reported less knowledge and more difficulty in neurology compared with other medical specialties, they also reported that local neurology services provided better patient satisfaction [2]. Mia T Minen, et al. 2016 conducted a study to evaluate PCP's knowledge regarding migraine diagnosis and management in primary care settings found that PCPs had knowledge regarding prevalence of migrain but didn't know specifications of management. 47% of physicians would order imaging for a new type of headache, 31% for worsening headache, and 35% for a headache unresponsive to treatment. 34% knew that opioids can cause medication-overuse headache and most participants don't recommend non-pharmacologic treatment [3].

Another study in 2010 by Andrzej Sloma et al. aimed to study patients with stroke/TIA in primary health care and risk factors for having a new event of stroke/TIA knowledge, possible associations between knowledge and patient characteristics. The study found that 90% of patients had risk factors as hypertension, hyperlipidaemia and smoking while 50% had atrial fibrillation and diabetes. Family history of cardiovascular disease, carotid stenosis, atrial fibrillation or diabetes patients knew these were stroke/TIA risk factors more than patients without these conditions. 56% of participants taking anticoagulant drugs considered it as prevention, while 48% of those taking platelet aggregation inhibitors thought this was for prevention [4]. A Cross-Sectional Study at Primary Health Care Centers in Morocco conducted by Ahmed Kharbach, et al. 2020 to study knowledge on stroke, its risk associated factors, and warning symptoms in the population attending urban primary health care centers estimated that median knowledge score was 8 (range 4- 13). The most well-known risk factors were high blood pressure (55.7%), depression and stress (48.8%). Most common warning sign reported by participants was sudden weakness of the face, arms or legs (37.3%). Illiteracy, primary education and rural residential were independently associated with a lower level of knowledge of stroke [5]. Another cross-sectional survey on nurses

who provide community-based care conducted by Barbara M Daly, et al. in 2019 to diabetes knowledge held by primary health care nurses found that nurse's knowledge about stroke as a diabetes-related complication and pathology of diabetes has increased [6].

A comparative study undertaken by Marie Charasson et al. 2018 aimed to compare GP awareness about three main locations of atherosclerosis reported that transient ischaemic attack knowledge among 48.2% of participants was significantly higher than stable angina and intermittent claudication knowledge (3.0%, 0.4% respectively). A significant difference between SA knowledge and IC knowledge was reported. Inadequate prescription of supplementary investigations and treatments was observed with poor knowledge ratings for all three locations [7]. Another survey by Faiz KW, et al. 2019 aimed to study changes in knowledge regarding stroke and lifestyle among patients experiencing a cerebrovascular event reported that Self-reported symptom knowledge was increased at three months and persisted at twelve months. Poor correlation between increasing symptom knowledge and stated lifestyle behavior changes was reported. 63% of participants knew their own cerebrovascular subtype [8]. Lo IL, et al. 2020 investigated knowledge, attitude and preventive practice on dementia care among primary health professionals and reported that most of studied sample had adequate knowledge, positive attitude and appropriate preventive practice on dementia care [9].

Another study by Pérez-Pérez J, et al. 2005 aimed to assess origins of the knowledge, clinical control and attitudes of PCP towards epilepsy management. The study found that most studied physicians acquire their knowledge about seizure in the med school and during hospital residency. 44% of them aren't satisfied with their knowledge. The most highly valued therapists are neurologists and neuro-paediatricians. They rarely establish or modify antiepileptic treatment and state that they have doubts about neuropsychological disorders and integrating patients with epilepsy in the workplace [10].

Methodology

This study aims at describing the most common known sign and symptoms about the five most common neurological diseases in Saudi Arabia, describing the least known signs and symptoms about the five most common neurological diseases in Saudi Arabia. Finally, the study aims to measure the relationship between the level of the residency program and the level of knowledge. This chapter is divided into research design, the population of the study, sampling, data collection instruments that will be used, data analysis, research quality and lastly the ethical considerations to adhere to.

Research Design

This cross-sectional research was carried out on family medicine physicians working at major tertiary hospitals in Saudi Arabia to investigate Awareness and knowledge of five most common neurological diseases. Recruited 86 people aged 18 and

older to take part in an online survey that they were responsible for administering themselves. The technique of sampling that was used was one that did not rely on chance. In order to enter the data and conduct the analysis, Microsoft Excel and SPSS were used.

Data Collection method: This research will utilize primary sources to collect data, which will be collected directly from the respondents in Google form.

Duration of the study: One year.

Target population: All family medicine physician in PSMMC-R, starting from R1 family resident to senior consultant.

Sampling methods: non-probability Convenience sampling.

Data Collection

The data collection form was collected and designed to cover signs and symptoms of the five most come neurological diseases and was validated through:

1. The data collection form was reviewed by 3 Family medicine consultants.

2. Pilot for a total for 10 was done.

Sampling techniques and sampling size

A sampling technique is defined as the method that a researcher employs to pick a sample size from the entire population [11]. Non-probability Sampling will be adopted for this study. According to Mugenda and Mugenda (2011) Non-probability Convenience Sampling was ideal for a study.

A sample size is defined as the element of a study that represents the actual population, or that elements to be examined within a study, from which, inference was made to the entire population [12]. The study targeted a total of 300.

Confidence Level: 95%; Confidence Interval: 5; Population: 300; Sample size needed: 169

Statistical methods

We will use Microsoft Excel for Data entry. We will use frequencies and percentages for categorical data and mean and standard deviation for numerical data. For inferential statistics we will use logistic regression (t-test for numerical data and chi square test for categorical data. The level of significance in this study will be 0.05.

Results

Demographic Data

From visualized demographic information, the majority were males at 54.65% while the females constituted 45. 54% of the total sample population 86 that took part in the study (Figure 1).
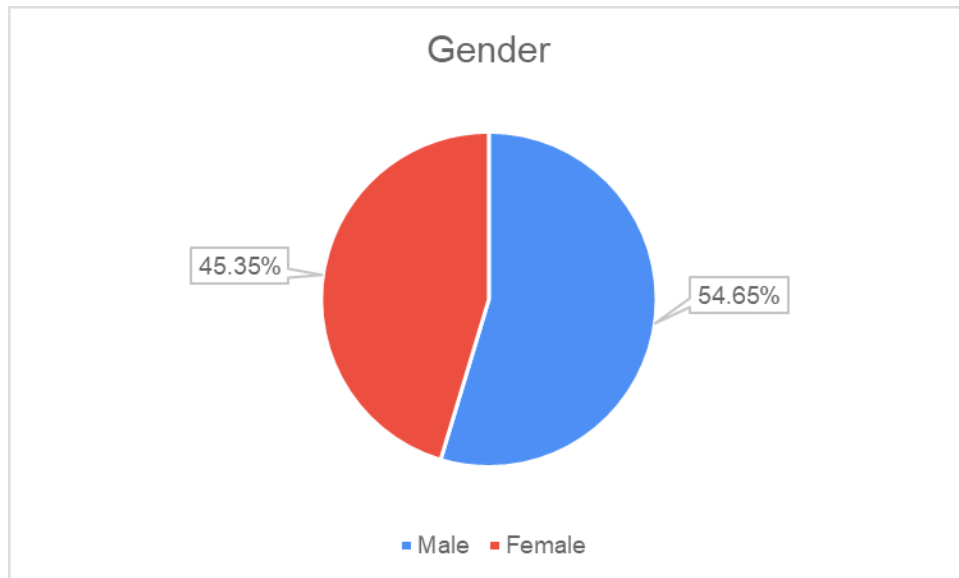
Figure 1: Gender.

From figure 2 above the population that took part in the survey for this study constituted persons age above 18 years of age. The population was categorized into two discrete groups. The majority were the group that consisted of individuals between 24 years to 35 years. This were the majority 94.19% of the total population. The remaining portion 36-45 years constituted 5.81% of the total population of study (Figure 3).
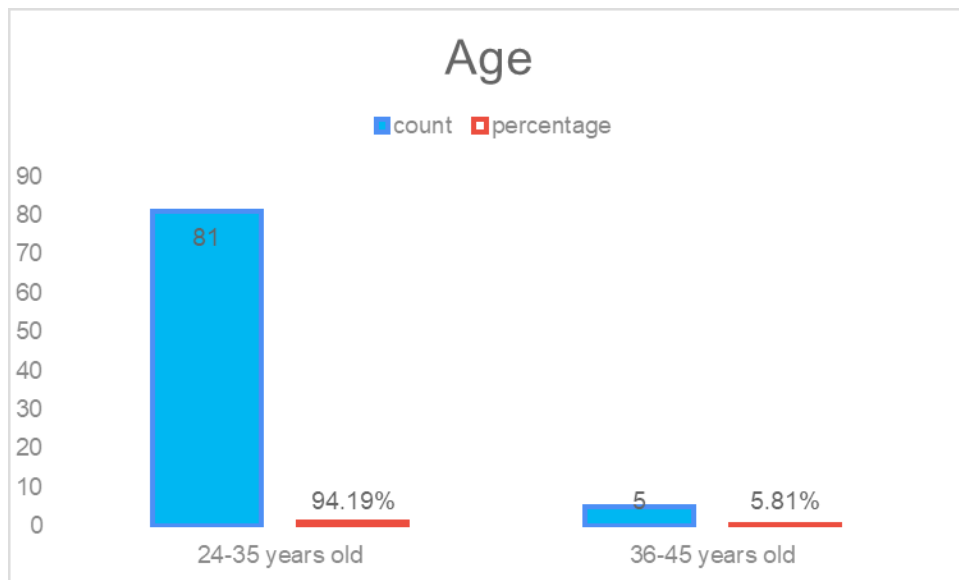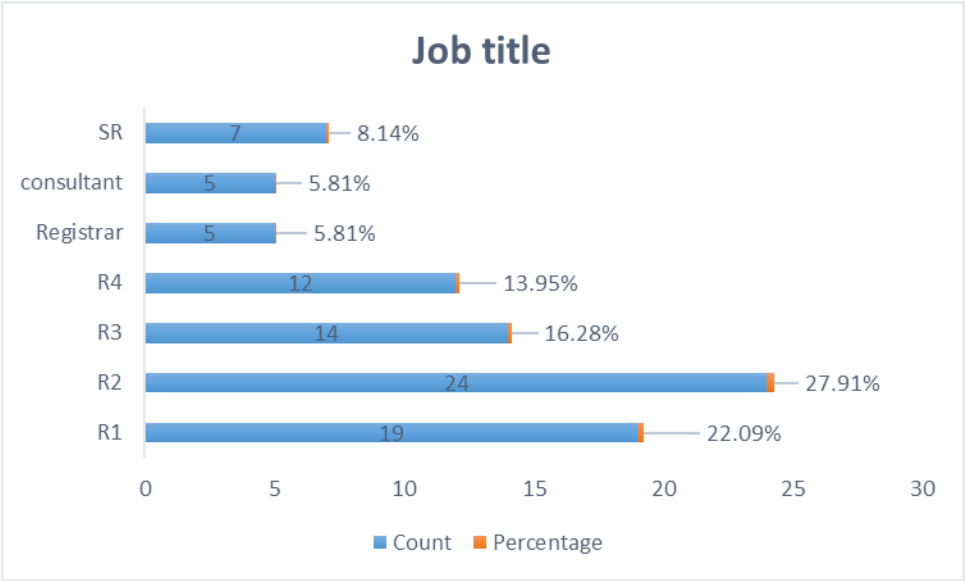

Figure 2: Age.

Figure 3: Job Title.

From the above descriptive statistics, 24 (27.91) majority of the people who took part in the study held the R2 position. Followed closely by R1 at 22.09%. Consultant and registrar did get the least 5 at 5.81% (Figure 4).
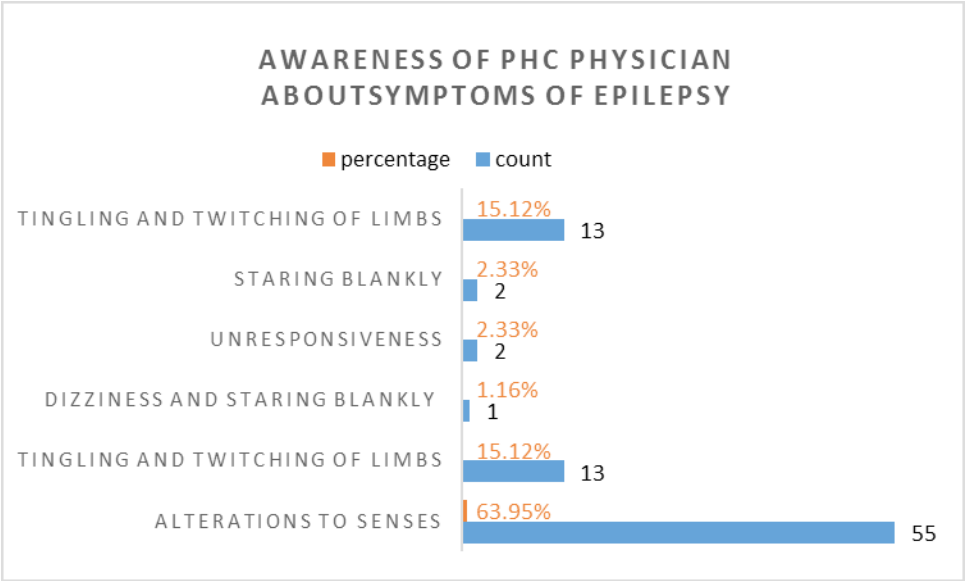

Figure 4: Awareness of PHC physician about Symptoms of Epilepsy.

From the statistics above concerning symptoms of epilepsy, the majority 63.95% indicated that they were aware that alterations to sense of taste, smell, sight, hearing, or touch, dizziness, tingling and twitching of limbs, staring blankly, unresponsiveness, performing repetitive movements, loss of bladder or bowel control, biting of the tongue, loss of consciousness is the major sign of epilepsy. Followed by Tingling and twitching of limbs. Staring blankly, Unresponsiveness, performing repetitive movements, biting of the tongue, Loss of consciousness. 1% of the population indicated that dizziness and staring blankly could be a symptom of epilepsy (Figure 5).
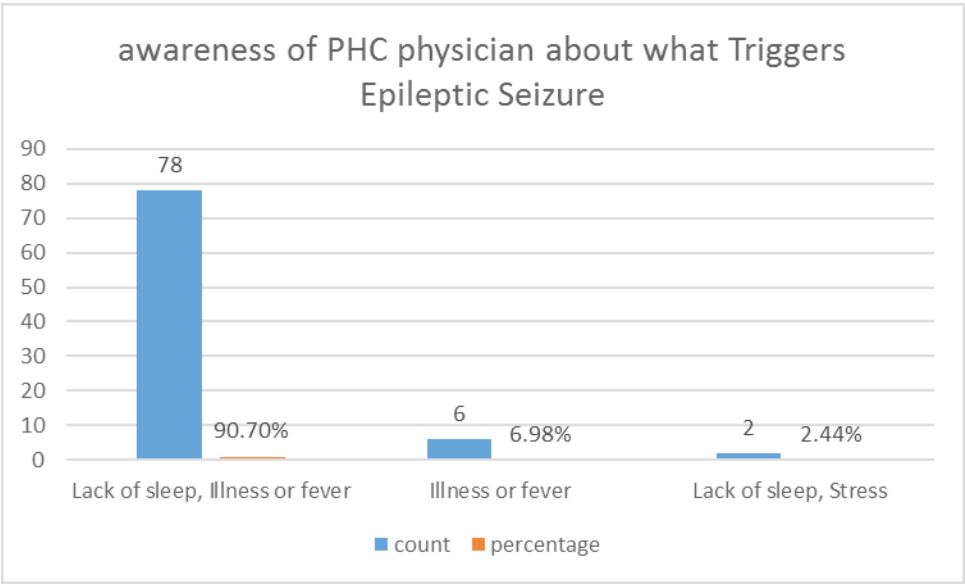
Figure 5: Awareness of PHC physician about what Trigger Epileptic Seizure.

According to the data shown in the preceding graphic, 78, (90.70 percent) of respondents believe that the primary factor that brings on an epileptic seizure is a combination of a lack of sleep and an illness or fever. The results of the survey showed that 6.98 percent of respondents believed that sickness and fever might potentially bring on an epileptic seizure. 2.44 percent of those who responded were in agreement with the statement that an epileptic seizure might be brought on by stress as well as a lack of sleep (Figure 6).
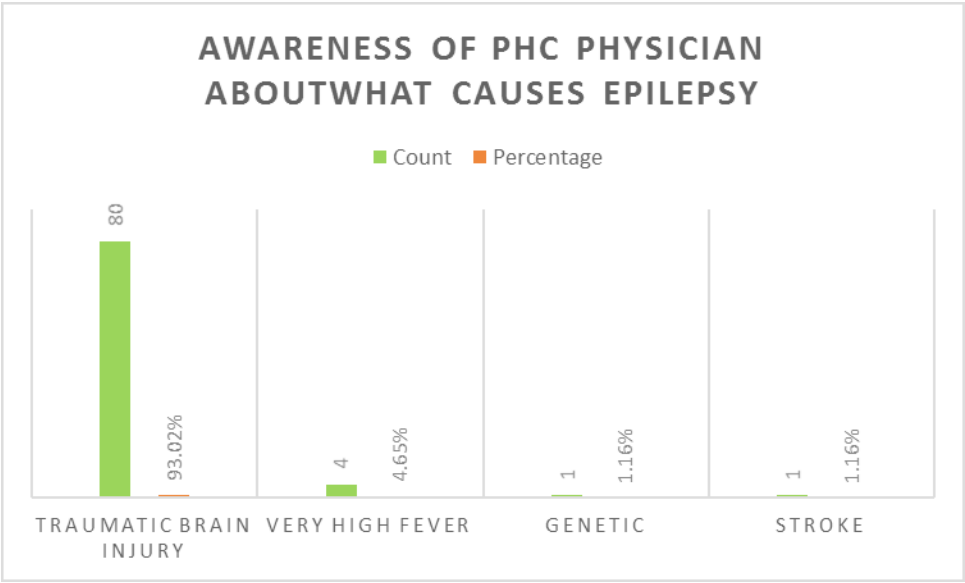

Figure 6: Awareness of PHC physician about what Causes Epilepsy.

Following the aforementioned study, the conclusion that traumatic brain damage is the primary cause of epilepsy was reached, with 93.02 percent of respondents indicating this to be the case. The respondents answered that an extremely high fever may be the cause of epilepsy 4.65 percent of the time. Only one percent of respondents believed that epilepsy may be brought on by variables related to stroke and genetics (Figure 7).
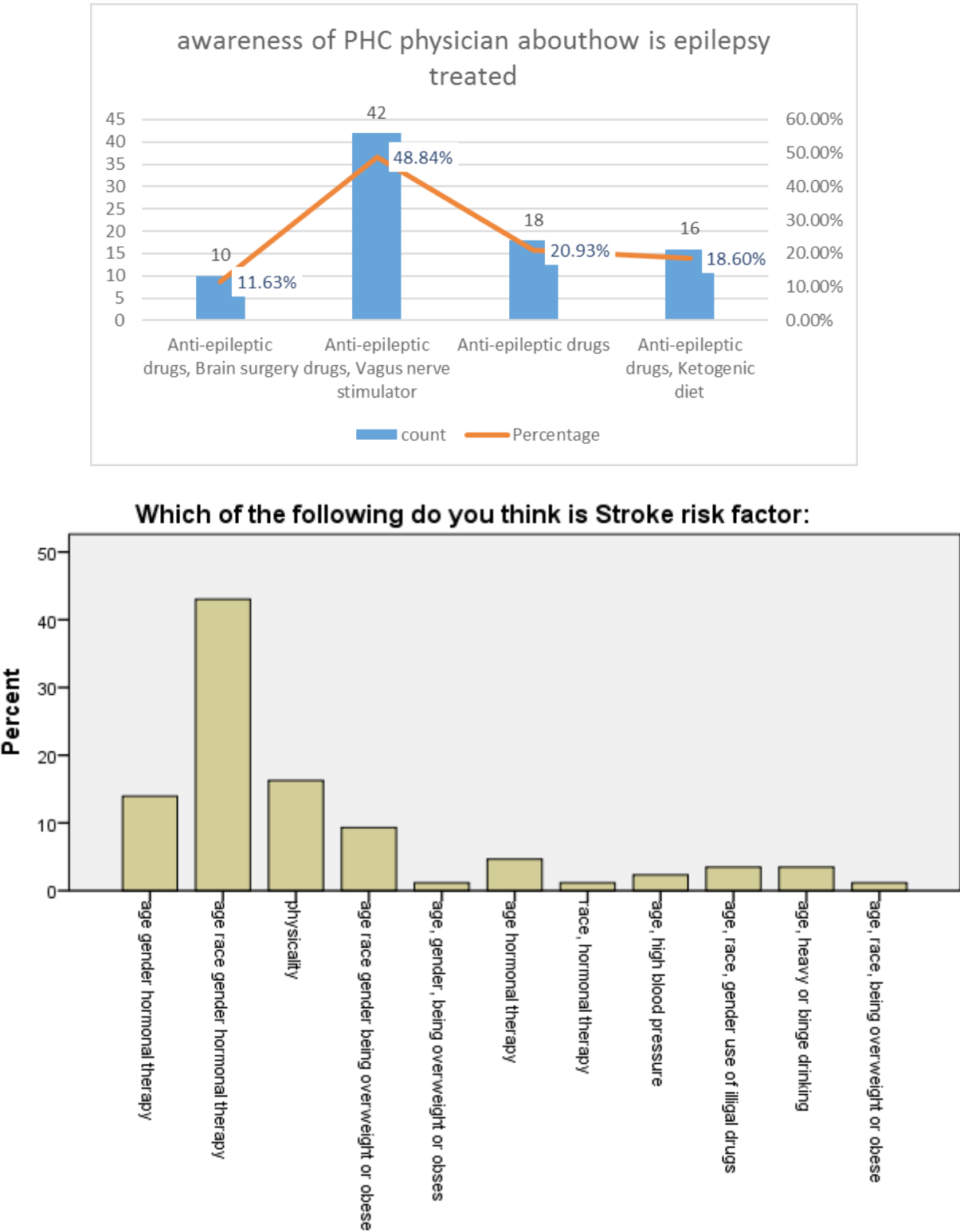
Figure 7: Awareness of PHC physician about stroke Risk Factor.

Based on the visual presented above, it was determined that the primary risk factors for stroke include a person's age, gender, race, and use of hormone medication. According to the findings of the research, another risk factor for stroke is physical activity, which accounts for 16% of the risk (Figure 8).
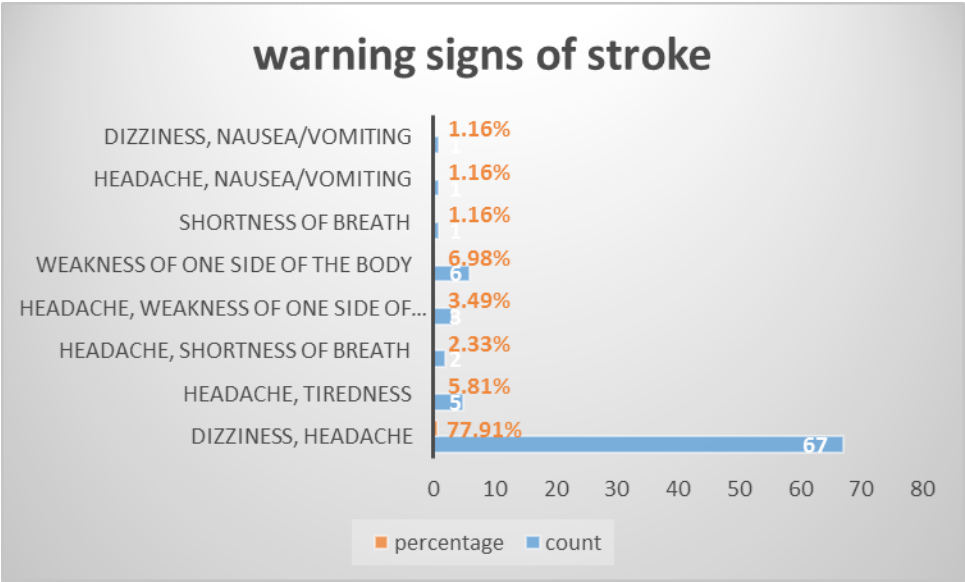

Figure 8: Awareness of PHC physician about warning Signs of Stroke.

According to the data above, 77.91 percent of people experience headaches and dizziness as the primary warning indication. 5.81 percent of those surveyed said that fatigue may be an indicator of a stroke. One side of the body weakness may be an indication of a stroke, according to 6.98 percent of respondents. Only 1.16 percent of respondents said that symptoms including nausea, vomiting, and shortness of breath might possibly be signs of a stroke (Figure 9).
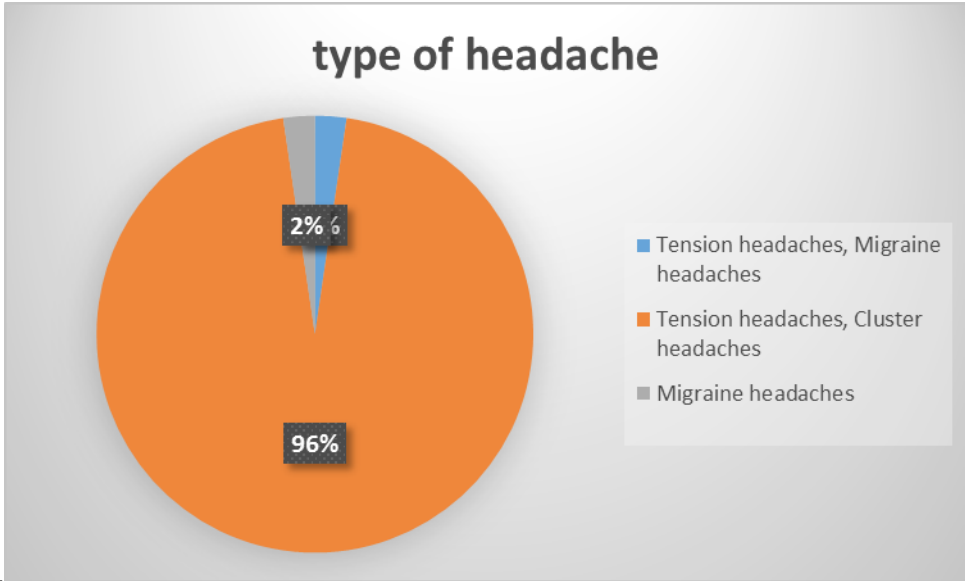

Figure 9: Opinion about the most common type of headache.

According to the results above 96% of the respondents were aware about Tension headaches, migraine headaches type of headache. The remaining each 2% were aware about tension cluster headache and migraine headache (Figure 10).
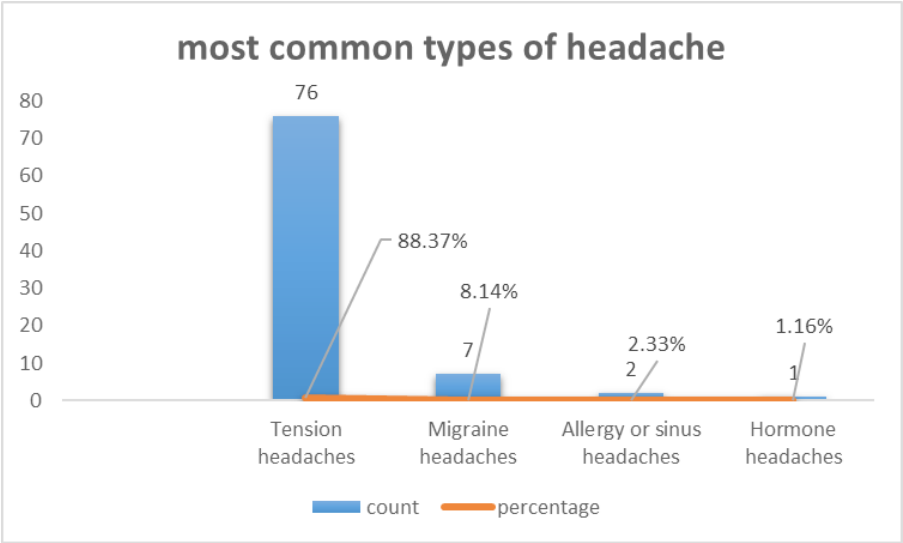
Figure 10: Opinion about the most common type of headache.

According to the result, it was clear that tension headaches are the most common types of headaches at 88.37% (76) of the total population.

Which of the following is a cause of headache?					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Lack of sleep, skipped meals	70	81.4	81.4	81.4
	Lack of sleep stress	14	16.3	16.3	97.7
	Alcohol withdrawal	1	1.2	1.2	98.8
	Acute sinusitis	1	1.2	1.2	100.0
	Total	86	100.0	100.0	

Table 1: Awareness of PHC physician about causes of headache.
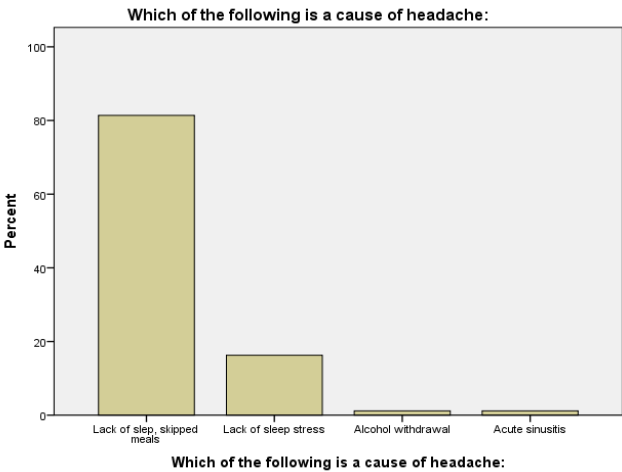

Figure 11: Awareness of PHC physician about causes of Headache.

According to the above results Table 1 and Figure 11, 81.4% (70) agreed that lack of sleep and skipping meals is the main cause of headache. 16.3% indicated that lack of sleep and stress can also cause headache (Table 2).

Which of the following is a symptom of multiple sclerosis				
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Numbness or weakness in one or more limbs	78	90.7	90.7	90.7
	prolonged double vision, slurred speech	1	1.2	1.2	91.9
	Partial or complete loss of vision	1	1.2	1.2	93.0
	Electric-shock sensations that occur with certain neck movements	4	4.7	4.7	97.7
	Tremor, Lack of coordination	1	1.2	1.2	98.8
	Tremor, Unsteady gait	1	1.2	1.2	100.0
	Total	86	100.0	100.0	

Table 2: Awareness of PHC physician about symptoms of Multiple Sclerosis.

According to the analysis results above, 90.7% showed that numbness or weakness in one or more limbs is the most known symptom of multiple sclerosis. 4.7% of the respondents specified that Electric-shock sensations that occur with certain neck movements is also a sign of multiple sclerosis (Figures 12 and 13, Table 3).
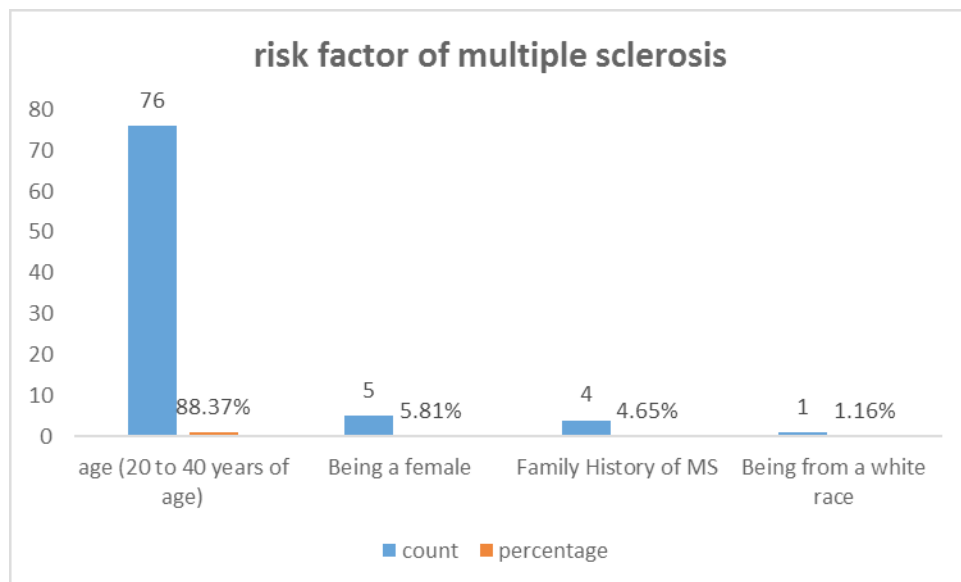

Figure 12: Awareness of PHC physician about risk Factor of Multiple Sclerosis.
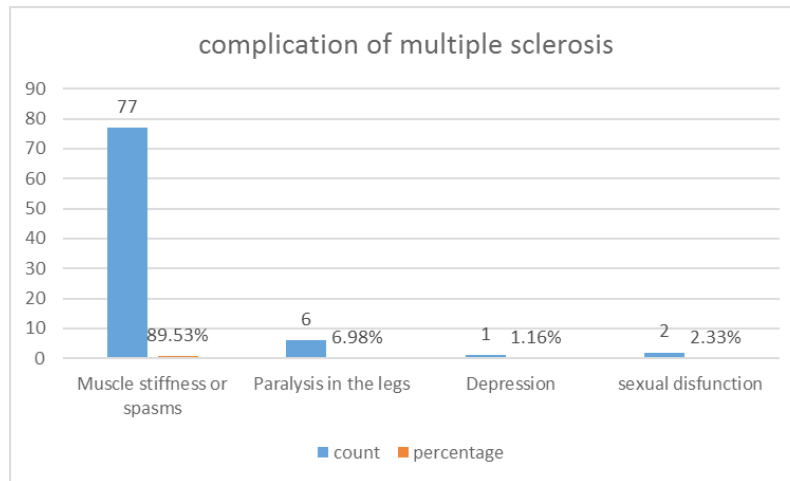
Figure 13: Awareness of PHC physician about complication of Multiple Sclerosis.

Complication of multiple sclerosis					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Muscle stiffness or spasms	79	91.9	91.9	91.9
	Paralysis in the leg	6	7.0	7.0	98.8
	Depression	1	1.2	1.2	100.0
	Total	86	100.0	100.0	

Table 3: Awareness of PHC physician about complication of multiple sclerosis.

From the finding, 89.53% of the muscle stiffness or spasms is the main complication of multiple sclerosis. 6.98% believed that paralysis in the legs. 1.16% indicated depression complication of multiple sclerosis (Figure 14, Table 4).
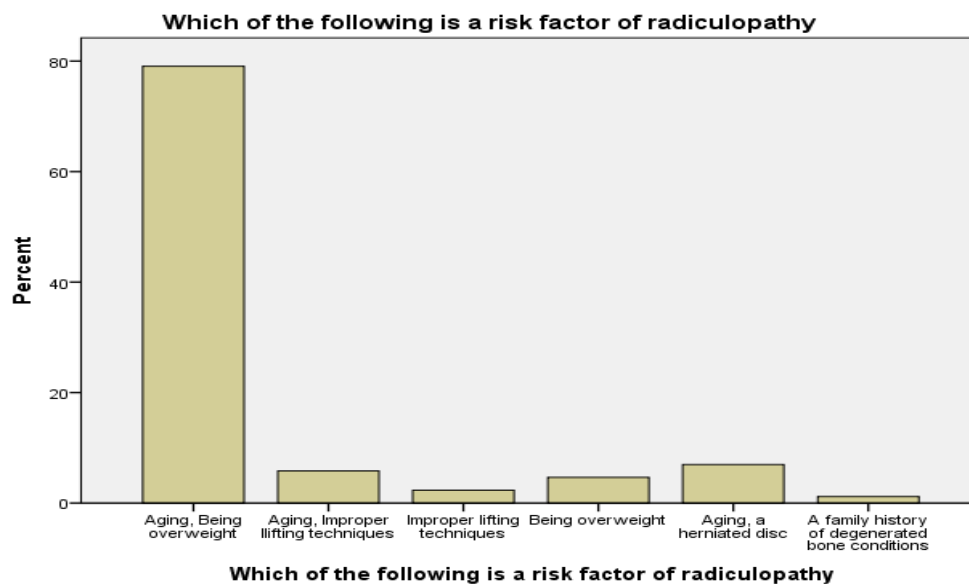

Figure 14: Awareness of PHC physician risk Factor of Radiculopathy.

Risk factor of radiculopathy					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Aging, Being overweight	68	79.1	79.1	79.1
	Aging, Improper lifting techniques	5	5.8	5.8	84.9
	Improper lifting techniques	2	2.3	2.3	87.2
	Being overweight	4	4.7	4.7	91.9
	Aging, a herniated disc	6	7.0	7.0	98.8
	A family history of degenerated bone conditions	1	1.2	1.2	100.0
	Total	86	100.0	100.0	

Table 4: Awareness of PHC physician Risk Factor of Radiculopathy.

According to above results 79.1% of the individuals indicated that aging and being overweight is the main risk factor of radiculopathy. 7% of the respondents indicates that aging and herniated disc could be radiculopathy risk factor. 2.5% of the respondents specified that improper lifting techniques is a risk factor of radiculopathy. 4.7% indicated that being overweight is a risk factor. Finally, 1.2% of the respondents indicated that A family history of degenerated bone conditions could be a risk factor of radiculopathy.

Chi-Square Test

Cross-tabulation of Age against Characteristic Variables

Characteristic Variables	Frequency	P-Value
Gender * Which of the following are symptoms of epilepsy:	86	0.216
Gender * What trigger epileptic seizure:	86	0.342
Gender * What causes epilepsy:	86	0.124
Gender * How is epilepsy treated	86	0.573
Gender * Which of the following is a warning signs of stroke	86	0.582
Gender * Which of the following is a type of headache:	86	0.175
Gender * Which of the following is the most common type of headache?	86	0.629
Gender * Which of the following is a cause of headache:	86	0.557
Gender * Which of the following is a symptom of multiple sclerosis	86	0.586
Gender * Which of the following is a risk factor of multiple sclerosis:	86	0.208
Gender* Which of the following is a complication of multiple sclerosis:	86	0.732
Gender * Which of the following is a risk factor of radiculopathy	86	0.146
Gender * Which of the following is a symptom of radiculopathy	86	0.273

Cross-tabulation of Gender against Characteristic Variables

Characteristic Variables	Frequency	P-Value
Age * Which of the following are symptoms of epilepsy:	86	0.935
Age * What trigger epileptic seizure:	86	0.762
Age * What causes epilepsy:	86	0.723

Age * Which of the following do you think is Stroke risk factor:	86	0.723
Age * Which of the following is a warning signs of stroke	86	0.986
Age * Which of the following is a type of headache:	86	0.879
Age * Which of the following is the most common type of headache?	86	0.730
Age * Which of the following is a cause of headache:	86	0.750
Age * Which of the following is a symptom of multiple sclerosis	86	0.990
Age * Which of the following is a risk factor of multiple sclerosis:	86	0.874
Age * Which of the following is a complication of multiple sclerosis:	86	0.909
Age * Which of the following is a risk factor of radiculopathy	86	0.924
Age * Which of the following is a symptom of radiculopathy	86	0.918

Based on the chi-square test results shown above, there is sufficient evidence to fail to reject the null hypothesis with a level of confidence of 95%. This is due to the fact that all of the p-values are greater than the alpha value of 0.05. This suggests that there is no relationship between the level of the residency program and the amount of knowledge that is possessed by the individual.

Discussion

Due to the rising prevalence of chronic diseases, family physicians are becoming more and more necessary in Saudi Arabia, where the importance of family medicine has been expanding [13]. Regardless of age, gender, or comorbidities, family physicians offer ongoing care for family members. Epilepsy and seizure disorders, headaches, stroke, multiple sclerosis, cervical and lumbosacral radiculopathy, are the five most prevalent neurological illnesses. The analysis showed that, the majority 63.95% indicated that they were aware that Alterations to senses is the main sign of epilepsy. The results indicated that more males 54.65 % while females constituted 45.35 percent of the participants.

Approximately 23.3% of responders to the current poll were unable to accurately identify more than one stroke symptom. This group was thought to have inadequate understanding of the symptoms, which would alter how they should react to a stroke and have bad results [14] This outcome is in line with results from earlier research conducted in Riyadh, the Kingdom of Saudi Arabia, the Gulf area, and other European nations [15].

The most often recognized risk factor for stroke was hypertension, followed by age. This result was consistent with the findings of research from Brazil, Australia, and Ireland, where high blood pressure was the most prevalent risk factor for stroke [16]. But our results were at odds with a Saudi research that claimed smoking was the most prevalent risk factor for stroke [17] Because hypertension is the most significant single risk factor for stroke and is quite common in the Saudi population, it is crucial that the general public be aware of its relationship with stroke.

These findings are comparable to those of a different survey carried out in Jazan, which found that 467 (56.3%) of the participants were aware neurological conditions. But a sizable portion of the participants (749, 90.2%) did not have a regular family doctor, and 496 (59.8%) chose to see a specialist [18]. In a previous study conducted in the cities of Dammam and Al-Khobar, Aldhamadi and Alzahrani found that patients may avoid PHCs for a variety of reasons, including long wait times (29.94 percent), unfavorable hours of operation (29.94 percent), unreliable doctors (29.38 percent), and far-off PHCs (6.21 percent) [19].

Conclusion

According to the findings of this study, the family physicians of Prince Sultan Military Medical City in Riyadh has moderately quite some significant awareness of neurological disorders. The majority of the participants were aware of the most prevalent neurological illnesses, as well as the warning signals and treatment options. Furthermore, the tests chi-square test of association conducted above indicated that there is no relationship between the level of the residency program and the level of the knowledge.

References

1. Casabella B, Pérez J (1995) Level of knowledge on neurology among primary care general physicians. Med Clin (Barc) 105: 3367-3369.

2. Loftus AM, Wade C, McCarron MO (2016) Primary care perceptions of neurology and neurology services. Postgrad Med J 92: 318-321.

3. Minen MT, Loder E, Tishler L, Silbersweig D (2016) Migraine diagnosis and treatment: A knowledge and needs assessment among primary care providers. Cephalalgia 36: 358-370.

4. Sloma A, Backlund LG, Strender LE, Skånér Y (2010) Knowledge of stroke risk factors among primary care patients with previous stroke or TIA: a questionnaire study. BMC Fam Pract 11: 47.

5. Kharbach A, Obtel M, Achbani A, Bouchriti Y, Hassouni K, et al. (2020) Level of Knowledge on Stroke and Associated Factors: A Cross-Sectional Study at Primary Health Care Centers in Morocco. Ann Glob Health 86: 83.

6. Daly BM, Arroll B, Scragg RKR (2019) Diabetes knowledge of primary health care and specialist nurses in a major urban area. J Clin Nurs 28: 125-137.

7. Charasson M, Mahé G, Le Brun C, Jaquinandi V, Rossignol E, et al. (2018) Atherosclerosis knowledge - diagnosis and management in primary care. Vasa 47: 465-470.

8. Faiz KW, Labberton AS, Thommessen B, Rønning OM, Barra M (2019) Stroke-Related Knowledge and Lifestyle Behavior among Stroke Survivors. J Stroke Cerebrovasc Dis 28: 104359.

9. Lo IL, Zeng W, Lei CI, Lam C, Lou HL (2020) Knowledge, Attitude and Preventive Practice on Dementia Care among Primary Health Professionals in Macao. J Prev Alzheimers Dis 7: 83-86.

10. Pérez-Pérez J, Sosa AM, González-Casanova S (2005) The knowledge, clinical control and attitudes of Primary Care physicians when dealing with epileptic patients. Preliminary findings. Rev Neurol 40: 385-393.

11. Al Rasadi K, Almahmeed W, AlHabib KF, Abifadel M, Farhan HA, et al. (2016) Dyslipidaemia in the Middle East: current status and a call for action. Atherosclerosis 252: 182-187.

12. Alaqeel A, AlAmmari A, AlSyefi N, Al-Hussain F, Mohammad Y (2014) Stroke awareness in the Saudi community living in Riyadh: prompt public health measures must be implemented. J Stroke Cerebrovasc Dis 23: 500-504.

13. Aldhamadi MA, Alzahrani FA (2019) The public perception of and attitude toward primary healthcare centers in comparison to other specialties among the Saudi community. J Family Med Prim Care 8: 1895.

14. Elagi AAA, Jaber BA, Wassly AHA, Ahmed RMS, Bosily FAA (2019) Public's perception and satisfaction on the role and services provided by family physicians in Saudi Arabia: A cross-sectional study. J Family Med Prim Care 8: 3282-3286.

15. Gomes ABAGR, Henrique Jr M, Schoeps VA, Santos MMSA, Pellegrinelli A, et al. (2017) Popular stroke knowledge in Brazil: A multicenter survey during "World Stroke Day". eNeurologicalSci 6: 63-67.

16. Kamran S, Bener AB, Deleu D, Khoja W, Jumma M, et al. (2007) The level of awareness of stroke risk factors and symptoms in the Gulf Cooperation Council countries: Gulf Cooperation Council stroke awareness study. Neuroepidemiology 29: 235-242.

17. Meo SA (2016). Prevalence and future prediction of type 2 diabetes mellitus in the Kingdom of Saudi Arabia: A systematic review of published studies. J Pak Med Assoc 66: 722-725.

18. Silver FL, Rubini F, Black D, Hodgson CS (2003) Advertising strategies to increase public knowledge of the warning signs of stroke. Stroke 34: 1965-1968.

19. Worthmann H, Schwartz A, Heidenreich F, Sindern E, Lorenz R, et al. (2013) Educational campaign on stroke in an urban population in Northern Germany: influence on public stroke awareness and knowledge. Int J Stroke 8: 286-292.