

Review

Knowledge of and attitudes towards epilepsy among teachers: A systematic review



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ARTICLE INFO

Article history:

Received 21 May 2018

Revised 17 June 2018

Accepted 22 June 2018

Available online xxxx

Keywords:

Epilepsy

Children

Teachers

Attitudes

Knowledge

ABSTRACT

The objective of this study was to systematically review research that has focused on knowledge of and attitudes towards epilepsy among teachers.

Embase, PubMed, PsycINFO, Google Scholar, and Cochrane library databases from 2000 to 2017 were searched. Cross-sectional and interventional studies were included and analyzed for quality. Thematic analysis was used to identify common themes in the results. Fifty-four eligible studies (17,256 total participants in 27 different countries) were identified in the search period including seven studies that focused on assessing attitudes and knowledge before and after an educational intervention. It was not possible to systematically analyze levels of knowledge and nature of attitudes because of the wide variety of mostly bespoke study specific instruments used. Few studies employed valid and reliable instruments. Thematic analysis revealed three main themes in the results: 1.) deficits in knowledge and negative attitudes were pervasive across all studies; 2.) teachers often had a negative attitude towards participation of children with epilepsy in physical activities/sport; and 3.) teachers often expressed limited knowledge of seizure management/emergency procedures. There was a lower level of knowledge and more negative attitudes among teachers towards epilepsy compared with other conditions. All studies focusing on interventions showed that at least some aspects of knowledge and attitudes improved as a result of teacher participation in an educational intervention, but study quality was universally rated as low. A higher level of education and experience of teaching a child with epilepsy was significantly associated with greater knowledge in a number of studies. Additionally, having experience of teaching a child with epilepsy and greater assessed knowledge of epilepsy were associated with more positive attitudes. The wide range of methods used makes it difficult to generalize regarding level of attitudes and knowledge among teachers towards epilepsy. Nevertheless, all studies indicate that there are some deficits in knowledge of and negative attitudes towards epilepsy among teachers. It would appear that knowledge and attitudes can be improved by educational interventions. Future research should focus on developing psychometrically sound assessment instruments that can be used globally and on identifying the most effective ways of delivering efficacious educational initiatives employing robust study designs.

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1. Introduction

Population-based studies of long-term outcome in childhood epilepsy indicate that the condition is associated with significant adverse outcomes compared with the healthy population across a range of domains including education and employment [1,2]. In addition to seizures, children with epilepsy are at increased risk of learning and behavioral difficulties compared with children without epilepsy and children with other chronic medical conditions [3,4]. Additionally, the

condition is often associated with significant stigma, which can result in significant impairments in quality of life [5] and mental health difficulties [6]. Stigma and social discrimination are often the most difficult aspects of having epilepsy for individuals with epilepsy, especially in resource-poor settings [7].

School-related difficulties, as evidenced by receipt of special educational services, are common in children with epilepsy [8]. Cognitive, behavioral, motor, and academic difficulties are often associated with the condition [9,10]. These additional difficulties often have a greater impact on quality of life than the epileptic seizures [11] and contribute most to the economic cost of the condition [12]. However, the difficulties are often unrecognized despite having a very significant impact on school performance [9].

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A number of studies have highlighted a significant gap in teachers' knowledge of epilepsy and highlighted the presence of negative attitudes [13]. From a list of seven medical conditions, teachers reported lowest familiarity with epilepsy [14]. Teachers including those who were teaching a child with epilepsy at the time are often not aware of the high risk of learning difficulties in individuals with epilepsy [14], and in many cases, parents are likely to be the main providers of information to teachers of children with epilepsy [14]. Studies have also highlighted teachers' concerns about emergency procedures for students with epilepsy, apprehension in responding to seizures, a lack of resources and knowledge for meeting the needs of a child experiencing a prolonged convulsive seizure, and a fear of liability [15].

Given the potential wide-ranging impact of epilepsy on a child's education, it is important to understand the levels of knowledge among teachers as well as their attitudes towards epilepsy. The aim of this paper was to systematically review studies that have focused on levels of knowledge and attitudes towards epilepsy among teachers. Studies that focus on interventions to improve knowledge and attitudes are also reviewed. Additionally, the review focuses on factors significantly associated with knowledge and attitudes.

2. Methods

The Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines [16] were followed in order to undertake the systematic review of the literature and to present the results. A literature search was conducted on 15th January 2018. The electronic databases PubMed, Cochrane CENTRAL, Embase, ERIC, PsycINFO, and Google Scholar were searched using different combinations of the following keywords: teachers, knowledge, attitudes, epilepsy, and perception between the period 1st January 2000 to 31st December 2017. The combinations searched are in Supplement 1. Inclusion criteria were at least some teachers (this included teachers in training) in the sample, a focus on either attitudes towards or knowledge of epilepsy or both, and should be published in English. Studies could be cross-sectional or interventional, i.e., studies which assessed attitudes and knowledge before and after an educational intervention. Papers were excluded if a clearly defined measure of attitudes/knowledge was not found or the participants did not include teachers. A data extraction form was developed (see Supplement 2), which focused on extracting the main study characteristics and results. Data were independently extracted by two reviewers (CJ and CR), with any differences being resolved by consensus. The review was registered at https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=91026.

Because of the heterogeneity of the methods used, it was not possible to systematically review/analyze levels of knowledge or nature of attitudes among teachers. Given this, it was decided to conduct a qualitative analysis using thematic analysis [17] to identify themes in the results regarding levels of knowledge and nature of attitudes among teachers. Thematic analysis is a method of identifying and subsequently analyzing and reporting patterns or themes within data. The process of thematic analysis involved the two raters (CR and CJ) familiarizing themselves with the results in all studies. The results sections in all papers were read through in their entirety by both researchers. At this stage, both researchers took notes to hint at possible themes. The results sections of each paper were then blindly rated by both researchers using the generated themes on three separate occasions. After each occasion, the raters met to discuss discrepancies, i.e., lack of agreement regarding where a response should go in terms of themes, and agreement was reached before the next coding. The final coding was performed unblinded by both researchers together in order to facilitate agreement on themes, and it is this final assignment of themes that is reported on in the current paper.

In reporting of the results in the intervention studies, the term "significant" is used to denote associations between variables that were statistically significant at the $p < 0.05$ level.

2.1. Study quality

All intervention studies were assessed for quality using the Effective Public Health Practice Project (EPHPP) quality-rating tool (http://www.ephpp.ca/PDF/Quality%20Assessment%20Tool_2010_2.pdf accessed 3rd May 2018). This measure includes six questions focusing on selection bias, study design, confounders, blinding, data collection methods, and withdrawals and dropouts. Ratings on the six questions are used to derive a global rating classified as "strong" (no weak ratings), "moderate" (one weak rating), or "weak" (two or more weak ratings), and these are reported on in the current study.

Study quality for the cross-sectional studies was based on two questions from the EPHPP focusing on selection bias and data collection methods. On each of these two questions, a study was rated as "strong", "moderate", or "weak". Each study was given a rating for both these questions.

Study quality for all studies was rated together by CJ and CR.

3. Results

Fig. 1 shows the search process. Fifty-five studies that met eligibility criteria were identified, and data were subsequently extracted from

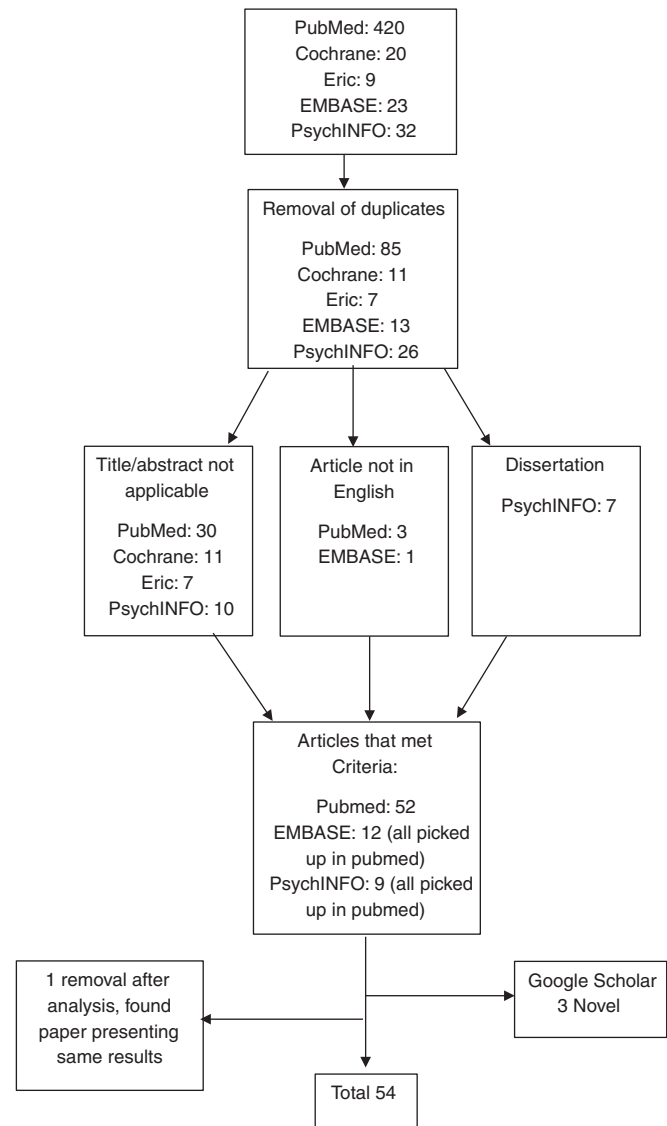


Fig. 1. Search process of the systematic review of knowledge of and attitudes towards epilepsy among teachers.

Table 1

Cross-sectional studies that have focused on knowledge of and attitudes towards children with epilepsy among teachers.

Authors	Year	Country/region	Urban/ rural	Sampling method	Sample size/female/ response rate	Measures of knowledge/ attitude	Focus	Analysis	Study quality	
									Valid	Reliable
Quereshi et al. [20]	2017	Northern Tanzania, Hai District	Rural	Convenience	35/63%/NS	Focus groups	Both	Thematic analysis	NR	NR
Elhassan et al. [21]	2017	Sudan, Khartoum state	Both	Cluster random	317/47%/82.4%	Bespoke survey	Both	Descriptives, Pearson chi-square, and ANOVA	Strong	Moderate
Berhe et al. [22]	2017	Ethiopia, Addis Ababa	Urban	Convenience	135/28%/54%	Bespoke survey	Both	Descriptives and chi-square	Weak	Weak
Gebrewold et al. [23]	2016	Ethiopia, Addis Ababa	Urban	Cluster random	845/42%/NS	Bespoke survey	Both	Descriptives, Spearman's correlation, Kruskal–Wallis	Moderate	Weak
Al-Hashemi et al. [24]	2016	Kuwait	Urban	Random	824/45%/97%	ATPE	Both	Mann–Whitney, Kruskal–Wallis, Spearman correlation, <i>t</i> -test, logistic regression	Strong	Moderate
Kampra et al. [25]	2016	Greece, countrywide	Both	Random	446/67%/22%	Bespoke survey	Both	Qualitative analysis and chi-square	Moderate	Weak
Savarese et al. [26]	2015	Italy, Campania	NS	Convenience	113/100%/NS	Bespoke survey	Both	Descriptives, <i>t</i> -tests	Weak	Weak
Brabcová et al. [27]	2015	Czech Republic	NS	Convenience	374/71%/NR	Bespoke survey	Both	<i>t</i> -Tests, Pearson correlation	Weak	Strong
Dumeier et al. [28]	2015	Germany	Urban	Random	1243/87%/44% ^a	Bespoke survey	Both	Frequencies and chi-square test	Moderate	Poor
Karimi and Heidari [29]	2015	Iran, Kermanshah	NS	Random	305/72%/NS	Bespoke survey	Both	Descriptives, <i>t</i> -test, ANOVA, linear regression	Weak	Weak
Alqahtani [30]	2015	Saudi Arabia, Mushate	Urban	Random	315/0%/63%	Bespoke survey	Both	Descriptives	Weak	Weak
Buccheri and Quattropani [31]	2015	Italy, Sicily	NS	Convenience	932/47%/63%	Bespoke survey	Both	Descriptive and Mann–Whitney	Weak	Weak
Khanal et al. [32]	2015	Nepal, Kathmandu	Urban	Convenience	165/58%/NR	Bespoke survey	Knowledge	Mann–Whitney, Kruskal–Wallis, chi-square test, Spearman rank correlation	Weak	Weak
Mecarelli et al. [33]	2014	Italy, countrywide	Both	Random	582/98%/NS	Bespoke survey	Both	Descriptive, multivariable logistic regression	Moderate	Weak
Owolabi et al. [34]	2014	Nigeria, Kano State	Urban	Random	200/38%/92%	Bespoke survey	Both	Descriptive, chi-square, multivariable logistic regression	Moderate	Weak
Ali et al. [35]	2014	Sierra Leone, Freetown	Urban	Convenience	150/NS/100% response	Bespoke survey	Both	Descriptive	Moderate	Weak
Bhesania et al. [36]	2014	Pakistan, Karachi	Urban	Convenience	110/67%/91.7%	Bespoke survey	Both	Descriptive	Moderate	Weak
Abulhamail et al. [37]	2014	Saudi Arabia, Jeddah	Urban	Random	615/53%/99%	Bespoke survey	Both	Descriptive and chi-square	Moderate	Weak
Toli et al. [38]	2013	Greece, countrywide	Both	Random	1404/62%/70–85%	Bespoke survey	Both	Chi-square, Mann–Whitney, multivariate logistic regression	Moderate	Weak
Lim et al. [39]	2013	Malaysia, Kuala Lumpur	Urban	Convenience	186/83%/69%	Public Attitudes Towards Epilepsy (PATE)	Attitude	ANOVA, <i>t</i> -tests	Moderate	Strong
Zanni et al. [40]	2012	Brazil, cities in the states of Sao Paulo and Rio De Janeiro	Urban	Convenience	56/91%/NR	Epilepsy Beliefs and Attitudes Scale (EBAS)	Both	Descriptive and <i>t</i> -tests	Weak	Strong
Asadi-pooya and Torabi-nami [41]	2012	Iran, Fars Province	NS	Convenience	42/NS/70%	Bespoke survey	Both	Descriptive	Weak	Weak
Brabcova et al. [42]	2012	Czech Republic	Urban	Random	193/91%/64%	Bespoke survey	Both	Descriptive <i>t</i> -tests and ANOVA	Moderate	Weak
Alkhamra et al. [43]	2012	Jordan	Urban	Convenience	259/73%/86%	Bespoke survey	Both	Descriptive <i>t</i> -tests and chi-square	Moderate	Strong
Mott et al. [44]	2012	Michigan, America	NS	Random	81/NS/9%	Bespoke survey	Knowledge	Fishers exact test	Weak	Weak
Mustapha et al. [45]	2012	Nigeria, Osogbo	Both	Random	269/66%/87%	ATPE	Both	Descriptive, <i>t</i> -test, chi-square, and linear regression	Strong	Strong
Akpan et al. [46]	2012	Nigeria, Akwa Ibom State	Both	Random	132/84%/NS	Bespoke survey	Both	Descriptive, chi-square, and <i>t</i> -test	Moderate	Weak
Mecarelli et al. [47]	2011	Italy	Both	Random	600/86%/NR	Bespoke survey	Both	ANOVA, chi-square, <i>t</i> -test, and multivariate logistic regression	Moderate	Poor
Babikar and Abbas [48]	2011	Sudan, Gezira State	Rural	Convenience	200/53%/100%	Bespoke survey	Both	Descriptive and chi-square	Weak	Poor
Lee et al. [49]	2011	South Korea, Seoul	Urban	Random	604/87%/94%	ATPE	Both	Descriptive and chi-square	Strong	Strong

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Table 1 (continued)

Authors	Year	Country/region	Urban/rural	Sampling method	Sample size/female/response rate	Measures of knowledge/attitude	Focus	Analysis	Study quality	
									Valid	Reliable
Wodrich et al. [14]	2011	US	NS	Convenience	294/80%/80%	Bespoke survey: Teacher Epilepsy Knowledge and Confidence Scale (TEKCS)	Knowledge	Descriptive, factor analysis, and ANOVA	Moderate	Strong
Lee et al. [50]	2010	South Korea, Seoul	Urban	Random	664/87%/94%	Bespoke	Both	Descriptive and chi-square	Strong	Strong
Shehata et al. [51]	2010	Egypt, Assiut City	Urban	Random	189/41%/97%	Bespoke survey	Both	Descriptive and chi-square	Strong	Weak
Thacker et al. [52]	2008	India, North Eastern Uttar Pradesh	Both	Random	568/38%/81%	Bespoke survey	Both	Descriptive	Strong	Weak
Bishop and Boag [13]	2006	USA, randomly selected states to represent all 5 regions of the USA	Both	Random	512/86%/26%	ATPE	Both	Descriptives and linear regression	Weak	Strong
Birbeck et al. [53]	2006	Zambia	Both	Convenience	171/36%/93%	Bespoke survey	Both	Descriptive, <i>t</i> -tests, ANOVA, and chi-square	Moderate	Weak
Sanya et al. [54]	2005	Nigeria, Kwara State	NS	Random	460/45%/75%	Bespoke survey	Both	Descriptive and chi-square	Moderate	Weak
Alikor and Essien [55]	2005	Nigeria, Post Harcourt	NS	Random	118/76%/NS	Bespoke survey	Both	Descriptive and chi-square	Moderate	Weak
Kaleyias et al. [56]	2005	Greece, Athens, Patra, Ioannina	Urban	Random	300/51%/100%	Bespoke survey	Both	Descriptive and chi-square	Strong	Weak
Olson et al. [57]	2004	US, Vermont and New Hampshire	Both	Convenience	384/83%/95%	Bespoke survey	Attitude	Descriptive, <i>t</i> -tests, Wilcoxon signed rank test	Strong	Weak
Bishop and Slevin [58]	2004	US, Kentucky	Both	Random	135/87%/23%	Test of Knowledge About Epilepsy (KAE)	Both	Descriptive and multiple linear regression	Weak	Strong
Millogo and Siranyan [59]	2004	Africa, Bobo-Dioulasso	Both	Random	260/54%/NS	Bespoke survey	Both	Descriptive	Weak	Weak
Prpic et al. [60]	2003	Croatia, Rijeka	NS	Random	216/61%/98%	Bespoke survey	Knowledge	Descriptive	Strong	Weak
Ojinnaka [61]	2002	Nigeria, Enugu State	Rural	NS	125/57%/NS	Bespoke survey	Both	Descriptive and chi-square	Weak	Weak
Rambe and Sjahrir [62]	2002	Indonesia, Medan	Urban	Convenience	84/69%/84%	Bespoke survey	Both	Descriptive	Moderate	Weak
Hsieh and Chiou [63]	2001	Taiwan, Mid-Taiwan	Both	Convenience	216/100%/72%	Bespoke survey	Both	Descriptive, <i>t</i> -tests, and regression	Moderate	Weak
Dantas et al. [64]	2001	Brazil, Campina Grande	Urban	Convenience	300/67%/100%	Bespoke survey	Both	Descriptive and chi-square	Moderate	Weak

NR = Not relevant as quantitative measure was not used, NS = Not specified in the paper, ATPE = Attitudes towards People with Epilepsy.

^a Based on school response rate.

these studies. During data extraction, it was noted that two studies [18, 19] reported on the same dataset using the same analysis and were identical with respect to study findings. One of these studies, which was published later [19], was subsequently removed from further analysis. Details on the 54 remaining studies are in Table 1 (cross-sectional studies) and Table 2 (interventional studies).

Forty-seven studies were cross-sectional in nature, focusing on level of knowledge about or nature of attitudes towards epilepsy, while seven were interventional, focusing on knowledge and attitudes among teachers before and after an educational intervention. Studies took place in 27 different countries. The country where studies were most often undertaken was Nigeria (7), followed by Italy and US (both 5). Study locations are categorized into WHO regions [71] in Fig. 2. The total number of respondents was 17,256 (range: 35–1404; mean: 319.56). In the 52 studies where the gender of the teacher was reported, 34% (5724) were male and 66% (11,075) were female. The response rate to the surveys was reported in 35 of the studies and ranged from 9.3% to 100%. Sampling was random in 29 (54%) cases, indicating that either schools and/or teachers were randomly selected for inclusion.

In 83% ($n = 45$) of the studies, the surveys used were bespoke in that they were created specifically for the study or used for the first time in that study. Of the nine studies that employed surveys that were standardized, i.e., had previously been used with data available on psychometric properties, five studies utilized the Attitudes Towards People with Epilepsy (ATPE) scale [72]. Forty-eight of the studies considered

knowledge and attitudes, four knowledge alone, and two attitudes alone. With respect to aspects of attitudes considered, 26 of the studies considered social contacts, 22 marriage, 14 driving, 20 employment, 10 aspects of education (predominantly inclusion of the child with epilepsy in the classroom), and seven participation in sports/physical activities. With respect to aspects of knowledge considered, 41 of the studies focused on management of seizures and 39 on beliefs about causes of epilepsy.

With respect to study quality, only three [44,49,50] of the cross-sectional studies were rated as “strong” with respect to both selection bias and data collection methods.

3.1. Level of knowledge and nature of attitudes

It was not possible to conduct any systematic analyses of the studies regarding the levels of knowledge of or attitudes towards epilepsy among teachers. The majority of surveys used were bespoke and contained different question types, i.e., categorical questions, Likert formats, or open questions. Reports of results of levels of knowledge or nature of attitudes were often based on analysis of single questions and/or nonobjective criteria, i.e., good/poor knowledge/attitudes based on subjective judgment. Even in the studies where a validated measure was used, the same version of the test or reporting of the responses was not uniform across studies.

Table 2
Interventions to improve teachers' knowledge of epilepsy.

Author	Year	Pre-intervention – sample size/female/response rate	Post-intervention – completed surveys/female/completion rate	Nature of intervention	Follow-up time	Main findings	Study quality global rating
Dumeier et al. [65]	2017	195/NS/14% ^a	123/93%/63%	40-min teaching session focusing on knowledge of epilepsy and management of seizures	1 year	<ul style="list-style-type: none"> Significantly more correctly identified all five descriptions of seizure symptoms (8% pre- vs. 15% post-). Significantly more felt better prepared to handle emergency seizures and administer rescue medication (39% pre- vs. 53% post-). Teachers were significantly less concerned about repercussions if they committed an error administering rescue medications (28% pre- vs. 23% post-). Significantly more were willing to take children on excursions under any circumstances (31% vs. 42%). The number of teachers prepared to handle an acute seizure rose significantly from 36 (29%) pre-intervention to 65 (53%) post-intervention. Significantly more were willing to administer a prescribed rescue medication: 66 (54%) to 93 (76%). The number of teachers who would place a solid object in the child's mouth during an attack fell significantly from 16 (13%) to seven (6%) ($p < 0.05$). 	Weak
Mecarelli et al. [66]	2015	582/100%/NR	317/100%/54%	Educational presentation on clinical manifestations with question-and-answer session	6–8 weeks	<ul style="list-style-type: none"> Knowledge of epilepsy significantly improved in all domains (nature and classification, underlying factors, clinical features, management, prevention). Attitudes (education and marriage) also improved but little change in numbers believing that epilepsy limits procreation and slight increase in considering epilepsy a limitation for sports and recreational activities. In addition, there was no change in the number of teachers willing to call an ambulance. 	Weak
Goel et al. [67]	2014	85/81%/43%	85/81%/NR	A series of workshops on 'first aid management of epilepsy', a manual/checklist on first aid management of epilepsy in the school	Immediately after intervention and 3 months after	<ul style="list-style-type: none"> Most of the knowledge domains (nature and classification, underlying factors, clinical features, management, prevention, and general aspects) significantly improved at immediate and at 3 months follow-up. Most of the attitude domains (education, employment, and marriage) significantly improved at immediate and at 3 months follow-up. Teachers' skills assessment in management of epilepsy also improved. 	Weak
Eze and Ebuehi [18]	2013	226/67%/NR	216/NR/96%	1 1/2 h of epilepsy lecture, followed by discussion	12 weeks	<ul style="list-style-type: none"> There was a significant increase in the proportion who thought that seizures originated in the brain (63% pre- vs. 74% post-). The proportion agreeing that epilepsy is an infectious disease fell significantly (48% pre- to 34% post-). There was a decrease in the number of teachers who thought that the presence of a student with epilepsy in the class creates some problems (86% pre- vs. 76% post-). 	Weak

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Table 2 (continued)

Author	Year	Pre-intervention – sample size/female/ response rate	Post-intervention – completed surveys/ female/completion rate	Nature of intervention	Follow-up time	Main findings	Study quality global rating
Fernandes et al. [68]	2007	100/97%/NS	20/95%/20%	'Epilepsy and health' training course	2 years	<ul style="list-style-type: none"> • Significant increase in proportion that thought children with epilepsy can be involved in strenuous activity (11% pre- vs. 17% post-). • Significantly more knew what to do if a child is having a seizure (33% pre- vs. 50% post-). • Knowledge and beliefs improved after intervention. • Significant decrease in those who said that they would not know how to act if a child was having a seizure (26% pre- vs. 0% post-). • Significant increase in number who would call an ambulance if a seizure lasted more than 10 min (53% pre- vs. 70% post-). 	Weak
Aydin and Yildiz [69]	2006	300/46%/91%	275/46%/100%	45-min education program	1 month	<ul style="list-style-type: none"> • Teachers' inclination to refuse having a student with epilepsy in their class was significantly more positive. • Significantly more would encourage children with epilepsy to play with others after the program. • Significantly more teachers considered their ability improved to deal with epilepsy seizures after the intervention (24% pre- vs. 42% post-). 	Weak
Bekiroğlu et al. [70]	2004	396/NR/NR	346/82%/87%	Seminars on nature and management of epilepsy as well as training about attitudes towards students with epilepsy	Immediately after seminars	<ul style="list-style-type: none"> • Significantly more felt that epilepsy is a disease that could be treated (87% vs. 99%). • Significantly more would offer a person with epilepsy a job (86% vs. 98%). • Significantly more would know how to help a patient with epilepsy during a seizure (41% vs. 98%). 	Weak

NR = not reported.

^a School response rate.

The qualitative process of thematic analysis study resulted in the following agreed themes: 1.) deficits in knowledge and negative attitudes were pervasive across all studies and 2.) teachers had a negative

attitude towards participation of individuals with epilepsy in physical activities or sport [18,21,30,33,47,48,61]. This included a belief that children/individuals with epilepsy should not participate in

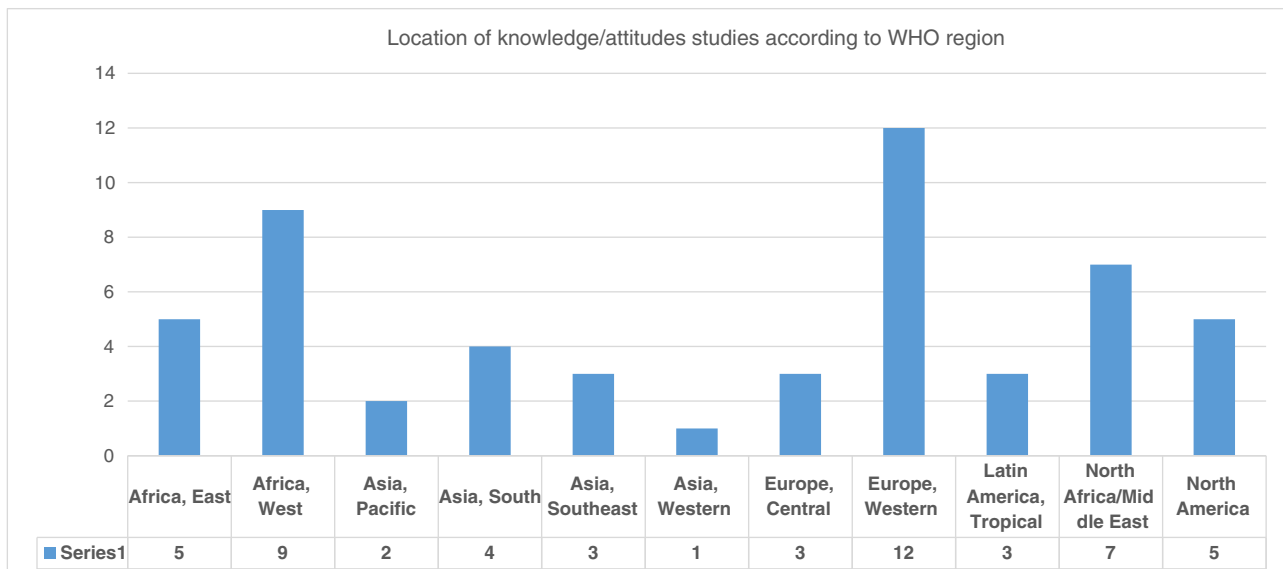
**Fig. 2.** Location of studies according to WHO regions.

Table 3
Factors considered as possible correlates of knowledge of and attitudes towards epilepsy among teachers.

Authors	Gender		Age		Level of education		Number of years spent teaching		Previous/current contact with PWE		Nationality		Marital status		Location		Knowledge significantly associated with attitude
	K	A	K	A	K	A	K	A	K	A	K	A	K	A	K	A	
Elhassan et al. [21]	Sm +	Sm +	NS	S –	S ^a	NS	S –	NS	NR	NR	NR	NR	NR	NR	NR	NR	NR
Al-Hashemi et al. [24]	NS	NS	NS	NS	NS	NS	S +	S +	S ^{>}	S ^{>}	NS	S ^b	NS	S ^c	NR	NR	NR
Kampra et al. [25]	NR	NR	NS	NR	NR	NR	NS	NR	NR	NR	NR	NR	NR	NR	S ^d	NR	NR
Brabcová et al. [27]	NS	NS	NR	NR	S ^e	NR	NR	NR	NS	S ^{>}	NR	NR	NR	NR	NR	NR	S
Karimi et al. [29]	Sf +	NS	NR	NR	S +	NS	S –	NS	NS	NS	NR	NR	S ^c	NS	NR	NR	NR
Khanal et al. [32]	NR	NR	NS	NR	S +	NR	S +	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Mecarelli et al. [33]	NS	Sf + ^g	NS	NS	NR	NR	NS	NS	NS	NS	NR	NR	NR	NR	NS	NR	NR
Owolabi et al. [34]	NS	Sf +	NR	NR	S +	NS	NS	NS	NR	NR	NR	NR	NR	NR	NR	NR	NR
Abulhamail et al. [37]	NS	NR	NS	NR	S +	NR	NS	NR	S ^{>}	NR	S ^h	S ^h	NR	NR	NR	NR	S
Eze and Ebuehi [18]	NS	NS	S –	NS	NS	NS	S –	NS	NR	NR	NR	NR	S ^f	NS	NR	NR	NR
Brabcová et al. [42]	NR	NR	NR	NR	NR	NR	NR	NR	S ^{>}	S ^{>}	NR	NR	NR	NR	NR	NR	NR
Mustapha et al. [45]	Sm +	NS	NS	NS	NS	NS	NS	NS	NR	NR	NR	NR	NS	NS	S ⁱ	NS	NS
Akpan et al. [46]	NR	NR	NR	NR	S + ^j	NR	NR	NR	NR	NR	NR	NR	NR	NR	NS	NS	NR
Mecarelli et al. [47]	NS	Sm ^k	NS	S – ^l	NS	NR	NR	NR	NR	NR	NR	NR	NS	NS	S ^m	NS	NR
Lee et al. [49]	NR	NR	NR	NR	NR	NR	NR	NR	NR	S ^{>}	NR	NR	NR	NR	NR	NR	S
Wodrich et al. [14]	NR	NR	NR	NR	NR	NR	NR	NR	S ^{>}	NR	NR	NR	NR	NR	NR	NR	NR
Lee et al. [50]	NR	NR	S –	NR	NR	NR	S –	NR	NR	S ^{>}	NR	NR	NR	NR	NR	NR	S
Bishop and Boag [13]	NR	Sf +	NR	NR	S +	S +	S +	S +	S ^{>}	S ^{>}	NR	NR	NR	NR	NR	S ⁱ	NR
Birbeck et al. [53]	NS	NS	NS	NS	NS	NS	NR	NR	NS	S ^{>}	NR	NR	NS	NS	NS	S ⁱ	NR
Sanya et al. [54]	NR	Sf +	NR	NR	NR	S +	NR	NR	NR	S ^{>}	NR	NR	NR	NR	NR	NR	NR
Alikor and Essien [55]	NS	NS	NR	NR	NS	NS	NS	NS	NS	S ^{>}	NR	NR	NR	NR	NR	NR	NR
Bishop and Slevin [58]	NR	NR	NR	NR	NR	NR	NR	S +	NR	S ^{>}	NR	NR	NR	NR	NR	NR	NR
Ojinnaka [61]	NR	NR	NR	NR	S +	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Rambe and Sjahrir [62]	NS	NR	NS	NR	NS	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Hsieh and Chiou [63]	NR	NR	NR	S +	NR	NR	NR	S +	NR	NR	NR	NR	NR	NR	NR	NR	NR

NR = not reported, S = significant, NS = not significant, PWE = person with epilepsy, Sm + = males have more positive knowledge/attitude, Sf + = females have more positive knowledge/attitude, S – = a negative association between age/years teaching and knowledge/attitude, S + = a positive association between age/years teaching and knowledge/attitudes, S[>] = contact with a person with epilepsy positively associated with better knowledge/attitudes, S^{>>} = contact with a person with epilepsy positively associated with better attitudes among freshmen.

^a Those with graduate level of education had higher knowledge compared with those with secondary or postgraduate level of education.

^b Kuwaiti nationals had higher attitude scores compared with non-Kuwaiti nationals.

^c Married people had higher knowledge/attitude scores compared with single people.

^d Schools in capital cities or towns had higher knowledge scores than those in villages.

^e Senior trainee teachers had higher knowledge scores compared with freshmen teachers.

^f Single students had higher knowledge score compared with married students.

^g Female teachers had higher propensity not to block children's arms/legs during seizures.

^h Teachers of Saudi nationality were more likely to report good knowledge and have better attitudes compared with those of other nationalities.

ⁱ Knowledge/attitude scores were higher in urban settings.

^j With regard to knowledge of seizure attacks originating from the brain and use of medicine to control seizures.

^k Males were more likely to have a negative attitude towards people with epilepsy procreating and more likely to believe that epilepsy causes learning difficulties.

^l Younger teachers had more accurate knowledge of age at seizure onset, and older teachers were more likely to believe that epilepsy causes learning difficulties.

^m Residence in Southern or Central Italy or on the islands was the only factor predicting the belief that epilepsy is a mental disorder, and teachers living in Northern Italy were less likely to consider children with epilepsy to need a support teacher and more likely to know correct management of a seizure.

certain sports/physical activities or that their participation should be restricted. 3.) Teachers often expressed limited knowledge of seizure management/emergency procedures.

3.2. Studies which included comparison conditions

Five studies included questions that focused on knowledge of or attitudes towards other medical or neurodevelopmental conditions in comparison with epilepsy. Aydin and Yildiz [69] compared knowledge of and attitudes towards epilepsy and asthma in a sample of Turkish teachers. The teachers had significantly more negative attitudes towards children with epilepsy than towards children with asthma on all nine attitude questions in the survey, which included having a child with epilepsy/asthma in their class, concerns about the child's aggression, placement in a special school, objections from parents if the child with epilepsy was in the class, participation in sports, and encouraging their own child to play/sit beside a child with epilepsy. However, significantly more teachers felt that they could manage an epileptic seizure compared with an asthma attack. With respect to knowledge, significantly more teachers felt incorrectly that epilepsy was a psychological disease and was related to poor living conditions compared with asthma. Kampra et al. [25] reported that with respect to hindering school attendance, Greek teachers

felt that heart disease was the most important, followed by epilepsy, diabetes, and asthma. Toli et al. [38] reported that Greek teachers perceived epilepsy as the most difficult condition to manage in school compared with cancer, diabetes, and asthma. Bishop and Boag [13] considered teacher familiarity with seven conditions. Epilepsy was the condition with the lowest familiarity and thus is lower in order of familiarity than attention-deficit/hyperactivity disorder (ADHD), diabetes, asthma, human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS), mental retardation, and autism. Olson et al. [57] reported that teachers in the US felt that epilepsy and AIDS were the conditions with the greater overall impact on schooling. The other conditions were asthma, leukemia, diabetes, and congenital heart disease. Epilepsy was most often endorsed as the condition where other children would be disrupted by the presence of a child with epilepsy, and teachers believed that children with epilepsy were most likely to need more teacher attention and parent contact compared with the other conditions. Additionally, epilepsy was the condition that was most associated with creating a medical emergency in the school.

3.3. Intervention studies

Studies that have focused on interventions are in Table 2.

The follow-up period after intervention ranged from immediately postintervention [70] to one-year follow-up [65]. The interventions that were described mostly consisted of once-off presentations/workshops. In all cases, at least some aspects of attitudes or knowledge significantly improved as a result of participation in the intervention. However, the global rating of study quality was weak for all intervention studies (see Supplement 3 for all ratings). None of the studies involved randomization or blinding.

3.4. Factors considered as possibly associated with knowledge/attitudes

Table 3 shows the factors considered as possibly associated with levels of knowledge of or attitudes towards epilepsy among teachers.

The influence of gender was considered in 12 studies on knowledge and 11 on attitudes, and results were inconsistent for both knowledge and attitudes. A significant difference was found for knowledge in three studies. Males had significantly higher knowledge in two studies [21,45] and females in one study [29]. A significant difference between males and females in relation to attitudes was found in six studies. Females had significantly better attitudes in four studies [33,34,13,54] and males in one study [21] while males had significantly more negative attitudes in one study [47].

Age of the teachers was considered in 12 studies for knowledge and eight for attitudes, and again, results were inconsistent regarding direction of association where a significant difference was found. In two studies, younger teachers had significantly better knowledge than older teachers [18,50]. In two studies, younger age was associated with better attitudes [21,47] while in one study, better attitudes were found in older teachers [63].

Level of education was considered in 16 studies focusing on knowledge and 10 on attitudes, and there was a consistent association between higher level of education and knowledge. A higher level of education was associated with significantly better knowledge in eight studies [13,27,29,32,34,37,46,63] and with better attitudes in two studies [13,54]. Number of years spent teaching was considered in 13 studies focusing on knowledge and 11 focusing on attitudes. Three studies showed a significant positive relationship between number of years spent teaching and knowledge [24,32,13], and four showed a significant negative relationship [18,21,29,50]. Four studies showed a significant positive relationship between numbers of years spent teaching and attitudes [13,24,58,63].

Ten studies considered the role of previous experience/contact with a person with epilepsy on knowledge and 12 on attitudes, and a consistent association between previous/contact experience and better attitudes was evident. Five studies showed a significant positive association between previous contact/experience and knowledge [13,14,24,37,42], and ten showed a significant positive association between previous contact/experience and attitudes [13,24,27,42,49,50,53–55,58]. Marital status was considered in six studies on knowledge and six on attitudes. In one study, married teachers had significantly better knowledge [29], and in another study, single teachers had significantly better knowledge [18]. In one study, married teachers had significantly better attitudes [24]. Location was included as a consideration in five studies on knowledge and six studies on attitudes. In two studies, urban residence was associated with significantly better knowledge [25,45]. In two studies, urban residence was significantly associated with better attitudes [13,53]. In the four studies where a possible association between knowledge and attitudes was considered, a significant positive association was noted [27,37,49,50].

4. Discussion

This systematic review provides a comprehensive overview on studies that have focused on levels of knowledge and attitudes towards epilepsy among teachers. Additionally, the review provides for a consideration of factors associated with knowledge and attitudes as well as the

impact of interventions to improve knowledge and attitudes among teachers. This synthesis of the literature can inform directions for policy and future research directions. Despite the heterogeneity in assessment approaches, the review suggests that there are sufficient gaps in knowledge and a significant degree of negative attitudes among teachers to warrant concern. The results of the limited number of intervention studies suggest, however, that targeted educational initiatives can positively impact knowledge and reported attitudes although study quality was universally low.

Studies focusing on teacher attitudes and knowledge on all continents in the study area with the exception of Oceania have been published in the period considered in this review. This highlights that teacher attitudes towards and knowledge of epilepsy are a global issue. The wide variation in survey instruments used makes it impossible to compare results between studies or across countries, but the qualitative analysis suggests that attitudes and knowledge are a concern in all countries where they have been assessed. Limited knowledge and negative attitudes among teachers are likely to add to the challenges faced by children with epilepsy who are already a group at increased risk of cognitive, behavioral, and academic difficulties [3,4,10]. The results of this review suggest that attitudes towards participation in physical activities are particularly negative. People with epilepsy have often been advised against participating in sports and exercise because of fear, overprotection, and ignorance [73,74]. However, the International League Against Epilepsy (ILAE) Task Force Report on Sports and Epilepsy emphasizes the importance of sport and exercise in epilepsy because of their positive medical and psychosocial effects; there are only a few sports that should be off-limits provided that appropriate individualized risk assessment has been carried out [75]. Given this, a particular focus on improving attitudes towards physical activity among teachers and children with epilepsy will be useful. Another theme that emerged from the analysis was that teachers often felt ill-equipped to deal with the management of seizures and administration of emergency medication. A previous review focusing on emergency medication practices in six European countries identified that existing legal frameworks are vague and open to interpretation [15]. Additionally, it was suggested that whether a child receives rescue medication at school depends primarily on the availability of a willing teacher [15]. A study focusing on the training of preschool teachers in the administration of rescue medication showed that such training not only improved self-confidence but also reduced errors in administration of medication [76]. Thus, training as well as comprehensive guidelines may be needed to ensure that teachers feel comfortable administering emergency medication [77].

The studies that have compared epilepsy with other chronic medical conditions indicate that teachers not only have limited knowledge of epilepsy but also have attitudes towards it that are more negative. This highlights that even though school professionals may have positive attitudes about children with chronic health conditions [57], concern about specific diseases such as epilepsy persists. In the case of epilepsy, parents are often the sole providers of disease information [14], but school professionals often only feel confident dealing with the situation when someone perceived to be an expert in epilepsy visits that school [78]. This increases the risk that educational professionals' concerns may not be addressed [57] and the need for epilepsy professionals to support parents in informing educational professional about the condition.

This review included seven intervention studies that focused on improving knowledge and attitudes, and in all cases, improvements were noted, indicating that educational interventions are likely to be useful. The areas where improvements were noted varied significantly across studies, probably reflecting the differing focus of the interventions. Therefore, identifying what aspects of the interventions are most successful with respect to knowledge and attitudes is difficult. Additionally, none of the studies included control group or randomization, highlighting the need for more robust study design in this area.

Regarding factors associated with increased knowledge, previous/current contact/experience with a child with epilepsy was associated with improved knowledge in most studies where it was considered, suggesting that teachers may learn on the job when they come into contact with a child with epilepsy. Better attitudes were also associated with contact with a child with epilepsy, perhaps decreasing fear of the unknown. Better attitudes were associated with better knowledge emphasizing the positive role of knowledge-based interventions to not only increase knowledge but also improve attitudes. Future intervention studies should include more robust study design including randomized controlled studies. Educational interventions in epilepsy employing Randomized Controlled Trials (RCT) designs have been successfully used to improve student knowledge of and attitudes towards epilepsy [78] and individuals' knowledge of epilepsy [79]. Online training to reduce stigma in young adults has been successful [80], and the use of online training for teachers should also be evaluated to maximize participation. Multisite studies across countries using not only assessment methods agreed upon but also interventions to assess attitudes and knowledge should be considered. The development of education programs should be done collaboratively with teachers, parents, and young people so that they address the areas important to stakeholders. Follow-up over a long period is needed to assess whether knowledge gains and attitude changes are sustained.

5. Summary and conclusion

Deficient knowledge of and negative attitudes towards epilepsy among teachers are found in all parts of the world where they have been studied. Educational interventions appear to be useful in improving knowledge and attitudes. However, better quality research employing a more robust study design is needed to develop a better understanding of what negative attitudes exist and what are the most effective methods of improving both attitudes and knowledge.

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.yebeh.2018.06.044>.

Conflict of interest

The authors have no conflict of interest to report.

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