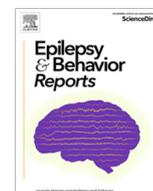




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Knowledge of and attitude towards epilepsy among university students in Saudi Arabia: Misconceptions of the next generation



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Introduction

Epilepsy is a common neurological disorder with immense socio-cultural implications. The World Health Organization estimated that around 40 million people with epilepsy live in developing countries where epilepsy is under-recognized and often poorly funded concerning clinical care and research [1,2]. This may be partly due to the ancient nature of epilepsy being associated with being possessed by demons and spirits, which have led to persistent restrictions in different cultures that have been stigmatizing and discriminating against people with epilepsy over many generations [3,4].

The socio-cultural dimensions of epilepsy are important predictors of its clinical outcomes and are often among the significant barriers to appropriate management [5]. One of the common consequences of discrimination and the associated stigma is that patients and their families do not seek treatment, even when available. A meaningful way to “bring epilepsy out of the shadows” is to educate the public about the modern concept that epilepsy is a disease like any other [4]. University students are potential future leaders, making them highly influential in their fields. Therefore, some studies were conducted globally among university students to measure their knowledge and awareness of epilepsy. Positive attitudes of university students toward people with epilepsy have been reported in surveys in Canada and Malaysia [6,7]. On the other hand, studies in some Arab countries found that students’ knowledge of epilepsy and their attitudes toward people with epilepsy are unfavorable and should be improved [3,8,9].

Healthcare is one of the main focus areas of Saudi Vision 2030, a comprehensive plan for reform of the entire economic structure of Saudi Arabia. One of its objectives is to improve the quality of life and healthcare services provided to patients outside hospitals. Understanding the degree of university students’ knowledge and their attitude is key to designing educational programs and efforts to alleviate the social stigma and discrimination associated with epilepsy; this is lacking in Saudi universities. Our objectives were

to examine the knowledge of epilepsy and attitudes toward people with epilepsy and their predictors among the undergraduate students at Jazan University.

Methods

Study design, setting, and population

An observational cross-sectional study was conducted among Jazan University students. Jazan University is the leading higher educational institution in the Jazan region, which was established in 2006. Approximately 47,000 students are enrolled in the undergraduate programs of 24 colleges. The Jazan (also called the Gizan) region is one of the thirteen provinces of Saudi Arabia. This region is highly populated, with a total population of 1.5 million, as estimated in the fourth Saudi population census conducted in 2010. It is less urbanized than large cities in Saudi Arabia (e.g., Riyadh and Jeddah), but experiences expeditious economic development.

The present study targeted undergraduate students registered for the academic year 2015/2016. The administrative department of each college identified the codes and names of the courses. The teachers of those courses were approached at the beginning of each session and were provided with a brief explanation of the study. Permission was obtained for students to take 10–15 min at the beginning of the class to complete the questionnaire. Students were instructed not to discuss the questions with their colleagues. If they had any queries, they were encouraged to ask a member of the research team. The identity of the student was not requested to ensure privacy and to encourage accurate responses. Data were collected from university campuses in March and April 2015.

Sampling procedures

A sample of 630 participants was estimated for this study. This sample size was calculated using the formula for a single cross-sectional survey, $n = [(z^2 * p * q)]/d^2$, using the following parameters: p = prevalence of epilepsy knowledge = 50%, Z = 95% confidence (CI) interval, d = error not more than 4%, and q = 5% non-response rate. The sample was first stratified according to

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three sectors: Health-related colleges, Sciences colleges, and Arts and Humanities colleges. In the second step, two colleges were randomly selected from each sector. Health-related colleges included Pharmacy and Applied Medical Sciences. The Sciences colleges included Natural Sciences and Computer Sciences. The Arts and Humanities colleges included Business Administration and Arts. Students from the College of Medicine were excluded, as their knowledge would be similar to that of health service providers, rather than to that of young adults in general. Probability proportional to size sampling (PPS) was used to determine the number of students in each of the selected colleges.

Data collection and study instrument

A self-administered questionnaire was designed based on the available published literature on epidemiological studies and surveillance of epilepsy [8,10,11]. It was thought that a self-administered questionnaire would offer participants more freedom to express their thoughts when compared with a personal interview approach. The questionnaire was initially drafted in English and subsequently translated into Arabic. It involved questions on the knowledge of the nature, causes, and treatment of epilepsy and the participant’s attitude towards marriage, employment, and social interaction with people and children with epilepsy. Demographic data of age, gender, class, family background, father’s and mother’s education levels, and income levels were also collected. A panel of three faculty members assessed the face and content validity of the study instrument. Additionally, reliability tests were conducted for the whole instrument and produced an acceptable level of Cronbach’s alpha of 0.647 for the 34 items.

Statement of ethics

This study was conducted in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki). This manuscript is in line with the Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals and aimed for the inclusion of representative human populations (sex, age, and ethnicity) as per those recommendations. The study protocol was approved by the Jazan University Ethical Committee (Reference # SCBRE 1436 13). Informed consent was obtained and the privacy rights of the participants were protected. Participation in the study was voluntary.

Statistical methods

Data analysis was performed using the Statistical Package for the Social Sciences software (SPSS version 17.0, IBM, USA). Descriptive statistics based on frequencies and percentages were used to determine the participants’ perception of epilepsy and their level of knowledge about epilepsy. The Chi-square test was used to assess the association between a set of independent variables, such as age, gender, marital status, grade point average (GPA), and the level of epilepsy knowledge. An epilepsy knowledge score for each student was obtained based on the students’ correct or positive responses on items pertaining to knowledge about the nature, causes, and treatment of epilepsy. Epilepsy knowledge scores were then classified into three categories: the “High score” group for respondents with an epilepsy knowledge score above 80, the “Intermediate score” group for respondents with a literacy score of 60–80, and the “low score” group for respondents with a literacy score below 60. To assess factors associated with epilepsy knowledge, the study participants were classified as having good knowledge with a score greater than 60 and those having less knowledge with a score of less than 60. A logistic regression model was used to

predict a good level of knowledge using a set of sociodemographic and educational predictors. Statistical significance was set at $P < 0.05$.

Results

Characteristics of the study participants

A total of 511 (out of 630) students completed the questionnaire, giving a response rate of 81.1%. Of the total, 277 students (54.2%) were women. The mean \pm SD age was 21.6 ± 1.6 years (range: 18 to 27 years). Students in Health-related colleges comprised 35.8%, Sciences colleges comprised 34.8%, and Arts and Humanities colleges comprised 29.4% of the study participants. Majority of the students were single (82.0%). Table 1 shows the remaining characteristics of the study participants.

University students’ personal experience about epilepsy

Of the 511 students, 90.1% reported that they had heard about epilepsy, and 37% knew a friend or a family member with epilepsy (Table 1). Almost half of the students (57%) had witnessed someone experiencing what they believed to be an epileptic seizure, and 27.2% reported that they knew how to help an individual having an epileptic seizure. About 27% of the students perceived their knowledge about epilepsy as adequate, and 73% perceived it as either insufficient or nothing at all. Women and health-specialties students were more likely to perceive their knowledge about epilepsy as adequate ($P < 0.05$).

University students’ knowledge about the nature of epilepsy

Table 2 shows the students’ knowledge about the nature, causes, and treatment of epilepsy. Of the students surveyed, 40.6% believed that epilepsy is a brain disorder, while 66.3% believed that epilepsy is a treatable disease. Epilepsy was linked to mental disorders by 19.9% of the students. Only 3.5% of the students considered epilepsy to be an infectious disease. Women and health-specialties students were more likely to know that epilepsy is a treatable brain disorder ($P < 0.05$).

When respondents were asked about manifestations of epilepsy, 81.1% of the students identified convulsions, particularly

Table 1
Characteristics of the study participants.

Characteristics	Men	Women	Total
Age Groups (n = 431)			
18–20 years	41 (21.2)	86 (36.1)	127 (29.5)
20–21 years	87 (45.1)	93 (39.1)	180 (41.8)
23 and above	65 (33.7)	59 (24.8)	124 (28.8)
Colleges (n = 511)			
Health-related	86 (36.8)	97 (35.0)	183 (35.8)
Sciences	109 (46.6)	69 (24.9)	178 (34.8)
Arts and Humanities	39 (16.7)	111 (40.1)	150 (29.4)
Mode of Living (n = 508)			
Rural	164 (70.7)	158 (57.2)	322 (63.4)
Urban	68 (29.3)	118 (42.8)	186 (36.6)
Marital Status (n = 506)			
Single	216 (93.1)	199 (72.6)	415 (82.0)
Married	15 (6.5)	62 (22.6)	77 (15.2)
Divorced/Widowed	1 (0.4)	13 (4.7)	14 (2.8)
Grade Points Average (n = 395)			
Pass	30 (16.8)	16 (7.4)	46 (11.6)
Good	73 (40.8)	89 (41.2)	162 (41.0)
Very Good	61 (34.1)	87 (40.3)	148 (37.5)
Excellent	15 (8.4)	24 (11.1)	39 (9.9)
Total	234 (45.8)	277 (54.2)	511 (100)

Table 2
University students' knowledge about the nature, causes, and treatment of epilepsy.

Variable (% Yes)		Gender		p. value	Colleges			p. value	Total
		M	F		Health Sciences	Sciences	Arts & Humanities		
Students' knowledge about the nature of epilepsy	Think epilepsy is:								
	Brain Disorder	37.7	43.0	P < 0.05	65.6	29.7	23.3	P < 0.05	40.6
	Infectious disease	3.2	4.2	NS	2.3	3.3	4.9	NS	3.5
	Mental illness	10.6	8.8	NS	28.3	18.0	13.3	NS	19.9
	Treatable disease	51.1	69.6	P < 0.05	82.9	63.9	52.0	P < 0.001	66.3
Students' knowledge about the causes of epilepsy	Think epilepsy manifest as:								
	Foaming from the mouth	29.1	31.8	NS	31.3	30.9	29.3	NS	3.6
	Convulsions	80.9	81.2	NS	92.2	78.7	70.7	P < 0.05	81.1
	Screaming	25.7	21.7	NS	26.3	27.5	15.3	P < 0.05	23.5
	Changes in behavior	20.9	18.1	NS	27.9	15.7	13.3	P < 0.05	19.3
Students' knowledge about the treatment for epilepsy	Think epilepsy is caused by:								
	Genetic	25.1	16.2	P < 0.05	22.7	18.1	13.4	P < 0.05	20.3
	Evil spirits	16.9	14.8	NS	18.9	14.0	14.0	NS	15.7
	Depression or anxiety	23.4	19.9	NS	26.7	19.1	18.0	NS	21.5
	Head trauma	23.8	10.8	P < 0.05	25.0	12.9	11.3	P < 0.05	16.7
What would you do if you witness someone having an epileptic seizure attack?	Congenital malformations	9.5	2.5	P < 0.05	9.4	3.9	3.3	P < 0.05	5.7
	Punishment from God	3.5	1.1	NS	2.2	1.7	2.7	NS	2.2
	Holy Qur'an	47.2	45.1	NS	39.4	58.4	39.3	P < 0.05	46.1
	Herbs	5.6	5.1	NS	2.8	6.7	6.7	NS	5.3
	Acupuncture	4.3	2.5	NS	3.1	2.3	3.4	NS	3.3
	Specialist doctor consultation	58.3	58.1	NS	71.7	51.1	50.3	P < 0.001	58.2
	Get medicine from pharmacy	6.9	4.7	NS	10.0	3.4	3.3	P < 0.05	5.7
	Surgery	9.6	6.9	NS	15.2	4.5	4.0	P < 0.05	8.1
	No treatment	9.1	3.2	P < 0.05	6.7	5.6	5.3	NS	5.9
	No need for treatment	4.3	0.4	P < 0.05	2.8	2.8	0.7	NS	2.2
If you had epilepsy and the physician instructs you not to drive; would you follow his instruction	Put a cloth in patient's mouth	31.0	36.6	NS	31.6	33.9	37.2	NS	34.3
	Through water on his face	6.9	8.5	NS	2.6	10.2	9.3	NS	7.9
	Hold or tie him down	19.0	18.3	NS	28.9	13.6	16.3	NS	18.6
	Take him away from danger	12.1	11.0	NS	10.5	10.2	14.0	NS	11.4
	Call 997	12.1	8.5	NS	18.4	6.8	7.0	NS	10.0
If you had epilepsy and the physician instructs you not to drive; would you follow his instruction	I don't know	6.9	1.2	NS	5.3	5.1	0	-	3.6
	Yes	55.9	67.5	P < 0.05	73.3	60.0	51.4	P < 0.05	62.2
	No	18.3	12.8	NS	6.1	15.4	26.4	P < 0.05	15.3
	I do not know	25.8	19.7	NS	20.6	24.6	22.3	NS	22.5

Note. NS = Not Significant; M = male; F = female

those of health specialties ($P < 0.05$). In contrast, most of the health-specialties students did not realize that it could manifest as changes in behavior (27.9%).

University students' knowledge about the causes of epilepsy

Depression or anxiety (21.5%), genetic causes (20.3%), and head trauma (16.7%) were the most commonly reported causes of epilepsy (Table 2). A total of 15.7% of the students linked epilepsy to spirit possession, with no significant variations by gender or college type. Health-specialties students significantly linked epilepsy to genetic cause, head trauma, and congenital malformations compared to students in other disciplines ($P < 0.05$).

University students' knowledge about the treatment of epilepsy

About two-thirds of the students responded that patients with epilepsy should consult specialist doctors, particularly those of health specialties ($P < 0.001$) (Table 2). Nevertheless, almost half of the students (46.1%) responded that it is possible to treat epilepsy with spiritual ritual treatment (the Holy Qur'an). Less than 6% of the students believed that patients with epilepsy should seek complementary and alternative therapies. When asked what they would do if they witnessed an individual having an epileptic attack, more than one-third of the participants (34.3%) responded that they would put a cloth in the patient's mouth, with no significant gender or college type variations. Two-thirds of the participants (62.2%) had reservations about allowing someone with

epilepsy to drive; this was significant among women and health-specialties students ($P < 0.05$).

Epilepsy knowledge scores

The students' knowledge scores regarding epilepsy are shown in Table 3. Of the surveyed students, 51.6% had intermediate knowledge of epilepsy, whereas 25.2% and 23.2% had high and low knowledge scores, respectively. Students of health specialties had higher scores than the others ($P < 0.0001$). There was no statistically significant difference between the age groups ($P = 0.571$). Women showed higher scores than men, but the difference was not statistically significant ($P = 0.392$).

Factors associated with a good knowledge of epilepsy among the study participants

The logistic regression analysis (Table 4) showed that students of health specialties had more favorable knowledge than those in other colleges (4.2 [95% CI: 2.36,7.480]; $P 0.000$). Associations of knowledge with age groups, gender, and GPA were insignificant ($P > 0.05$).

University students' attitudes toward people with epilepsy

Table 5 presents the attitudes of students toward people with epilepsy. Only 22% of the students were willing to marry someone with epilepsy, which was significant in men ($P < 0.05$). About 24%

Table 3
Epilepsy knowledge scores according to some selected background characteristics.

Variable	Knowledge Score, n (%)			p. value
	low<60	Intermediate60–80	High>80	
Age Groups (n = 431)				
18–20 years	33 (26.6)	66 (53.2)	25 (20.2)	0.571
20–21 years	41 (23.2)	90 (50.8)	46 (26.0)	
23 and above	21 (17.6)	64 (53.8)	34 (28.6)	
Colleges (n = 492)				
Health-related	20 (11.6)	98 (57.0)	54 (31.4)	< 0.0001
Sciences	529 (29.9)	82 (47.1)	40 (23.0)	
Arts and Humanities	52 (35.6)	74 (50.7)	20 (13.7)	
Gender (n = 492)				
Men	62 (28.2)	113 (51.4)	45 (20.5)	0.392
Women	62 (22.8)	141 (51.8)	69 (25.4)	
Marital Status (n = 488)				
Single	96 (24.1)	215 (53.9)	88 (22.1)	0.121
Married	24 (32.0)	30 (40.0)	21 (28.0)	
Divorced/Widowed	3 (21.4)	6 (42.9)	5 (35.7)	
Grade Points Average (n = 384)				
Pass	15 (33.3)	24 (53.3)	6 (13.3)	0.371
Good	40 (25.5)	84 (53.5)	33 (21.0)	
Very Good	33 (22.8)	73 (50.3)	39 (26.9)	
Excellent	6 (16.2)	18 (48.6)	13 (35.1)	
Mode of Living (n = 490)				
Rural	79 (25.5)	158 (51.0)	73 (23.5)	0.967
Urban	44 (24.4)	95 (52.8)	41 (22.8)	
Overall Knowledge	124 (25.2)	254 (51.6)	114 (23.2)	

of the students reported that people with epilepsy should have the same employment opportunities as others, and half of the students (54.1%) would allow their children to play with children with epilepsy, particularly those of Health-related colleges ($P < 0.05$). Only 16.5% believed that children with epilepsy must join schools for persons with disabilities. The proportion of students who thought that people with epilepsy must not get married or not have children was 8.6% and 3.8%, respectively. More than 80% of the students reported that they would easily treat a person with epilepsy naturally during social encounters, which was significant in women ($P < 0.05$). A total of 87.6% of the students believed that adult people with epilepsy should have the ability to think and

judge like the normal population, particularly students of health specialties ($P < 0.05$).

The sources of students’ knowledge about epilepsy

The most common source of students’ knowledge about epilepsy was personal experience related to relatives (19.5%) and friends (12.5%). Other resources included the Internet (15.6%) and television or radio (8.8%). About 13% of the students reported university subjects and lectures as sources for their information.

Discussion

University students represent the generation that is about to enter the workforce in a broad range of vocations. In this large study, we assessed epilepsy-related knowledge and attitudes in a university setting, given the widespread community misconceptions and misinformation in this geographical region of interest. The study highlights a major issue that requires future intervention; the “spiritual” and “mental disorder” misconceptions about epilepsy in a higher education institution and the attitudes toward individuals with epilepsy in terms of marriage, employment, and different aspects of social interactions. The results could be very informative and helpful in designing awareness programs for epilepsy in this region.

Majority of the study participants had heard about epilepsy, half witnessed a seizure, and one-third knew someone with epilepsy. These data compare favorably with those of two previous studies among the general population in Saudi Arabia [10,11]. In both the previous studies, however, more than two-thirds of the participants were younger than 30 years of age and had university or postgraduate levels of education. Our results are also consistent with those among university students in Saudi Arabia and other Arab countries [3,6–9]. Data for comparisons with similar studies worldwide and with the Saudi Arabian general population studies are presented in Table 6.

Table 4
Factors associated with epilepsy good knowledge among study participants.

Category	Univariate logistic regression			
	OR	95% C.I. Lower	Upper	p-value
Age Groups				
18–20 years	1			
20–21 years	1.203	0.708	2.043	0.494
23 and above	1.692	0.913	3.137	0.095
Colleges				
Health-related	4.204	2.36	7.481	0.000
Sciences	1.298	0.81	2.075	0.276
Arts and Humanities	1			
Gender				
Men	1			
Women	1.329	0.884	1.999	0.172
Marital Status				
Single	1			
Married	0.673	0.394	1.152	0.149
Divorced/Widowed	1.162	0.318	4.250	0.821
Grade Points Average (GPA)				
Pass	1			
Good	1.463	0.715	2.993	0.298
Very Good	1.697	0.817	3.526	0.156
Excellent	2.583	0.885	7.543	0.083

Note. C.I. = Confidence interval

Table 5
University students' attitudes toward people with epilepsy.

Variable (% Yes)		Gender			Colleges			p. value	Total
		M	F	p. value	Health Sciences	Other Scientific	Humanities & Arts		
Would you be willing to	Marry someone with epilepsy	27.6	17.5	<i>P</i> < 0.05	15.0	28.0	22.7	<i>P</i> < 0.05	22.0
	Allow your child to play with a child with epilepsy	49.5	57.9	NS	63.3	51.0	47.7	<i>P</i> < 0.05	54.1
	Employ someone with epilepsy in a job	23.0	24.6	NS	21.8	21.0	29.5	NS	23.9
How would you react if you discovered that someone you know had epilepsy	I would treat him like before	81.0	90.5	<i>P</i> < 0.05	92.2	83.7	81.8	<i>P</i> < 0.05	86.2
	I would feel awkward and try to avoid him	3.9	1.1	<i>P</i> < 0.05	0	2.8	4.7	NS	2.4
	I would feel awkward and stop my relationship with him	3.5	1.1	NS	0	3.4	3.4	NS	2.2
Having a relationship with someone with epilepsy	No objection to having a social relationship	75.0	84.3	<i>P</i> < 0.05	80.9	79.4	79.9	NS	80.1
	No objection to having a close friendship	80.3	81.5	<i>P</i> < 0.05	80.9	79.1	83.2	NS	81.0
Children with epilepsy should	Be successful in their Study	71.9	80.7	<i>P</i> < 0.05	85.3	73.0	70.7	<i>P</i> < 0.05	76.7
	Be isolated from other children	4.4	0.7	<i>P</i> < 0.05	1.1	4.5	1.4	<i>P</i> < 0.05	2.4
	Attend special needs schools	19.7	13.9	NS	12.4	18.0	19.7	NS	16.5
	Be restricted from sports in schools	3.9	4.7	NS	1.1	4.5	8.2	<i>P</i> < 0.05	4.4
People with epilepsy should	Not get married	11.0	6.6	NS	2.8	9.8	14.2	<i>P</i> < 0.05	8.6
	Not have children	2.6	4.8	NS	1.7	5.2	4.7	NS	3.8
	Think and judge like other people	86.4	88.6	NS	95.5	85.1	81.1	<i>P</i> < 0.05	87.6

Note. NS = not significant; M = male; F = female

Table 6
Comparison with similar studies worldwide and with the Saudi Arabian general population studies.

Variable	The present study 2021	University Students Arabic countries			University Students International		General Population	
		Saudi Arabia (Obeid, Abulaban et al. 2012)	Jordan (Hijazeen, Abu-Helalah et al. 2014)	Kuwait (Al-Rashed, Al-Yahya et al. 2009)	Malaysia (Ab Rahman 2005)	Canada (Young, Derry et al. 2002)	Saudi Arabia (Alaqael and Sabbagh 2013)	(Muthaffar and Jan 2014)
Sample size	511	244	1,165	753	289	191	7078	749
Had heard about epilepsy	90.1%	81.1%	77.7%	-	86.5%	91%	95.5%	77.4%
Had witnessed a seizure	57%	45.5%	48.7%	-	55.6%	48%	42.7%	-
Know someone with epilepsy	37.3%	-	20.6%	-	6.3%	57%	60%	-
Epilepsy is a brain disorder	40.6%	-	-	-	-	-	54.7%	52%
Epilepsy is a treatable disease	66.3%	64.3%	76.4%	78.4%	46.3%	-	-	-
Epilepsy is a form of insanity or madness	10.9%	-	27.5%	10.5%	-	9%	8.1%	-
Epilepsy is a mental illness	19.9%	46.5%	15.6%	12.2%	39.7%	-	24%	-
Epilepsy is an infectious disease	3.5%	-	2.9%	1.7%	4.9%	-	14.2%	-
Epilepsy is caused by evil spirits (jinn) possession	15.7%	50.4%	31.5%	25%	5.3%	-	-	15%
Preferred spiritual ritual treatment (Holy Quran)	46.1%	81.6%	71.4%	-	-	-	40.2%	37%
Objected to marryingsomeone with epilepsy	78%	-	50.5%	56%	-	5%	76%	71%
Would not allow his/her child to play with a child with epilepsy	54.1%	-	-	12.5%	-	5%	27%	-
People with epilepsy should be employed at the same jobs as other people	23.9%	-	71.6%	73.8%	86%	84%	42.2%	61%
Children with epilepsy should attend special needs schools	16.5%	-	44.4%	29%	-	-	-	-
People with epilepsy should not get married	8.6%	-	16.2%	8%	-	-	-	-
People with epilepsy should not have children	3.8%	-	17.3%	12.5%	-	11%	-	-
People with epilepsy should be treated normally during social encounters	80.1%	-	79.3%	83.4%	-	-	-	-

In line with our expectations, students in health specialties had higher knowledge scores, perhaps because learning about epilepsy is a part of their curriculum, which they should be competent in before graduating. These students, compared to their counterparts in other disciplines, significantly linked epilepsy to head trauma, genetic causes, and congenital malformations, differentiated epilepsy as a brain disorder, and identified convulsions as a sign of epilepsy. The latter finding was higher than that previously reported in Saudi Arabia and Canada [6,10]. However, a significant proportion of health-specialties students did not realize that epilepsy may manifest as changes in behavior and responded by putting a cloth in the patient's mouth if they witnessed someone having a seizure. These responses highlight the need for more education and first-aid training among university students.

Despite their educational levels, a significant proportion of students still believe that spirit possession is a cause of epilepsy. This result compares favorably with previous studies among university students [3,8,9], but is consistent with that reported by the general population in Saudi Arabia [11]. Interestingly, a similar proportion of students also linked epilepsy to psychiatric diseases. The flow of these misconceptions down the generations has led to significant social stigma toward people with epilepsy and improper provision of epilepsy care in Saudi Arabia. For this reason, a large proportion of individuals with epilepsy in our communities may not receive the treatment they need, resulting in a tremendous individual, family, social, and economic burden [12]. The stigma and spiritual misconceptions about epilepsy exhibited by the next generation are major concerns that require immediate intervention. Educating university students that epilepsy is a disease like any other is warranted. They are future influencers, and their attitudes will matter in bringing about a change.

The study also showed that almost half of the respondents preferred spiritual ritual treatment (reading Holy Quran), regardless of their strong belief in modern medicine. This result compares favorably with those from studies on the general population in Saudi Arabia and reflects the way people link epilepsy with psychiatric diseases and spirit possession [10,11]. Previous studies in Saudi Arabia and other Arab countries concluded that patients with epilepsy seek spiritual ritual treatment to alleviate their anxiety and depression, which commonly occur in epilepsy [8–10]. Accordingly, we can understand, at least in this cohort, that spiritual treatment was not preferred alone but as an adjunctive to medical treatment.

The results also showed that most respondents, particularly women, would object to marry someone with epilepsy. This attitude appears to be consistent with that reported in Saudi Arabia, Malaysia, and China [7,10,11,13]. The attitude might be influenced by the concern that epilepsy is an inherited disease, although few respondents in this study linked epilepsy to genetic causes. Contrary to this attitude in Arab countries and China, few people in the USA, Canada, Austria, and New Zealand objected to marrying someone with epilepsy [6,14–16]. On the other hand, only a few respondents in this study thought that people with epilepsy should have the same employment opportunities as others. This could likewise be influenced by their concerns about the safety and abilities of people with epilepsy and does not reflect workplace discrimination. Further analysis will likely reveal employment as an area of public concern, requiring additional educational programs and special legislation.

Even now, a significant proportion of students thought that children with epilepsy must join schools for persons with disabilities, although they are fewer compared to previous studies [8–10]. In addition, almost half of the students were reluctant to allow their children to interact with other children with epilepsy. It is of interest that most respondents, particularly women, had no prob-

lems with social relationships or friendships with people with epilepsy. Overall, the difference in attitudes between men and women was small, but significant. Except for their objection to marrying someone with epilepsy, women were slightly but significantly more tolerant than men towards other social interaction variables. However, there was no gender effect on epilepsy knowledge scores. It is unclear whether this difference is biological rather than cultural, as this finding was observed in other studies worldwide [6,10]. Further studies are required to address this issue.

Our study differs from other studies in Saudi Arabia and other Arab countries in comparing the knowledge and attitudes of health-specialties students with their counterparts in other disciplines. To our best knowledge, this is the largest study among university students in Saudi Arabia. The association between students' knowledge and attitudes was relatively remarkable. Health-specialties students were more knowledgeable and had favorable attitudes in most aspects than others. Nevertheless, it was disappointing that even the attitudes of health-specialties students were unfavorable toward marriage, employment, and interaction of their children with other children with epilepsy. Regarding the worldwide comparison, the survey in Canada showed some discrepancies between knowledge and attitudes, but in the opposite direction. In that survey, the knowledge was patchy and weak, but the attitude was positive, particularly towards marriage (95% in Canada versus 22% in Saudi Arabia) [6]. The only negative attitudes in that survey were toward agreement on equal employment opportunities (14% versus 24%) and people with epilepsy to have children (11% versus 3.8%).

This study has some limitations. First, the study design was an observational cross-sectional design, so associations between the selected predictors and knowledge levels should be interpreted with caution. Second, all information on attitudes and knowledge was based on a self-reported questionnaire, which is a potential source of error. The structured questions did not allow for a more detailed exploration of the problem. Unlike personal interviews, this approach offers participants more freedom to express their attitudes. The participants represent a young, educated generation, and some may argue whether they represent the general population. However, Saudi Arabia has a high proportion of young people between the ages of 15 and 34 years (36.7%). In 2016, the total capacity of 38 universities in Saudi Arabia reached approximately 1.7 million. This greater number of youth population was remarkable in previous public surveys on epilepsy in Saudi Arabia [10,11]. The study included students from Health-related colleges (Pharmacy and Applied Medical Sciences) to ensure that they are superior in their knowledge of epilepsy compared to their counterparts in other disciplines.

Conclusions

This study demonstrated that 20% of university students in Saudi Arabia linked epilepsy to spirits possession and mental disorders. Spiritual and ritualistic approach was preferred in almost half of this group. Knowledge of and attitudes towards epilepsy were more favorable among students of health specialties. With exception of marriage for people with epilepsy, social interactions were more favorable among Saudi women. Universities, a key partner of Saudi vision 2030, should make efforts to correct misconceptions and reduce the social burden of epilepsy through educational programs, campaigns, letters, commentaries, regional conferences, and other awareness-raising activities. Such efforts would empower individuals with epilepsy to seek appropriate treatment, get married, have children, and participate in modern social and family life.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Authors' contributions

T.H., A.M., and M.H. conceptualized and designed the study. H. N., A.A., R.H., N.A., and A.J.M. assisted with data acquisition and entry. M.M. assisted with the data analysis and interpretation. T. H. drafted the original manuscript. All authors have revised the manuscript and read and approved the final version.

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