

## ORIGINAL ARTICLE

# The assessment of the knowledge and practices of healthcare providers regarding paroxysmal non-epileptic events (PNES) in children: A cross-sectional study

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## Abstract

**Objective:** Paroxysmal non-epileptic events (PNES) are a group of disorders that may be misdiagnosed as epilepsy. This study has aimed to assess the knowledge and practices of family physicians and pediatricians regarding the diagnosis, treatment, and follow-up of PNES in children.

**Methods:** The study was designed as a prospective cross-sectional study that was conducted between March 1, 2022, and June 1, 2022, by reaching pediatric specialists and assistants, family physicians, subspecialty assistants, and subspecialists using a Google questionnaire. The survey consists of 26 questions. The questionnaire used by the researchers was prepared in accordance with the literature search and it included detailed questions on the diagnosis, treatment, and differential diagnosis of PNES.

**Results:** A total of 37.3% worked as specialists. Most of the participants (41.3%) have worked in training and research hospitals, and 44.3% have been physicians for 6–10 years. The mean and standard deviation for the total score were  $10.1 \pm 2.6$ . The scores of family physicians were statistically lower than those of specialists, subspecialty assistants, and subspecialists. A total of 67.2% left the decision of whether the patient should stop taking their medication to another clinician. 45% of the doctors said that they were uncomfortable with the diagnosis.

**Significance:** The study findings emphasized the significant knowledge gap among healthcare providers regarding PNES in children, highlighting the need for targeted educational interventions to improve their understanding and diagnostic skills in this area.

## KEYWORDS

children, educational interventions, knowledge assessment, paroxysmal nonepileptic events

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## 1 | INTRODUCTION

Paroxysmal non-epileptic events (PNEs), which involve repetitive motor movements, behavioral changes, and somatic symptoms, can occur at different stages of childhood and adolescence. These events can occur during childhood and adolescence and include fainting, loss of consciousness, headache, vomiting, dizziness, abdominal pain, irregular breathing, sleep disturbances, and sensory and psychiatric symptoms.<sup>1</sup> PNEs can last from a few seconds to several minutes and can occur at any age with a sudden onset and cessation of movement.<sup>1</sup> In particular, certain PNEs, such as Benign Paroxysmal Torticollis, can last for hours or even days.<sup>2</sup>

PNEs can mimic true epileptic seizures, and they can be seen in various ways during neonatal, childhood, and adolescence.<sup>3</sup> In the neonatal period, jitteriness, hyperreflexia, and benign sleep myoclonus may be observed; in infancy and childhood, gasping, tremors, stereotypies, benign paroxysmal torticollis, benign paroxysmal tonic upward gaze, benign paroxysmal vertigo, sleep disturbances, gratification disorder, spasm nutans (head movements), Sandifer syndrome, and tics may be observed.<sup>4</sup> Tics, migraine, functional seizures, sleep disorders, and syncope are the most common types of PNEs in adults.

The incidence of paroxysmal movements in the first year of life is 8.9%.<sup>5</sup> The benign presentation of neonatal/infantile sleep myoclonus occurs exclusively during sleep and ceases upon awakening.<sup>6</sup> The typical age of onset is usually within a few days to 6 months, with resolution of the majority of cases by 3 months of age.<sup>7</sup> This description illustrates the characteristic of jitteriness (or recurrent tremor): rhythmic, involuntary, and oscillatory movements. In healthy newborns (there is no other neurological symptom), this event can be considered physiological.<sup>8</sup> During the first year of life, shuddering attacks usually occur. These episodes may occur several times a day. The movements are similar to the reaction a child would have if an ice cube were to slide down his/her back, resulting in shaking and grimacing.<sup>9</sup>

Spontaneous paroxysmal tonic upgaze may resemble absence seizures, where the upward displacement of the eyeballs and the resulting vacant expression of the child's gaze are observed. Paroxysmal tonic upgaze is a completely benign in most cases. It resolves spontaneously in an otherwise healthy children.<sup>10</sup> Infantile masturbation is a stereotypical movement and is more commonly observed in girls. The typical age ranges from three months to 3 years. It can include noises, gasping, hot flashes, and sweating.<sup>11</sup> Spasmus nutans, a benign, idiopathic, and self-limiting disorder, manifests in infants and children. Typically, it presents in

### Key points

- Family physicians play a crucial role as the primary healthcare providers within the community. Therefore, it is vital that they receive comprehensive education and have access to the current resources on paroxysmal nonepileptic events.
- In order to ensure accurate diagnosis and effective treatment of PNEs, it is essential for doctors to feel confident and well-supported.
- Distinguishing these events from epileptic seizures can be a complex task, which emphasizes the need for educational programs and clinical guidance.
- Such initiatives will empower doctors to effectively differentiate PNEs and develop appropriate management strategies.
- There is a potential lack of confidence or clarity in managing such cases. Addressing this challenge requires developing comprehensive guidelines and providing support to enable physicians to make informed decisions and actively participate in the management of PNEs patients.

young children aged between 4 and 12 months, with spontaneous resolution occurring after a few months or years. All episodes last one or 2 min, and there is no impairment of consciousness. The head movement was not isolated but frequently coincided with simultaneous movements of the upper limbs or shoulders, and there was no impairment of consciousness.<sup>12</sup> Sandifer syndrome is a rare complication of gastroesophageal reflux disease. The clinical manifestations consist of episodes of spasmodic torsional dystonia with arching of the back and opisthotonic posturing and/or spastic torticollis.<sup>4</sup> Stereotypies are recurrent, repetitive movements, or postures that usually involve the upper extremities. They may stop voluntarily or end when the child focuses on a new activity or becomes distracted.<sup>13</sup> Tics are sudden, rapid, and repetitive movements. In addition, similar to the stereotypies, tics can be voluntarily interrupted, although usually only for a short period of time.<sup>4</sup>

During puberty, patients may experience syncope, sleep disorders, functional seizures, tics, and migraine. Syncope is characterized by rapid onset, short duration, and spontaneous recovery. Patients often experience prodromal symptoms (pre-syncope) consisting of dizziness, lightheadedness, palpitations, visual changes (tunnel vision, blurred vision), and/or hearing changes

(ringing in the ears or muffled hearing). Motor symptoms, including limb or full-body jerking, may be seen with syncope.<sup>14</sup> Parasomnias (sleepwalking, night terrors, and nightmares), sleep-related movement disorders (periodic limb movements during sleep, nocturnal leg cramps, and rhythmic movement disorders), narcolepsy, benign paroxysmal nocturnal events (hypnic jumps and benign childhood sleep myoclonus), breath-holding spells, Sandifer syndrome, and behavioral disorders in which conversion disorder is seen in children over 5 years of age. Its frequency increased with age, which has led to becoming the most common type of PNEs among adolescents.<sup>15</sup> There are also PNEs of psychogenic origin where no somatic cause can be found.<sup>16,17</sup> Migraine is a common neurological disorder that occurs paroxysmally. Migraine auras may be a mimic of various types of epileptic manifestations.<sup>18</sup> The possibility that a headache may be the only ictal manifestation of an epileptic seizure can be a diagnostic challenge.

The diagnosis of PNEs is mainly based on a detailed study of the precipitating factors, parental opinion, and direct clinical observations.<sup>19</sup> The accurate diagnosis of paroxysmal nonepileptic events (PNEs) is crucial as they can closely mimic true epileptic seizures and may lead to unnecessary treatment with antiseizure medications (ASMs). Direct observation of an event during evaluation can be challenging so video recordings provided by parents can be a valuable source to observe and verify the accounts of witnessed events. It is important to clarify whether multiple distinct events or repetitive stereotyped episodes were observed since this distinction has implications for diagnostic classification. Although they are generally benign, these common events may cause anxiety for families.

When diagnosis is difficult, electroencephalogram (EEG) and video-EEG monitoring can be used. Furthermore, if needed, additional laboratory tests such as magnetic resonance imaging (MRI), electrocardiography (ECG), and blood tests can be performed in order to confirm the diagnosis.<sup>19,20</sup>

The unnecessary use of ASMs by undiagnosed patients can result in wasted time as well as irreversible labor and economic losses not only for the family but also for the child.<sup>19</sup> With the increasing knowledge and experience of physicians about PNEs in relation to the childhood age group, the misdiagnosis of epilepsy is prevented, and therefore, the use of ASMs decreases.

As a result, because the existing literature has not addressed this area, this study has aimed at raising awareness of PNEs by reviewing the state of knowledge of pediatricians and family physicians in relation to clinical findings, treatment, and differential diagnosis of PNEs.

## 2 | MATERIALS AND METHODS

For this study, the research was initiated following the approval of the Ethics Committee for Scientific Research of Gulhane Training and Research Hospital Decision No. 2022–65 dated 02/17/2022. The study was designed as a prospective cross-sectional study and it was conducted between March 1, 2022, and June 1, 2022, by reaching pediatric specialists and assistants, family physicians, subspecialty assistants, and subspecialists using a Google questionnaire. A total of 314 participants took part in the study; however, those with missing data were excluded from the study. Hence, it was completed with 271 people.

The study data were collected using a questionnaire describing the characteristics of the participants (age, gender, professional position, level of education, place of work, duration of active employment) and detailed questions on the diagnosis, treatment, and differential diagnosis of PNEs. The questionnaire that was used by the researchers was prepared in accordance with the literature search. During the creation of the questionnaire, the questions were edited based on similar questionnaires in the literature.<sup>21</sup> The survey consisted of a total of 26 questions. (The questionnaire is available in [Tables 1–4](#)).

**TABLE 1** Descriptive characteristics of the participants.

Variables	Statistics
Age, (year)	
Mean $\pm$ SD	37.0 $\pm$ 8.5
M (min-max)	36.0 (25.0–69.0)
Gender, n (%)	
Female	175 (64.6)
Male	96 (35.4)
Position, n (%)	
Pediatric specialist doctor	102 (37.6)
Pediatric assistant doctor	53 (19.6)
Subspecialty assistant doctor	17 (6.3)
Family physician	58 (21.4)
Subspecialist doctor	41 (15.1)
Hospital, n (%)	
Public hospital	44 (16.2)
University hospital	69 (25.5)
Education-research hospital	112 (41.3)
Health center and family health center	16 (5.9)
Private hospital	30 (11.1)
Duration of employment in the profession (year)	
0–5	90 (33.2)
6–10	61 (22.5)
11 and above	120 (44.3)

Abbreviations: M, Median value; SD, Standard deviation.

**TABLE 2** Frequencies of answers to informational questions.

Questions	n (%)
(Q7) PNEs of childhood are a complex condition involving repetitive motor movements, behavioral changes, and somatic manifestations	
Yes	256 (94.5)
No	1 (0.4)
No idea	14 (5.1)
(Q8) Using the PNEs expression	
Is suitable	193 (70.8)
Is not suitable	13 (4.8)
No idea	66 (24.4)
(Q9) Which is true about PNEs? <sup>a</sup>	
It can occur in all age groups	197 (72.7)
There is a familial predisposition	198 (73.1)
It lasts lifelong	104 (38.4)
It limits itself with age	229 (84.5)
All	98 (36.2)
(Q10) Which of the following is/are (a) PNEs in the neonatal period? <sup>a</sup>	
Jitteriness	251 (92.6)
Hyperekplexia	193 (71.2)
Benign sleep myoclonus	245 (90.4)
All	185 (68.3)
(Q11) Which of the following is/are (a) PNEs in infant and toddler periods? <sup>a</sup>	
Breath-holding spells	241 (88.9)
Shuddering attacks	205 (75.6)
Stereotypes	185 (68.3)
Benign paroxysmal torticollis	174 (64.2)
Benign upward gaze	145 (53.5)
Sleep disorders	168 (62.0)
Gratification disorder	187 (69.0)
Spasmus nutans (Head movements)	140 (51.7)
Sandifer	156 (57.6)
Tic	199 (73.4)
All	99 (36.5)
(Q12) Which of the following is/are (a) PNEs in the adolescence period? <sup>a</sup>	
Syncope	169 (62.4)
Sleep disorders	182 (67.2)
Functional seizures	197 (71.6)
Tics	223 (82.3)
Migraine	152 (56.1)
All	127 (46.9)
(Q13) Which is correct for the diagnosis of PNEs? <sup>a</sup>	
The most important step in diagnosis is obtaining an accurate and detailed history	250 (92.3)

**TABLE 2** (Continued)

Questions	n (%)
Long-term video-EEG monitoring is the most important examination for differentiating between epileptic attacks	191 (70.5)
The use of smartphones and tablets has increased the rate of disease diagnosis	181 (66.8)
Accurate and early diagnosis prevents ASMs and examinations	222 (81.9)
(Q14) In which gender does PNEs occur more commonly?	
Female	93 (34.3)
Male	69 (25.5)
Equal	109 (40.2)
(Q15) People with PNEs seizures may also have epileptic seizures	
Yes	198 (73.1)
No	23 (8.5)
No idea	50 (18.5)
(Q16) EEG should definitely be taken in PNEs at the diagnosis stage	
Yes	140 (51.7)
No	92 (33.9)
No idea	39 (14.4)
(Q17) The diagnosis of PNEs must be confirmed by video-EEG monitoring	
I agree	44 (16.2)
I do not agree, clinical diagnosis may be sufficient	43 (15.9)
Video-EEG is only required when the clinical diagnosis is unclear	127 (46.9)
Clinical diagnosis and video-EEG should be combined	57 (21.0)
(Q19) With which departments do you evaluate a patient with PNEs? <sup>a</sup>	
Child neurologist	94 (34.7)
Child psychiatrist	45 (16.6)
Child neurologist and child psychiatrist	203 (74.9)
Social pediatrics	43 (15.9)
Developmental pediatrics	59 (21.8)
Psychologist	45 (16.6)
I do not redirect, I manage the event	11 (4.1)
(Q20) What is the optimal treatment for PNEs? <sup>a</sup>	
Counseling and psychotherapy	168 (62.0)
Antiseizure medications (ASMs)	15 (5.5)
Psychiatric drugs	10 (3.7)
No need for medication	49 (18.1)
It limits itself with age, treatment is unnecessary	106 (39.1)

**TABLE 2** (Continued)

Questions	n (%)
(Q21) Patients with PNEs and patients with epileptic seizures must be followed and treated in a similar way to patients with epileptic seizures	
Yes	118 (43.5)
No	104 (38.4)
No idea	49 (18.1)

<sup>a</sup>Each category was independently evaluated.

**TABLE 3** Comparison of the participants' total scores by gender, positions, and hospitals where they work.

Variables	M	IQR	Test value	p Value
Gender				
Female	10.5	3.0	1.839	.066 <sup>a</sup>
Male	10.0	4.0		
Specialty				
Family physician	9.0 <sup>a</sup>	4.0	21.476	<.001 <sup>b</sup>
Pediatrics assistant doctor	9.0 <sup>ab</sup>	3.3		
Pediatric specialist doctor	10.0 <sup>bc</sup>	4.0		
Subspecialty assistant doctor	12.0 <sup>c</sup>	4.3		
Subspecialist doctor	11.0 <sup>c</sup>	2.2		
Hospital, n (%)				
Public hospital	10	3.7	4.631	.327 <sup>b</sup>
University hospital	10	3.5		
Education-research hospital	10	4.7		
Health center and family health center	9.0	3.7		
Private Hospital	11	3.2		
Duration of employment in the profession (year), n (%)				
0–5	10.0	4.0	2.342	.310 <sup>b</sup>
6–10	10.0	4.0		
11 and above	10.0	3.0		

Note: a, b, and c superscripts indicate differences between levels of doctors of the total scores. There was no statistical difference between levels with the same superscripts.

Abbreviations: IQR, Interquartile range; M, Median value.

<sup>a</sup>Mann–Whitney *U* test.

<sup>b</sup>Kruskal–Wallis test.

The data were evaluated in the statistics package program from IBM SPSS Statistics Standard Concurrent User V 26 (IBM Corp.). Descriptive statistics were presented as number of units (*n*), percent (%), mean standard deviation (mean ± SD), median (*M*), minimum (*min*), maximum (*max*), and interquartile range (*IQR*). Moreover, the normality of the numerical variable data was assessed using the Shapiro–Wilk normality test.

The correlations between numerical variables were evaluated using the Spearman correlation coefficient. While total knowledge scores by gender were

compared using the Mann–Whitney *U* test, knowledge scores by position and hospital were compared using the Kruskal–Wallis *H* test. In addition, Dunn–Bonferroni test was used as a multiple comparison test in the Kruskal–Wallis *H* test. The relationship between age, length of employment, and overall knowledge value was evaluated using Spearman's correlation coefficients. It was observed that the assumptions for the model were met. A value of *p* < .05 was considered as statistically significant.

### 3 | RESULTS

The mean age of the physicians participating in the study was 37 ± 8.5, and 64.6% of the participants were women. When the working positions were evaluated, it was determined that 37.3% of them worked as specialists. A total of 41.3% of the participants were working in Education–Research Hospitals. Furthermore, a total of 44.3% of the participants have been physicians for 11.4 ± 8.7 years (Table 1).

In Table 2, as can be observed, the questions assessed the knowledge of the physicians about PNEs. In this table,

**TABLE 4** Frequencies of answers to other questions.

Questions	n (%)
(Q18) How many PNEs diagnoses have you made so far?	
0–10	188 (69.4)
11–20	26 (9.6)
More than 20	57 (21.0)
(Q22) When a patient takes ASMs for functional seizures	
I stop ASMs	64 (23.6)
I continue ASMs	25 (9.2)
I leave the decision to someone else	182 (67.2)
(Q23) When my patients or most of their relatives are diagnosed with PNEs	
They accept the diagnosis	83 (30.6)
They deny the diagnosis	66 (24.4)
I do not interrogate	122 (45.0)
(Q24) Most of the time I feel comfortable diagnosing PNEs based on clinical history	
I agree	122 (45.0)
I do not agree	115 (42.4)
No idea	34 (12.6)
(Q25) Most of the time I can distinguish PNEs from epileptic seizures when I witness the event	
I agree	169 (62.4)
I do not agree	78 (28.8)
No idea	24 (8.8)
(Q26) What is your level of knowledge to diagnose a patient when you meet one with PNEs? (rated from 1 to 5)	
Weak	59 (21.8)
Moderate	111 (41.0)
Good	83 (30.6)
Very Good	11 (4.1)
Perfect	7 (2.5)

it can be seen that there are questions on the diagnosis and treatment of PNEs and their differential diagnosis from epileptic seizures and PNEs types by age group. There are a total of 17 information questions in Table 2. The correct answers were given 1 point, and the others were given 0 point. A total score was calculated for 17 questions. The scores of the participants vary between 3 and 16. The mean and standard deviation for the total score was  $10.1 \pm 2.6$ , and the median was 10.0. No statistical correlation was found between total score and age ( $\rho = 0.046$ ,  $p = .447$ ). Moreover, there was no statistically significant correlation between years of work experience and total score ( $\rho = 0.050$ ;  $p = .412$ ). The total scores are compared in the table below according to the gender and position of the participants and the hospital where they work.

According to Table 3, there was no significant difference between male and female physician total scores

( $p = .066$ ). On the other hand, total scores differ statistically by position ( $p < .001$ ). The score of family physicians was statistically lower than that of specialists ( $p = .034$ ), subspecialty assistants ( $p = .003$ ), and subspecialists ( $p = .002$ ). Moreover, the overall score of pediatrics assistants was lower than that of subspecialty assistants ( $p = .021$ ) and subspecialists ( $p = .041$ ). The difference between pediatrics assistants and family doctors was not statistically significant ( $p = .998$ ). There was no significant difference between the overall grades of pediatric specialists and subspecialty assistants ( $p = .368$ ) and subspecialists ( $p = .985$ ). Finally, total scores do not differ statistically by hospital and length of profession ( $p = .327$ ).

In Table 4, it can be seen that physicians were asked about the number of PNEs they had encountered in their professional lives and how they dealt with PNEs. A total of 69.4% of physicians reported diagnosing 0–10 patients. In PNE patients taking antiepileptic drugs, 67.2% of the participants left the decision of whether the patient stops taking their medication or not to another clinician. 45% of the doctors said they were uncomfortable with the diagnosis. A total of 62.4% of physicians said they could easily distinguish PNEs, but when asked about their level of knowledge, 41% of them stated that they have moderate knowledge in this area.

## 4 | DISCUSSION

The study found significant variations in the knowledge levels of participating physicians regarding PNEs based on their specialization positions. Furthermore, the majority of physicians reported relying on another clinician's decision when it came to discontinuing ASMs for PNEs patients and expressed discomfort in making the diagnosis. These findings highlight the need for further education and training for physicians in the diagnosis and treatment of PNEs.

According to the findings of the study, the participants showed a high level of knowledge about PNEs (94.5%). In this study, 70.8% of the participants found it appropriate to use the term PNEs. However, according to a study by Dworetzky et al.,<sup>22</sup> where the response rate was 95%, there was no consensus on which terminology and diagnostic codes to use for nonepileptic events. This lack of agreement on the terminology and diagnostic criteria for PNEs can be noted as a significant challenge in the diagnosis and management of the condition. Therefore, further research and collaboration among healthcare professionals are necessary in order to establish a standardized approach to the diagnosis and management of PNEs. Despite the ongoing debates, the use of standardized terminology and

diagnostic codes for PNEs can improve the accuracy of diagnosis and ultimately lead to better patient outcomes.

Childhood PNEs are common conditions. While the diagnosis of many PNEs can be made based on a detailed history and clinical examination, the diagnosis of some repetitive episodes can be difficult in children as they may be mistaken for epilepsy due to ineffective history taking or indirect information provided by caregivers. The frequency of PNEs diagnosis varies among studies, with a rate of 23% reported in the study by Kutluay et al.,<sup>23</sup> 15% reported in the study by Kotagal et al.,<sup>15</sup> and 22% reported in another study.<sup>24</sup>

The occurrence of PNEs at this frequency in children as well as the presence of different types of PNEs among different age groups and the possibility of coexistence of epilepsy and PNEs can be concerning for clinicians. While some of the PNEs observed in the neonatal, infant, and adolescent stages were well known, some of them proved to be less well known to physicians. Similar to this study, a previous study found that breath-hold seizures were more familiar to pediatricians, and other PNEs, such as reflex anoxic seizures, were not known although they were common.<sup>25</sup>

In a study by Kotagal et al.,<sup>15</sup> the patients were separated according to age groups, and their PNEs diagnoses were examined. In the study, the diagnosis of PNEs was determined as stereotyped movements, hypnotic jerks, parasomnias, and Sandifer's syndrome in patients 2 months to 5 years of age. They were identified as conversion disorder (psychogenic seizures), inattention or daydreaming, stereotyped movements, hypnotic jerks, and seizure-type movement disorders with concomitant epilepsy in patients aged 5–12 years and as conversion disorders in adolescence.<sup>15</sup> Similarly, in this study, doctors knew better diagnoses in certain age groups. In fact, PNEs are an age-limited disease and are not followed up like epileptic patients.<sup>4</sup>

Among the PNEs of infancy and early childhood, benign myoclonus of early infancy may be misdiagnosed as infantile epileptic spasms. This type of PNEs does not affect neurological status and is not associated with development delay. Initially described by Lombroso & Fejerman as “Benign Myoclonus of Early Infancy-BMEI” in 1977.<sup>26</sup> These episodes were characterized by normal EEG findings and their transient nature. In the subsequent years, Caraballo et al.,<sup>27</sup> in 2009 revealed that polygraphic recordings demonstrated five distinct types of muscle contractions, encompassing terms like “shuddering attacks,” “tonic limb contractions,” and “myoclonic jerks.” The distinction between these phenomena holds paramount significance, particularly within the realm of pediatric neurology. This led to a reevaluation of the term “BMEI,” which was considered inadequate. Various alternative

names were proposed, including “Fejerman syndrome” by Bernardo Dalla Bernardina<sup>28</sup> and “Benign Polymorphous Movement Disorders of Infancy” by Fernandez-Alvarez in 2015.<sup>2</sup> “Benign polymorphous movement disorder of infancy” by TIM (transient infant movements) which was the denomination suggested by Piscitello et al.<sup>12</sup> Recent investigations advocate for the utilization of video recordings as a valuable tool to facilitate the identification and precise diagnosis of these paroxysmal non-epileptic movements. These recent discoveries substantially contribute to a more comprehensive understanding and differentiation of such phenomena in the context of childhood.

Therefore, it is essential for clinicians to stay up-to-date with the latest information and diagnostic methods. In this study, it was observed that clinicians provided different responses to questions about PNEs symptoms and clinical differences among age groups, depending on their areas of expertise. The scores of pediatric residents and family physicians were lower than those of subspecialists, subspecialty residents, and pediatricians. Studies have shown that the evaluation of the initial paroxysmal event diagnosis in children is moderate even among experienced pediatric neurologists.<sup>29</sup>

In this research, the involvement of family physicians as the first point of contact for patients and the direct referral to pediatric neurology may have led to a decrease in the frequency of encounters between pediatric residents and these patients, resulting in their lack of experience. What is noteworthy about this study is that it is the first study on this topic conducted with family doctors.

The results of the study are also important in stressing the need for better ways to diagnose PNEs in children. This emphasizes the importance of increased attention and vigilance during the diagnostic and treatment process, especially in accurately differentiating between PNEs and epilepsy and providing appropriate guidance to patients. It is crucial for the clinicians to have knowledge on current information and diagnostic methods in order to determine the correct diagnosis and treatment approaches.

Most symptoms in childhood PNEs are benign and self-limiting.<sup>15</sup> Most importantly, PNEs can sometimes be misdiagnosed as epilepsy and can be treated unnecessarily as such. In a study conducted in Sweden,<sup>30</sup> it was stated that diagnosing patients with PNEs in the emergency department is challenging and that a comprehensive history and clinical examination before performing an EEG is the first step in making an accurate diagnosis. The same study also found that clinicians had deficiencies in history taking and neurological examination, as well as deficiencies in recording, and in some cases, they did not perform these examinations at all. In the same study, 92.3% of clinicians believed that a detailed history was the first step, 70.2% believed that video-EEG was necessary; moreover,

66.8% believed that videos taken by families could assist in diagnosis. Clinicians were aware that making an accurate diagnosis could prevent unnecessary medical procedures and medication use. In the study done by the authors 92.3% of clinicians stated that a detailed history and accurate anamnesis were the first and most important steps and 70.5% believed that the use of video-EEG could be important in distinguishing epilepsy. Furthermore, 66.8% believed that imaging the moment of the event with a mobile phone or tablet could increase the frequency of diagnosis and reduce unnecessary treatment and testing.

Video-EEG is considered as the gold standard for the diagnosis of PNEs,<sup>31</sup> but its use is limited due to the need for specialized equipment and training. Video-EEG is an important tool for the diagnosis and classification of long-term epilepsy and epileptic syndromes in children. In addition, it is useful for the management of critically ill children. However, video-EEG requires specialized equipment and training, and its interpretation can be challenging, requiring the expertise of neurologists and pediatricians.<sup>32</sup>

In Turkey, the availability of video-EEG is limited, which highlights the need for alternative diagnostic tools. Recently, mobile telephone-recorded videos have been proposed as a useful adjunct to the diagnosis of seizures and paroxysmal events in children with suspected epileptic seizures as they can help differentiate between epileptic and nonepileptic events. Oyieke et al.<sup>33</sup> conducted a study that demonstrated the potential of high-quality home video recordings in differentiating between epileptic and nonepileptic events, improving diagnostic accuracy, and preventing unnecessary invasive and costly interventions and inappropriate antiseizure medications. After a comprehensive history and physical examination, the high-quality videos recorded with a mobile phone or tablet can be a considerably useful and accessible tool for the diagnosis of PNEs in the primary care setting.

When it comes to the gender of the patients, it can be seen that, based on the results of this study, PNEs are more common in females (34.3%). However, a study conducted in Iran has shown that PNEs are generally more common in females,<sup>34</sup> but gender differences are not significant in children and adolescents.

As indicated in other studies, PNEs may be associated with epileptic seizures.<sup>35,36</sup> The majority of respondents (73.1%) correctly answered that people with PNEs may also have epileptic seizures while 18.5% were unsure and 8.5% incorrectly answered no. The results also indicate that the majority of respondents have a good understanding of the association between PNEs and epileptic seizures. This is an important finding because misdiagnosis and mistreatment can occur if healthcare professionals are not aware of this association.

Although EEG is a useful tool in the diagnosis of epilepsy, changes in the EEG are not observed during an event in PNEs,<sup>1</sup> which makes it challenging to accurately diagnose the condition. As a result, the diagnosis of PNEs relies on other factors, such as the duration, location, nature, and timing of the attacks, as well as the patient's level of consciousness. A real diagnosis is essential since misdiagnosis and delays in treatment can worsen outcomes and lead to expensive treatments and unnecessary medication with various side effects.<sup>37,38</sup> Moreover, because there is no laboratory test to confirm the diagnosis, careful evaluation of clinical findings and home video recordings can provide clues to the diagnosis in many patients.<sup>31,39</sup> However, the results of the survey conducted on healthcare professionals' attitudes toward the use of EEG for the diagnosis of PNEs indicate that there is a lack of consensus on the necessity of EEG in the diagnosis of PNEs.

The results of the survey in this study indicate that healthcare professionals recognize the multidisciplinary nature of the management of patients with PNEs. The majority of respondents (74.9%) believed that patients with PNEs should be evaluated by both a child neurologist and a child psychiatrist. This is a positive finding because a multidisciplinary approach involving both medical and mental health specialists is essential for the optimal management of PNEs. Regarding the optimum treatment for PNEs, the most common response was counseling and psychotherapy (62.0%), followed by no need for medication (18.1%). This underlines the importance of psychological treatment in the management of PNEs because it is a psychogenic condition that requires psychological rather than pharmacological treatment. In the study conducted by Kozłowski et al., therapeutic treatment targeting underlying emotional and physiological triggers was found to be beneficial for patients with PNEs, and it was found that the quality of life of patients with PNEs improved with it.<sup>40</sup>

However, it is well established in the literature that comorbidity between PNEs and epileptic seizures is common, with up to 10%–30% of patients with PNEs also having epileptic seizures.<sup>41</sup> The question “People with PNEs may also have epileptic seizures” is crucial because it stresses the possibility of comorbidity between PNEs and epileptic seizures. The results of the survey show that there is no consensus among healthcare professionals on this issue, with 18.5% of respondents indicating that they have no idea whether people with PNEs may also have epileptic seizures. This suggests that further education and training may be necessary in order to better develop the understanding of the comorbidity between these two conditions among healthcare professionals.

The results of the survey done by the participants in this research also demonstrate that while approximately 45% of clinicians feel confident in diagnosing PNEs, they are more hesitant to make decisions regarding the discontinuation of ASMs in patients who have been diagnosed with seizure. Instead, they prefer to leave this decision to another clinician. The lack of discontinuation of ASMs in the presence of PNEs and the low rate of questioning patients' relatives about PNEs may be indicative of healthcare professionals' inadequate knowledge on this topic. In addition, according to the results of the survey, healthcare professionals' confidence level in clinically diagnosing PNEs is almost evenly split, with 45% feeling comfortable and 42% not feeling comfortable. Additionally, despite suspecting PNEs, 41% of healthcare professionals rate their level of knowledge as moderate, indicating difficulty in recognizing all cases of PNEs. These findings highlight the variation in perceptions and practices among healthcare professionals in identifying and managing PNEs, particularly in relation to treatment decisions around ASMs.

When the level of knowledge of the doctors according to gender, specialty, and length of professional service is evaluated, there was no significant difference between the specialists in pediatrics and family physicians and sub-branch assistants and specialists. However, family physicians had a lower mean score than subspecialty-assistant doctors and subspecialist doctors. Considering that physicians and health workers who work in the first places patients first apply are the pioneers in the diagnosis and treatment of epilepsy,<sup>42</sup> this result suggests that the awareness and level of knowledge of family physicians working in primary care should be increased. Bearing in mind that pediatric patients are cared for by pediatric neurologists and child psychiatrists, it was considered that the in-depth knowledge of the physicians working in this group could be used to provide this training. The reason for the higher values for female and male physicians compared to males could be attributed to the fact that most specialists in pediatrics in Turkey are women.<sup>43</sup>

## 5 | CONCLUSION

In conclusion, this study highlights the need to improve the knowledge and awareness of healthcare professionals, particularly family physicians, in the diagnosis and management of PNEs. The results revealed significant variations in the level of knowledge and awareness among healthcare professionals, with family physicians having a lower mean score than subspecialty assistants and

specialist doctors. As the first point of contact for patients seeking medical attention, primary care physicians play a crucial role in the identification and management of PNEs. Therefore, targeted training programs can be organized to enhance the knowledge and awareness of family physicians regarding PNEs. Additionally, all physicians should be made aware of the differential diagnosis of PNEs and epilepsies to avoid misdiagnosis and unnecessary treatment. Finally, further research is needed to develop more effective strategies for the identification and management of PNEs, particularly in children.

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## CONFLICT OF INTEREST STATEMENT

None of the authors have any conflicts of interest to declare.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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### Test Yourself

- Which of the following is NOT a characteristic feature of PNES ?
  - Abnormal EEG activity during the event.
  - Repetitive motor or behavioral changes.
  - Autonomic changes.
  - Sudden onset and offset.
- Which diagnostic tool is considered the gold standard for diagnosing PNES ?
  - MRI.
  - Video-EEG monitoring.
  - Spinal tap.
- Which of the following is a common treatment approach for PNES?
  - Antiseizure medications (ASMs).
  - Psychotherapy.
  - Surgery.
  - Referral to neurologist only.

Answers may be found in the [supporting information](#).