

# Knowledge, perception and attitudes toward epilepsy among medical students at King Abdulaziz University

SAGE Open Medicine

Volume 9: 1–6

© The Author(s) 2021

Article reuse guidelines:

[sagepub.com/journals-permissions](https://sagepub.com/journals-permissions)

DOI: 10.1177/2050312121991248

[journals.sagepub.com/home/smo](https://journals.sagepub.com/home/smo)

Salah Sabry Shihata<sup>1</sup> , Turki Salah Abdullah<sup>1</sup>,  
Abdulrahman Mansour Alfaidi<sup>1</sup> , Ammar Ali Alasmari<sup>1</sup>,  
Tala Mansour Alfaidi<sup>1</sup>, Anas Essa Bifari<sup>1</sup>, Wisam H Jamal<sup>2</sup>  
and Hisham A Rizk<sup>2</sup> 

## Abstract

**Introduction:** Epilepsy is a chronic neurological disorder characterized by repetitive seizures which could occur in different forms depending on the site of brain disturbance. It has both psychological as well as social effects resulting in stigmatization and isolation of epileptic patients. Even though medical students are considered a role model of well-educated communities, previous studies showed that students lack the satisfactory knowledge and attitudes toward epilepsy, so it is important to evaluate the concept of epilepsy and to measure awareness and attitudes toward epileptic patients among medical students of King Abdulaziz University. The aim of this study is to determine knowledge, perception and attitudes toward epilepsy among medical students at King Abdulaziz University.

**Methods:** An observational cross-sectional study was conducted on 455 medical students from Faculty of medicine, King Abdulaziz University, Jeddah, Saudi Arabia (Western region) through a web-based survey in July 2018. The survey is composed of many sections (demographic variables, knowledge, attitudes and practices toward epilepsy). The survey was applied as a Google form and the data were analyzed by IBM-SPSS for Windows, version 21.0. The chi-square test of independence was used for data analysis.

**Results:** Four hundred thirty-six out of 455 students (98.5%) were aware about epilepsy. However, the level of knowledge varies depending on the educational level of these students, because 88.5% of the students responded that brain injury is the most common cause and 57.3% said it is a genetic disease, while 3.7% stated that it was due to evil spirit. As a treatment method, medication and God's help were chosen by 95.8% and 57.8%, respectively. Objection to marry an epileptic patient was the most common negative attitude toward epileptics among the participants. Nonetheless, the overall attitude was found to be positive.

**Conclusion:** King Abdulaziz University medical students have had some misunderstandings regarding causes, manifestations and treatment of epilepsy which could affect their attitudes toward epileptic individuals. Educational programs which include more clinical exposure to such common diseases are required to improve students' impressions of these diseases.

## Keywords

Epilepsy, knowledge, attitude, Jeddah, medical students

Date received: 9 April 2020; accepted: 6 January 2021

## Introduction

Epilepsy is a prevalent chronic neurological disorder characterized by repetitive seizures which could relatively affect anyone at any age.<sup>1,2</sup> Manifestations of seizures differ depending on where in the brain disturbance first

<sup>1</sup>Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia

<sup>2</sup>Faculty of Medicine, University of Jeddah, Jeddah, Saudi Arabia

### Corresponding author:

Hisham A Rizk, Faculty of Medicine, University of Jeddah, P.O. Box 80327, Jeddah 21589, Makkah, Saudi Arabia.

Email: [hishamrizk@hotmail.com](mailto:hishamrizk@hotmail.com)



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons

Attribution-NonCommercial 4.0 License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).

starts. Transient symptoms occur such as disturbances of movement or sensation (including hearing, taste and vision) and loss of awareness or consciousness.<sup>3</sup> This disease affects approximately 50 million people around the world, accounting for 1% of the international burden of disease. However, 85% of the burden of epilepsy is in the developing countries.<sup>4</sup> In the Kingdom of Saudi Arabia, the prevalence of epilepsy is 6.54 per 1000 individuals.<sup>5</sup>

Epilepsy has multiple psychological and social consequences due to the ignorance and misconceptions regarding epilepsy among the population, resulting in stigmatization and isolation of epileptic patients, subsequently, signs of depression may be noted.<sup>6,7</sup> In addition, this lack of awareness and false perceptions about epilepsy have affected the attitudes of the patients' relatives toward epileptic patients. For instance, there will be an overprotective behavior and low expectations in terms of patients' academic and social performance, which can have an adverse effect on the diseased individual.<sup>8-10</sup> A previous study conducted in Al-Kharj Governorate 2018 concluded that negative attitudes exist in Saudi Arabia and a higher educational degree was a positive predictor.<sup>8</sup> Moreover, inadequate knowledge and mythological perspectives are the feeders of stigmatization and discrimination toward epileptics.<sup>9,10</sup> Studies have shown that a high level of knowledge about epilepsy closely correlates with low level of epilepsy-related stigma.<sup>11-13</sup>

Globally, many studies were conducted to measure the attitudes of the public toward epilepsy including studies from the United States<sup>14</sup> and China.<sup>15</sup> Domestically, however, only few studies were done and these are in Riyadh,<sup>16</sup> Almadinah Almunawwarah,<sup>17</sup> Aseer<sup>18</sup> and a systemic review done in Sub-Saharan Africa.<sup>19</sup> They all concluded that there is an association between the perception of epilepsy and the attitudes toward epileptic patients. Also, few studies were done on university students, as they are known to be well-educated, to evaluate their knowledge regarding epilepsy. Although the disorder is one of the commonest in Saudi Arabia, public awareness, knowledge and attitude regarding epilepsy in the Saudi population are deficient and the data are constrained.<sup>20,21</sup> There have not been studies done at the level of King Abdulaziz University (KAU) students in Jeddah, so this study aims to assess the awareness level and attitudes toward epileptic patients among KAU medical students.

## Materials and methods

### Research design

This study is an observational cross-sectional study aims to assess the medical students' knowledge, attitude and practice on epilepsy. The sample size calculated for this study was 326 participants, but we accepted up to 455 participants, the calculations were made using Raosoft sample size calculator.<sup>22</sup> This study was conducted medical students from faculty of medicine, KAU, Jeddah, Saudi Arabia (Western region) in July 2018.

### Sampling

In this study, we included all the medical students who are enrolled in the second through the sixth year and agreed to participate. The educational system of Faculty of Medicine, KAU is formed of a six-year curriculum preceded by the first preparatory non-medical year. The curriculum consists of 2 years of medical basic sciences, 3 years of clinical sciences and a seventh year of internship. Interns work for a whole year in various departments, so they are considered as medical practitioners and therefore excluded.

### Statistical analysis

We used a questionnaire and permission was acquired to use it by Kartal.<sup>23</sup> The questionnaire was in English. There were no tests of validity or reliability on the questionnaire instrument. The questionnaire was applied as a Google form, then it was sent as a message to students. We also distributed it to students who attended KAU Hospital. Google forms were used for easier distribution and data collection. Paper-based questionnaires were not used due to their low response rates.<sup>24</sup> The data were analyzed by IBM SPSS for Windows, version 21.0. The chi-square test of independence was used for data analysis.

### Research ethics

This study was approved by the Research Ethics Committee (REC) of KAU (494-18). Participation in this study was voluntary, and the first page of the online questionnaire provided the participants with the aim of this study. Participants consented by clicking a button that says "yes" when they were asked "Would you like to participate in this study?."

## Results

Among 941 students at our institution, 455 (48.35%) completed our questionnaire; of which 229 (50.3%) were filled by female students and 226 (49.7%) by males. Of the 455 students, 216 (47.4%) were preclinical years students, whereas 239 (52.6%) were clinical-year students, as shown in Table 1. Answers to questions about knowledge of epilepsy and its etiology as well as the attitudes toward epileptic patients are presented in Table 2.

### Knowledge of epilepsy

In total, 436 (95.8%) of the students replied that they have heard or read about epilepsy, 39.8% know someone with epilepsy and 40% had witnessed a seizure. In addition, 83.1% of the respondents acknowledged that epilepsy is a lifelong disease, while 76.9% thought it is a dangerous disease. The clinical-year students showed more significant results in terms of witnessing seizures than preclinical year students ( $p < 0.001$ ).

**Table 1.** Demographic features.

Variable	Frequencies N (n=455)	Percentage
Academic year		
Preclinical (2 and 3 years)	216	47.46
Clinical (4–6 years)	239	52.54
Second year	101	22.19
Third year	115	25.27
Fourth year	90	19.78
Fifth year	74	16.26
Sixth year	75	16.50
Gender	N	Percentage
Male	226	49.70
Female	229	50.30

Most common causes reported were brain damage (88.4%), inherited disease (67.9%) and then infections (56.9%). Some students, most of whom were females ( $p=0.022$ ), thought that epilepsy could be caused by psychological disorders (45.5%) or mental disorder (43.5%), 27.7% of the students referred the cause to be a vitamin deficiency and 24.4% reported their lack of knowledge about the etiology of epilepsy. A comparison between clinical students and their preclinical counterparts showed that clinical students more often reported infectious, avitaminosis and hematological disorders as causes of epilepsy ( $p<0.001$ ), ( $p=0.010$ ) and ( $p=0.017$ ), respectively. Furthermore, 44 (9.7%) of the participants believed that it could be a punishment from God. Significantly, a higher number of preclinical than clinical students reported evil spirit as a cause of epilepsy ( $p=0.028$ ). Regarding the conception of epileptic attacks among these students, tonic-clonic movements (87.9%) and sudden loss of consciousness (73.8%) were the most frequently identified manifestations, while urinary and fecal incontinence were the least known.

When asked about treatment methods, the majority chose the medical option (95.8%) and God's help (57.8%). Also, almost half of the students (51%), mostly from clinical years, thought that brain surgery could be considered as a treatment option ( $p<0.001$ ). In addition, for a question about what they would do to a person having a seizure; 343 out of 455 students (75.4%) responded that keeping the airway open would be the right response, while 73.2% of the sample would call an ambulance. Other options were also taken into account, for instance, keeping the patient's mouth open by inserting a piece between his teeth (35.6%), holding patient's extremities (34.7%), praying for the seizure to end (34.3%) and doing nothing (24.8%). A group of students, most of them are males from preclinical years, believed that onion or cologne smell could have an effect to arrest the seizure ( $p=0.002$ ) and ( $p=0.036$ ).

### *Attitudes toward epilepsy and epileptic patients*

Surprisingly, almost half of the students (44.6%) mostly are preclinical years students, stated that marrying a person with

epilepsy is not possible for them, yet it was statistically insignificant relationship ( $p=0.435$ ). Nearly all students felt that a person with epilepsy could have children (92.1%) and can be successful as any other person (95.8%). These findings demonstrated that educational levels could determine suitable attitudes toward the true nature of epilepsy.

## **Discussion**

The aim of this study is to evaluate the awareness, knowledge and attitudes toward epilepsy among KAU medical students. To our knowledge, this study is the first of its own to be done on medical students in Saudi Arabia. Results of this study vividly show that about 95.4% of the students of KAU, Faculty of Medicine are aware of the meaning of epilepsy, either by reading or hearing about it or simply by knowing someone with epilepsy. This finding is found to be better when compared with studies conducted on medical students of other developing countries such as Turkey.<sup>23</sup> Despite that many false beliefs and misconceptions regarding epilepsy are prevailing in Saudi community,<sup>25</sup> the awareness of medical students revealed in this study is quite similar to the public awareness found in a study done in Jeddah.<sup>26</sup> However, it was much better than the public awareness in Saudi population as a whole, attributing the cause to the sociocultural situation of Jeddah city, being the second largest city in Saudi Arabia with a civilized society.<sup>16</sup> This finding emphasizes the need for educational programs about awareness of epilepsy. Number of students who had witnessed a seizure attack (40%) is comparable with other studies done on same the population, which could be affected by the level of education and clinical exposure of these students.<sup>23,27</sup>

As most students (88.4%) thought that brain injury is the main cause of epilepsy, almost two-thirds of the sample (67.9%) said it could be a genetic disorder, which is consistent with studies done in Malaysia and Kuwait.<sup>28,29</sup> However, this percentage is a bit higher than percentages reported by other studies.<sup>23,27,30</sup> Other students (56.9%) selected the cause to be an infectious disease, which could influence the attitudes toward epileptic patients and even the immediate action to a person having a seizure. Nevertheless, about 45.5% and 43.5% of participants considered epilepsy as psychological and mental problems, respectively. This outcome is higher than the rates reported from Turkey, Jordan and Yemen.<sup>23,30,31</sup> Interestingly, clinical-year students reported vitamin deficiency to be a cause of epilepsy more than preclinical students, which may indicate higher knowledge as the educational level advances, given that studies proved the impact of avitaminosis in triggering seizures.<sup>32</sup> Furthermore, 9.7% of our respondents thought it as a punishment from God and 3.7% assumed that evil spirits (Jinn) are involved, which is a common belief in the Islamic world.<sup>28–30</sup> People tend to attribute psychiatric illnesses to possession by evil spirits, leading to the common misconception that epilepsy is a form of insanity.<sup>25,26</sup> This would explain the stigmatization

**Table 2.** Familiarity, knowledge and attitude toward epilepsy.

Percentage response (%)								
Percentage response to survey questions	Total		Gender (%)		p	Academic year (%)		p
	n	Percentage	Male	Female		Preclinical	Clinical	
Have you heard or read about epilepsy? (yes)	436	95.80	49.00	50.70	0.618	46.60	53.40	0.102
Do you know someone with epilepsy? (yes)	181	39.80	53.60	46.40	0.206	47.00	53.00	0.935
Have you ever witnessed a seizure? (yes)	182	40.00	54.40	45.60	0.121	35.20	64.80	0.000027
Do you think epilepsy is a lifelong disease? (yes)	378	83.10	48.40	51.60	0.287	48.10	51.90	0.607
Do you think epilepsy is a dangerous disease? (yes)	350	76.90	50.30	49.70	0.713	45.10	54.90	0.088
What do you think causes epilepsy?								
Brain injury	402	88.40	50.20	49.80	0.594	45.50	54.50	0.032
Hereditary disease	309	67.90	50.50	49.50	0.685	41.70	58.30	0.001
Psychological disorder	248	45.50	48.40	51.60	0.614	48.40	51.60	0.739
Infections	259	56.90	49.40	50.60	0.978	32.80	67.20	0
Avitaminosis	126	27.70	48.40	51.60	0.820	37.30	62.70	0.01
Punishment from God	44	9.70	56.80	43.20	0.401	70.50	29.50	0.002
Mental disease	198	43.50	56.10	43.90	0.022	51.00	49.00	0.218
Hematological disorders	108	23.70	44.40	55.60	0.257	37.00	63.00	0.017
Evil spirit	17	3.70	52.90	47.10	0.978	76.50	23.50	0.028
Don't know	111	24.40	46.80	53.25	0.565	55.00	45.00	0.088
What do you think an epileptic attack is?								
Sudden loss of consciousness	336	73.80	49.70	50.30	1.000	47.60	52.40	1
Tonic-clonic movements	400	87.90	49.30	50.80	0.734	42.30	57.80	0
Falling	274	60.20	48.50	51.50	0.619	47.10	52.90	0.912
Foaming of mouth and biting the tongue	314	69.00	43.30	56.70	0.000079	44.60	55.40	0.082
Urinary and fecal incontinence	210	46.20	44.30	55.70	0.042	27.10	72.90	0
What do you do when you see a person having a seizure?								
Keep the airway open	343	75.40	50.10	49.90	0.806	45.50	54.50	0.168
Call an ambulance	333	73.20	47.70	52.30	0.212	46.50	53.50	0.584
Insert an object between patient's teeth	162	35.60	47.50	52.50	0.561	58.60	41.40	0.001
Pray for an end to seizure	156	34.30	47.40	52.60	0.555	53.80	46.20	0.062
Hold the extremities of the patient	158	34.70	54.40	45.60	0.167	54.40	45.60	0.039
Let the person smell an onion or cologne	44	9.70	72.70	27.30	0.002	63.60	36.40	0.036
Throw water on patient's face	48	10.50	68.80	31.30	0.008	64.60	35.40	0.018
Do nothing	113	24.80	37.20	62.80	0.003	38.10	61.90	0.028
Treatment for epilepsy?								
Medical doctor	436	95.80	49.10	50.90	0.334	47.00	53.00	0.487
Brain surgery	232	51.00	47.80	52.20	0.427	37.10	62.90	0.000009
God's help	263	57.80	48.70	51.30	0.686	49.80	50.20	0.283
Acupuncture	61	13.40	54.10	44.90	0.545	52.50	47.50	0.484
Special foods, diet	120	26.40	47.50	52.50	0.654	49.20	50.80	0.744
Herbal medicine or traditional healer	65	14.30	60.00	40.00	0.096	69.20	30.80	0.000252
How effective is the medical treatment of epilepsy?								
Not effective	7	1.50	71.40	28.60	0.436	57.10	42.90	0.893
Sometimes	186	40.90	49.50	50.50	1.000	47.30	52.70	1
Always	135	29.70	51.10	48.90	0.767	23.00	77.00	0
I don't know	127	27.90	47.20	52.80	0.589	73.20	26.80	0
Would you marry a person with epilepsy? (yes)	252	55.40	47.20	52.80	0.285	45.60	54.40	0.435
Do you think a person with epilepsy should have children? (yes)	419	92.10	48.40	51.60	0.109	44.60	55.40	0.000072
Do you think that, in general a person with epilepsy can be successful as other people? (yes)	436	95.80	48.90	51.10	0.151	46.60	53.40	0.102



and the negative behavior of the general population toward patients with this condition. Thus, knowledge about the etiology of epilepsy seems to be a very important factor against negative attitudes toward epilepsy, which is consistent with the systemic review that showed negative attitudes coming from low education levels and living in a rural residence.<sup>19</sup> These variations in students' responses regarding causes of epilepsy clarify the inadequate knowledge of medical students, although they have to be at the highest level of education in the medical field.

High percentages of main manifestations of epileptic seizures, 87.9% for tonic-clonic movements and 73.8% for loss of consciousness, are justifiable as our findings show that most students are familiar with epilepsy. In regard to possible actions to be done when witnessing a live seizure attack, the results are somehow conformable with other studies except for the one-quarter of students (113, 24.8%) who think that doing nothing is the appropriate response, higher ratio than found on other studies.<sup>23,30</sup> Unexpectedly, almost 34.3% of the participants choose to pray for the seizure to end as a suitable action. This number could be related to the religious believes.

As for the treatment of epilepsy, 436 (95.8%) of the students agree that medications are the best treatment for epilepsy, slightly higher than analogous studies.<sup>23,27</sup> God's help is chosen by 57.8% of the sample and traditional healers (14.3%); we attribute the cause to the effect of religion over Islamic communities.<sup>23,28–30</sup> In addition, almost half of the respondents (51%) in our study, especially the more-experienced clinical-year students, appreciate the role of surgical intervention as a treatment option for epilepsy, much higher than medical students in Turkey (25.2%).<sup>23</sup> While in Jeddah public study, a percentage of 41% considered surgery as a treatment for epilepsy.<sup>33</sup>

Regarding attitudes toward epileptic patients, we observed a positive attitude in matters of having children and successfulness of those patients, but not for marriage which showed a disappointing result; about 44.6% refuse to be affianced to someone with epilepsy, which was consistent with a systemic review done in Africa (but it was better than study done in Nigeria where marriage was not a choice).<sup>19</sup> Attitudes of our students are better than the general attitudes of the public toward epilepsy in a study done in Riyadh.<sup>21</sup> In this study, 92.1% of students replied that epileptics could have children. This outcome is greater than that previously reported by studies conducted among university students in Kuwait and Jordan.<sup>29,30</sup> Pre-clinical-year students have more negative attitudes toward people with epilepsy than clinical-year students. We believe that it is because of their lack of knowledge and practical experience.

### Limitations and strengths

This study has some limitations. First, the study was limited only to medical students from the second year to the sixth

year in a single medical college which affects its generalizability. Second, while we have distributed the questionnaire, some of the students were discussing the questions due to the existence of some advanced terms, the matter that could have affected the responses. Finally, limited exposure with cases of epilepsy from some respondents may influence the attitudes observed in our study. This study also has strengths. The response rate of the sample size is high. Also, this study is the first of its type to be done in our institution.

### Conclusion

Our findings reveal that the participants have a good level of familiarity with epilepsy. However, they have had some misunderstandings regarding causes, manifestations and treatment of epilepsy which could affect their attitudes toward epileptic individuals. Also, we found that clinical-year students had more righteous believes, as the level of education can impact people's perspectives, and hence, their attitudes. As medical students are the future of medicine, we expect the knowledge and attitudes of these students to improve significantly with time and exposure. Furthermore, we suggest adding supportive educational and simulation programs that suite the students' materials to enhance understanding of the true nature of this disorder. For upcoming studies, we recommend adding the socio-economic factors to the data being studied and using interview-based questionnaires instead of self-administered questionnaires for more accurate results.

### Acknowledgements

The source of this article was from a related research with the title "Knowledge of, perceptions of, attitudes and practices regarding epilepsy among medical students in Turkey." The authors would like to attribute their thanks to all of the people who helped, especially Dr Mohammed Ridha Algethami, Mohammed Ahmed Safhi and Road of Change, for their help in data collection and article editing.

### Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Ethical approval

Ethical approval for this study was obtained from the Research Ethics Committee (REC) of King Abdulaziz University (494-18).


### Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

### Informed consent

The first page of the online questionnaire provided the participants with the aim of this study. Participants consented by clicking a button that says "yes" when they were asked "Would you like to participate in this study?."

## ORCID iDs

Salah Sabry Shihata  <https://orcid.org/0000-0002-9848-1345>

Abdulrahman Mansour Alfaidi  <https://orcid.org/0000-0002-3773-7749>

Hisham A Rizk  <https://orcid.org/0000-0002-0679-8952>

## Supplemental material

Supplemental material for this article is available online.

## References

- Jan MM. Perception of pediatric neurology among non-neurologists. *J Child Neurol* 2004; 19(1): 1–5.
- Millichap J. Mechanisms of epilepsy. *Pediatr Neurol Briefs* 2003; 17(10): 74–75.
- WHO. Epilepsy fact sheet, 2016, <http://www.who.int/mediacentre/factsheets/fs999/en/>
- Zhang Y, Yu N, Su L, et al. A prospective cohort study of prognosis for newly diagnosed epilepsy in east China. *BMC Neurology* 2013; 13(1): 116.
- Al Rajeh S, Awada A, Bademosi O, et al. The prevalence of epilepsy and other seizure disorders in an Arab population: a community-based study. *Seizure* 2001; 10(6): 410–414.
- Hirfanoglu T, Serdaroglu A, Cansu A, et al. Do knowledge of, perception of, and attitudes toward epilepsy affect the quality of life of Turkish children with epilepsy and their parents? *Epilepsy Behav* 2009; 14(1): 71–77.
- Shore CP, Buelow JM, Austin JK, et al. Continuing psychosocial care needs in children with new-onset epilepsy and their parents. *J Neurosci Nurs* 2009; 41(5): 244–250.
- Jacoby A, Gorry J, Gamble C, et al. Public knowledge, private grief: a study of public attitudes to epilepsy in the United Kingdom and implications for stigma. *Epilepsia* 2004; 45(11): 1405–1415.
- Caixeta J, Fernandes PT, Bell GS, et al. Epilepsy perception amongst university students: a survey. *Arq Neuropsiquiatr* 2007; 65(Suppl. 1): 43–48.
- Rose AW, Peace L and McBride M. On changing social conceptions of epilepsy. *Epilepsia* 1955; 4: 99–107.
- Sell Salazar F. Psychosocial aspects of childhood epilepsy. *Medicina (B Aires)* 2009; 69(1 Pt 1): 3–7.
- Parmar RC, Sahu DR and Bavdekar SB. Knowledge, attitude and practices of parents of children with febrile convulsion. *J Postgrad Med* 2001; 47(1): 19–23.
- Williams J. Learning and behavior in children with epilepsy. *Epilepsy & Behavior* 2003; 4(2): 107–111.
- Caveness WF, Merritt HH and Gallup GH Jr. A survey of public attitudes toward epilepsy in 1974 with an indication of trends over the past twenty-five years. *Epilepsia* 1974; 15(4): 523–536.
- Lai CW, Huang X, Lai YH, et al. Survey of public awareness, understanding, and attitudes toward epilepsy in Henan province, China. *Epilepsia* 1990; 31(2): 182–187.
- Muthaffar OY and Jan MM. Public awareness and attitudes toward epilepsy in Saudi Arabia is improving. *Neurosciences (Riyadh)* 2014; 19(2): 124–126.
- Neyaz HA, Aboauf HA, Alhejaili ME, et al. Knowledge and attitudes towards epilepsy in Saudi families. *J Taibah Univ Med Sci* 2017; 12(1): 89–95.
- Alhazzani AA, Alqahtani AM, Abouelyazid A, et al. Public awareness, knowledge, and attitudes toward epilepsy in the Aseer region, Saudi Arabia—A community-based cross-sectional study. *Epilepsy & Behavior* 2016; 63: 63–66.
- Kaddumukasa M, Kaddumukasa MN, Buwembo W, et al. Epilepsy misconceptions and stigma reduction interventions in sub-Saharan Africa, a systematic review. *Epilepsy Behav* 2018; 85: 21–27.
- Khan SA. Epilepsy awareness in Saudi Arabia. *Neurosciences* 2015; 20(3): 205.
- Alaqeel A and Sabbagh AJ. Epilepsy; what do Saudi's living in Riyadh know? *Seizure* 2013; 22(3): 205–209.
- Raosoftware. Sample size calculator, <http://www.raosoftware.com/sample-size.html> (2004, accessed 15 April 2010).
- Kartal A. Knowledge of, perceptions of, attitudes and practices regarding epilepsy among medical students in Turkey. *Epilepsy Behav* 2016; 58: 115–118.
- Greenlaw C and Brown-Welty S. A comparison of web-based and paper-based survey methods: testing assumptions of survey mode and response cost. *Eval Rev* 2009; 33(5): 464–480.
- Obeid T, Abulaban A, Al-Ghatani F, et al. Possession by 'Jinn' as a cause of epilepsy (Saraa): a study from Saudi Arabia. *Seizure* 2012; 21(4): 245–249.
- Haneef DF, Abdulqayoum HA, Sherbeni AA, et al. Epilepsy: knowledge, attitude and awareness in Jeddah Saudi Arabia. *BMC Genomics* 2014; 15(Suppl. 2): P61.
- Panda SB, Prabhu K, Rao S, et al. Evaluation of knowledge of and attitudes toward epilepsy among the health science students of Manipal University. *Epilepsy Behav* 2011; 20(3): 447–449.
- Ab Rahman AF. Awareness and knowledge of epilepsy among students in a Malaysian University. *Seizure* 2005; 14(8): 593–596.
- Al-Rashed H, Al-Yahya D, Al-Kandari A, et al. Knowledge of, perceptions of, and attitudes toward epilepsy among university students in Kuwait. *Epilepsy Behav* 2009; 14(2): 367–371.
- Hijazeen JK, Abu-Helalah MA, Alshraideh HA, et al. Knowledge, attitudes, and beliefs about epilepsy and their predictors among university students in Jordan. *Epilepsy Behav* 2014; 41: 238–243.
- Al-Eryani B, Saied KG, Sharaf Alddin R, et al. Knowledge of, attitudes toward, and perceptions of epilepsy among university students in Yemen. *Epilepsy Behav* 2015; 52(Pt A): 102–107.
- Ramos RJ, Pras-Raves ML, Gerrits J, et al. Vitamin B6 is essential for serine de novo biosynthesis. *J Inherit Metab Dis* 2017; 40(6): 883–891.
- Zainy LE, Atteyah DM, Aldisi WM, et al. Parents' knowledge and attitudes toward children with epilepsy. *Neurosciences (Riyadh)* 2013; 18(4): 345–348.