

Epileptologists' attitudes toward physical exercise and sports for persons with epilepsy in China

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ABSTRACT

We undertook a survey among epileptologists in China to explore their attitudes toward physical exercise and sports for persons with epilepsy (PWEs). A total of 288 epileptologists participated. Most recognized the potential benefits of physical exercise and sports for PWEs, including improved cognitive function (74.6 %), alleviation of mental disorders (73.2 %), and enhanced quality of life (83.8 %). Epileptologists overwhelmingly agreed on the importance of discussing and encouraging physical exercise and sports for PWEs (97.4 % and 95.2 %, respectively). Before engagement in physical exercise and sports, most epileptologists considered that the duration of seizure-free status could be shorter if the seizures were typically focal, non-motor, or without impaired awareness ($p < 0.05$). There was consensus (99.1 %) on the need to grade the risk of related activities. Opinions were divided regarding the use of health certificates for restricting PWEs (favored by 63.2 %). The majority (93.9 %) called for an expert consensus or clinical guidelines in China. In conclusion, epileptologists in China generally demonstrate a positive attitude toward physical exercise and sports for PWEs. Both benefits and risks of these activities have generally been acknowledged. It is recommended to prioritize activities with lower risks and higher benefits. However, the recommendations for PWEs with a lower likelihood of recurrence and less risky seizure types can be more liberal. Urgent development of normative guidance from governmental and professional bodies is warranted.

1. Introduction

Injury and trauma associated with epilepsy are common. Historically, persons with epilepsy (PWEs) were advised against participating in physical exercise and sports due to the risk of accidental injury. However, emerging evidence has highlighted the benefits of physical exercise and sports for PWEs, shifting clinicians' attitudes over recent decades. In 2016, the International League Against Epilepsy (ILAE) Task Force on Sports and Epilepsy issued a consensus document encouraging PWEs to participate in physical exercise and sports [1]. Physical activity has been shown to be beneficial and safe for PWEs, improving seizure control, providing psychosocial benefits, and enhancing the management of comorbidities, with a low risk of associated injuries [2].

Unfortunately, the current outlook regarding participation and engagement of PWEs in physical exercise and sports does not seem optimistic. Despite these benefits, PWEs remain less physically active and have poorer physical health compared to the general population, as shown in a recent systematic review [3]. Although this review did not

include studies from China, similar issues likely exist there. China has the world's largest population of PWEs, estimated to exceed 10 million, placing a significant burden on the public health system [4]. Thus, it is crucial to pay attention to the current status of physical exercise and sports participation among PWEs in China.

The scarcity of physical exercise and sports among PWEs may partially stem from the perpetuation of outdated attitudes among health professionals, particularly epileptologists. Given the influential role of epileptologists in shaping the behaviors of PWEs, comprehending epileptologists' attitudes can furnish valuable insights to promote greater participation in physical exercise and sports for PWEs. Consequently, we undertook an online survey among epileptologists in China to explore their attitudes toward physical exercise and sports for PWEs.

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2. Methods

2.1. Participants

A cross-sectional survey was conducted from August 25 to August 31, 2023, among members of the China Association Against Epilepsy (CAAE) who are involved in the diagnosis and treatment of epilepsy. All participants were qualified epileptologists actively engaged in medical work. Participation in the survey was voluntary and without any form of reward.

2.2. Questionnaire survey

The survey employed an online questionnaire format. Participants were briefed on the study's objectives and the timeframe for participation in advance. The questionnaire was shared in a WeChat group via a web link and a quick response code, ensuring the accessibility throughout the survey.

The online questionnaire comprised 25 multiple-choice questions, categorized into four sections: (1) gathering basic information about the epileptologists (Q1-2); (2) obtaining epileptologists' opinions on the benefits and risks of PWE participation in physical exercise and sports (Q3-8); (3) assessing epileptologists' attitudes toward PWE participation in physical exercise and sports in clinical practice (Q9-22); (4) assessing epileptologists' attitudes toward normative documents regarding PWE participation in physical exercise and sports (Q23-25). Some questions included a required explanatory field for the "Customized" option. The English version of the questionnaire is provided in Supplement 1.

To ensure participant confidentiality, no identity information was collected. All questions were mandatory to ensure completeness. Additionally, duplication was prevented to ensure each participant completed the survey only once. Data collected were automatically uploaded to a specific platform and exported following the survey.

2.3. Statistical analysis

Statistical analysis was performed using SPSS version 26.0. Descriptive analysis was performed to summarize the data. Chi-square goodness-of-fit test was employed to assess whether the observed response proportions significantly deviated from the expected proportions, which were set as equal. Chi-square test or Fisher's exact test was employed to compare the distribution of unordered responses between groups, while Mann-Whitney test was employed to compare that of ordered responses. In Q14-19, some customized responses classified as "Less than 3 months" and those falling between two options were considered as the smaller one. Subsequently, Wilcoxon signed rank sum test was employed to compare responses between Q14 and Q15, Q16 and Q17, and Q18 and Q19. A significance level of $p < 0.05$ was considered statistically significant.

3. Results

3.1. Participant characteristics

A total of 228 questionnaires completed by epileptologists in China were collected in this survey. The majority of participants were affiliated with epilepsy centers at various levels (73.7 %). Over 50 % of participants had practiced medicine for 10 years (58.3 %). Over 80 % had practiced medicine for over 5 years (80.7 %). Please refer to Table 1 for further detail.

3.2. Epileptologists' opinions on the benefits and risks of PWE participation in physical exercise and sports

There were notable variations in epileptologists' opinions regarding the impact of physical exercise and sports on seizure frequency.

Table 1
Basic information of the participants.

Questions	Options	Responses* n (%)
Q1 According to the standards set by the Chinese Association Against Epilepsy (CAAE), how would you classify your current workplace?	Comprehensive Epilepsy Center (Level III)	67 (29.4)
	Epilepsy Center (Level II)	77 (33.8)
	Specialized Epilepsy Clinic (Level I)	24 (10.5)
	Other	60 (26.3)
Q2 Which of the following best describes the number of years you have been practicing as an epileptologist?	Less than 5 years	44 (19.3)
	At least 5 years but less than 10 years	51 (22.4)
	At least 10 years and less than 15 years	39 (17.1)
	At least 15 years	94 (41.2)

* Total number $n = 228$.

Approximately 65 % of epileptologists considered that this cannot be generalized, while about 19 % believed that physical exercise and sports could decrease seizure frequency. Over 70 % of epileptologists believed that physical exercise and sports could improve cognitive function, alleviate mental disorders, and enhance quality of life for PWEs. Nearly 44 % of epileptologists also believed that these activities could promote medication effectiveness. Regarding the risk of injury/death from seizures during physical exercise and sports, epileptologists held significantly divergent opinions. Nearly 42 % of epileptologists believed that the risk could not be generalized, while approximately 28 % recognized no significant difference, and about 24 % acknowledged a higher-than-usual risk. Please refer to Table 2 for further details.

3.3. Epileptologists' attitudes toward the issue of PWE participation in physical exercise and sports in clinical practice

In general, epileptologists demonstrated consistent attitudes toward PWE participation in physical exercise and sports (Table 3). Over 97 % believed it necessary to discuss the issue with PWEs. Over 95 % advocated for encouraging PWEs to participate in these activities.

Regarding the classification of physical exercise and sports recommended to PWEs, epileptologists' opinions varied widely (Table 3). Approximately 60 % of epileptologists believed that both indoor and outdoor physical exercise and sports are equally suitable for PWEs, while around 32 % preferred indoor activities. Nearly 68 % of epileptologists believed that aerobic activities are more suitable for PWEs. Notably, there were significant differences in epileptologists' attitudes toward specific activities allowed for PWEs ($p < 0.05$). Specifically, the proportions of responses for Tai chi, running, ball games and Qigong were higher than expected, while others were lower (Fig. 1).

Epileptologists' attitudes toward physical exercise and sports varied for specific categories of PWEs (Table 3). The majority of epileptologists identified the "5-17 years" or "18-64 years" age groups as the most encouraged for physical exercise and sports, totaling 77.7 %. Regarding *peri*-pregnancy female PWEs, nearly 40 % of epileptologists recognized the pre-pregnant group as the most encouraged group for physical exercise and sports. Regarding the suitable duration of seizure-free status before physical exercise and sports for PWEs (see Supplement 2), the duration of 3 to 12 months was most commonly recognized. Furthermore, these durations were shorter for PWEs continuing to have focal seizures rather than generalized seizures ($p < 0.05$), for PWEs continuing to have non-motor seizures rather than motor seizures ($p < 0.05$), and for PWEs continuing to have seizures without impaired awareness rather than those with impaired awareness ($p < 0.05$).

Regarding general recommendations for PWEs to participate in physical exercise and sports, epileptologists' opinions varied significantly ($p < 0.05$). Specifically, the proportions of responses indicating "Let patients know to do what they can", "Equip patients with

Table 2
Epileptologists' opinions on the benefits and risks of PWE participation in physical exercise and sports.

Questions	Options	Responses* n (%)
Q3 How do you believe physical exercise and sports would affect seizure frequency in PWEs?	Decrease seizure frequency	42 (18.4)
	Increase seizure frequency	5 (2.2)
	No significant effect	33 (14.5)
	Cannot be generalized	148 (64.9)
Q4 How do you believe physical exercise and sports would affect cognitive function in PWEs?	Improve cognitive function	170 (74.6)
	No significant effect	25 (11)
	Cannot be generalized	33 (14.5)
Q5 How do you believe physical exercise and sports would affect mental disorders in PWEs?	Alleviate mental disorders	167 (73.2)
	Aggravate mental disorders	2 (0.9)
	No significant effect	23 (10.1)
	Cannot be generalized	36 (15.8)
Q6 How do you believe physical exercise and sports would affect the quality of life of PWEs?	Enhance quality of life	191 (83.8)
	No significant effect	9 (3.9)
	Cannot be generalized	28 (12.3)
Q7 How do you believe physical exercise and sports would affect medication effectiveness for PWEs?	Promote medication effectiveness	100 (43.9)
	Reduce medication effectiveness	2 (0.9)
	No significant effect	70 (30.7)
	Cannot be generalized	56 (24.6)
Q8 How do you assess the risk of injury/death from seizures during physical exercise and sports compared to usual for PWEs?	Higher than usual	55 (24.1)
	Lower than usual	15 (6.6)
	No significant difference	63 (27.6)
	Cannot be generalized	95 (41.7)

* Total number n = 228.

knowledge about exercise safety”, “Ensure the safety of the venues where patients are”, “Enable patients’ companions to master and apply seizure first aid knowledge” and “Wear personal protective equipment” were higher than expected, while others were lower (Fig. 2).

3.4. Epileptologists' attitudes toward the normative documents on PWE participation in physical exercise and sports

Over 99 % of epileptologists believed that it is necessary to classify appropriate physical exercise and sports into low-, medium- and high-risk levels for PWEs. Additionally, over 63 % of epileptologists thought that obtaining valid health certificates should be mandatory for PWEs in China to participate in specific physical exercises and sports. Nearly 94 % of epileptologists believed that there should be an expert consensus or even clinical guideline regarding PWE participation in physical exercise and sports in China. Please refer to Table 4 for further details.

4. Discussion

Our online questionnaire survey is the first study to examine epileptologists' attitudes toward physical exercise and sports for PWEs in China. This study provides valuable insights that could guide future efforts to encourage PWEs to participate in appropriate physical activities.

Currently, there is a consensus that PWEs should be encouraged to participate in physical exercise and sports. However, the situation in

Table 3
Epileptologists' attitudes toward the issue of PWE participation in physical exercise and sports in clinical practice.

Questions	Options	Responses* n (%)
Q9 Do you believe it is typically necessary to discuss the issue of participation in physical exercise and sports with PWEs?	Yes	222 (97.4)
	No	6 (2.6)
Q10 Do you believe that PWEs should generally be encouraged to participate in physical activity and sports?	Yes	217 (95.2)
	No	11 (4.8)
Q12 For indoor or outdoor physical exercise and sports, which type do you believe is better for PWEs?	Indoor	72 (31.6)
	Outdoor	21 (9.2)
	Equally suitable	135 (59.2)
Q13 For aerobic or anaerobic physical exercise and sports, which type do you believe is better for PWEs?	Aerobic	154 (67.5)
	Anaerobic	14 (6.1)
	Equally suitable	60 (26.3)
Q20 For PWEs of different ages, which of the following groups do you believe should be most encouraged to participate in physical exercise and sports?	Under 5 years old	5 (2.2)
	5–17 years old	95 (41.7)
	18–64 years old	82 (36)
	65 years old and above	4 (1.8)
	Not easy to compare	42 (18.4)
Q21 For PWEs in the <i>peri</i> -pregnancy period, which of the following groups do you believe should be most encouraged to participate in physical exercise and sports?	Pre-pregnancy (the preparatory period before pregnancy)	91 (39.9)
	First trimester (about the first 3 months of pregnancy)	2 (0.9)
	Second trimester (about the middle 3 months of pregnancy)	31 (13.6)
	Third trimester (about the last 3 months of pregnancy)	10 (4.4)
	Puerperium (postnatal recovery period)	33 (14.5)
	Not easy to compare	61 (26.8)

* Total number n = 228.

China appears less optimistic, which is closely tied to the opinions and guidance of epileptologists. This prompted us to survey epileptologists' attitudes in China. Previously, Arida et al. [5] conducted a questionnaire survey to investigate the neurologists' knowledge and attitudes toward physical exercise for PWEs in Latin America. They found that the majority of neurologists would advise PWEs to participate in exercise and believe that exercise could reduce comorbidities associated with epilepsy [5]. Most did not consider exercise as a seizure-precipitating factor, but more than half would limit exercise in PWEs with uncontrolled seizures [5]. These results were somewhat consistent with our findings.

Epileptologists in our study generally understood the benefits and risks of PWE participation in physical exercise and sports. They generally believed that physical exercise and sports benefit cognitive function, mental health and quality of life in PWEs, aligning with existing evidence [6]. However, fewer epileptologists recognized that physical exercise and sports might decrease seizure frequency and promote medication effectiveness, indicating a gap in understanding among some epileptologists. Indeed, only a few studies [5] have reported cases of exercise-induced epilepsy. Experimental and clinical studies have suggested that physical exercise and sports can either decrease seizure frequency or have no effect on it [7,8]. Some studies [9,10] have shown that physical exercise may not affect the serum level of anti-seizure medications but decrease epileptic discharges. The epileptologists in our study did not reach a consensus on the risk of seizure-related injury/death during physical exercise and sports. The risk is influenced by factors such as seizure frequency and type, as considered by the ILAE [1]. Seizure frequency is particularly dependent on the likelihood of a specific sport triggering a seizure. However, limited evidence suggests that physical exercise may induce seizures, with mechanisms that remain unclear and vary among individuals. Currently, it is generally accepted that physical exercise is unlikely to induce epileptic seizures

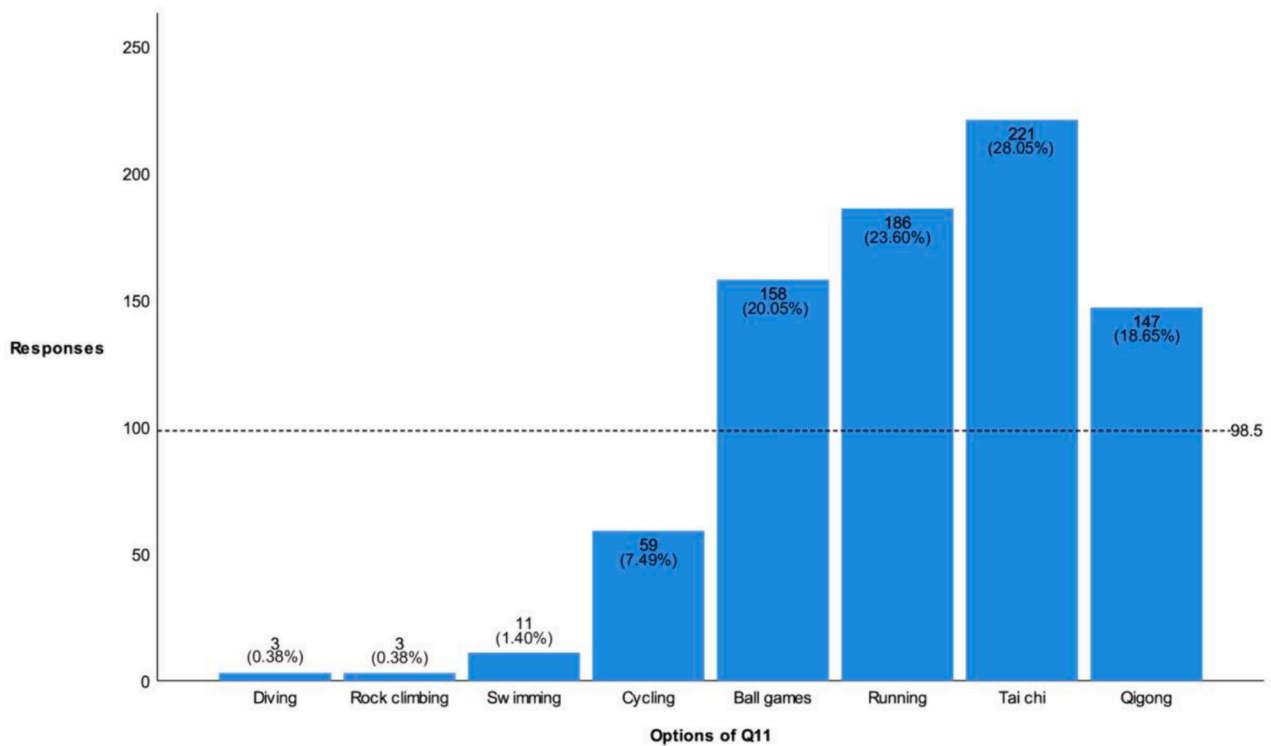


Fig. 1. Specific physical exercises and sports considered by epileptologists to be allowed for PWEs.

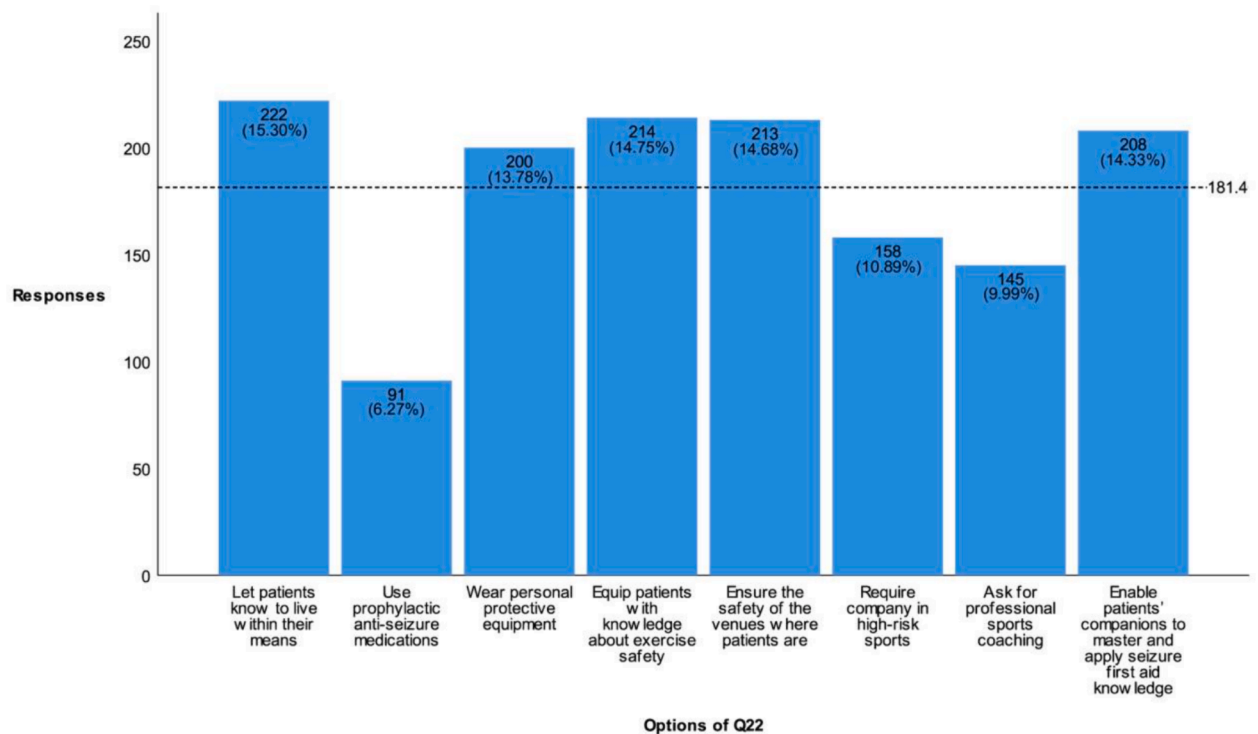


Fig. 2. General recommendations of epileptologists for PWEs to participate in physical exercise and sports.

[11].

Epileptologists in our survey generally emphasize physical exercise and sports for PWEs in clinical practice, especially activities with lower risks and higher benefits. A significant number of epileptologists preferred to recommend indoor activities probably due to perceived safety. However, this may not be absolute, as environmental factors may

influence the risk of seizure-related injuries [12]. Most epileptologists in our survey believed that aerobic activities are more suitable for PWEs. Physical exercise can improve the aerobic capacity of PWEs, but the effect of aerobic exercise on epilepsy remains uncertain [9,13]. Nonetheless, the World Health Organization generally recommended aerobic activities for their numerous benefits [14]. Therefore, it may be

Table 4
Epileptologists' attitudes toward normative documents on PWE participation in physical exercise and sports.

Questions	Options	Responses* n (%)
Q23 Do you believe it is necessary to classify appropriate physical exercise and sports for PWEs into low-, medium- and high-risk levels?	Yes	226 (99.1)
	No	2 (0.9)
Q24 Do you believe it is mandatory for PWEs in China to obtain relevant legally valid health certificates to participate in specific physical exercises and sports?	Yes	144 (63.2)
	No	84 (36.8)
Q25 Do you believe there is a need of an expert consensus or even clinical guideline regarding the participation of PWEs in physical exercise and sports in China?	Yes	214 (93.9)
	No	14 (6.1)

* Total number N = 228.

reasonable to recommend aerobic activities for PWEs as usual. Notably, Åkerlund et al. [8] found that patients with drug-resistant epilepsy in the exercise group increased their estimated $VO_2\max$ (an indicator of aerobic capacity) without deterioration of seizure frequency, which is encouraging. The ILAE categorized sports allowed for PWEs into low-, moderate- and high-risk activities [1]. In our survey, low-risk activities (running and ball games) were most recognized by epileptologists, followed by medium-risk activities (cycling and swimming) and high-risk activities (rock climbing and diving). Traditional Chinese Tai chi and Qigong also received substantial recognition, despite their undefined risks by the ILAE and lack of specific studies on their effects on PWEs. However, these two activities incorporate body movement, breathing and attentional training, and have shown efficacy in treating some neurological disorders as mind-body interventions [15]. Therefore, Tai chi and Qigong might also be beneficial for PWEs.

Another general opinion is that PWEs with a lower likelihood of recurrence and less risky seizure types should be more inclined toward participating in physical exercise and sports. In our study, PWEs aged under 5 years or aged 65 years and above received little encouragement. The risk of epilepsy-related injuries increases slightly with age [16]. Older adults are more susceptible to seizures and epilepsy due to various age-related and aging-related comorbidities associated with seizures [17]. Some studies [18–20] have indicated that PWEs with epilepsy-related injuries have an earlier onset of epilepsy. Acute symptomatic seizures are more prevalent in infants and the elderly, and a history of acute symptomatic seizures before the first unprovoked seizure elevates the risk of recurrence [21]. Therefore, caution should be exercised in recommending physical exercise and sports for young or older PWEs. Concerning *peri*-pregnant women with epilepsy, most epileptologists in our survey believed that pre-pregnant PWEs should be most encouraged for physical exercise and sports. People with a history of seizures before pregnancy may face a higher risk of seizures during pregnancy [22,23]. Exercise has been found to decrease or not to affect seizure frequency [8,24], suggesting that physical exercise and sports before pregnancy may be beneficial for seizure control throughout the *peri*-pregnancy period. Moreover, exercise during pregnancy is generally considered safe and helps prevent pregnancy-related diseases [25]. Regarding the appropriate duration of seizure-free status before physical exercise and sports for PWEs, the consensus among epileptologists in our study leaned toward durations ranging from 3 to 12 months. Overall, PWEs continuing to have focal seizures, non-motor seizures or seizures without impaired awareness are encouraged to initiate physical exercise and sports earlier. This approach is rational as previous studies have highlighted atonic seizures and generalized tonic-clonic seizures as relatively clear risk factors for epilepsy-related injuries; myoclonic seizures and focal unconscious seizures also pose potential risks; seizures with impaired awareness are clearly associated with the risk of injury [11].

Given the absence of relevant normative document in China, epileptologists are advocating for governmental and professional guidance.

Firstly, there is a call for the implementation of risk grading for physical exercises and sports suitable for PWEs in China. Although the Chinese government issued a normative document in 2013 outlining high-risk sports of swimming, skiing (alpine skiing, freestyle skiing, and snowboarding), diving and rock climbing [26], it is evident that this document cannot be directly applied in clinical practice. Secondly, the adoption of health certificates for PWEs in specific physical exercises and sports may prove beneficial in China, aligning with the recommendations from the ILAE [1]. Thirdly, there is a consensus among epileptologists for an expert consensus and even clinical guideline regarding physical exercise and sports for PWEs in China. Indeed, adaptation of international consensus to the Chinese context is essential. For instance, common Chinese traditional activities like Tai chi and Qigong, which are not classified for risk by the ILAE, need to be evaluated and classified by Chinese experts.

This study alone cannot fully determine how the supportive stance of Chinese epileptologists translates into practical actions. Some responses may reflect ideals rather than actual practices. For instance, some epileptologists might recognize the importance of encouragement but face barriers to its implementation. Regarding the barriers, we must acknowledge the absence of Chinese studies on this topic.

Nonetheless, we can tentatively explore potential barriers. Epileptologists in China contend with a substantial clinical workload, leaving them with insufficient time and energy to provide tailored recommendations. Reducing their workload is a solution, and how to achieve this is a matter that warrants consideration by the whole society. Moreover, the absence of relevant normative guidance compounds the challenge because non-standard medical practice may expose epileptologists to risk, leading some doctors to hesitate in providing advice. In this regard, relevant normative guidance may be necessary.

To promote participation in physical exercise and sports among PWEs, we proposed several recommendations in question 22 for discussion. Most of them were generally recognized. These can be grouped into two categories: providing health education about epilepsy and exercise, and ensuring that PWEs have external protection during physical activities. Notably, the use of prophylactic antiepileptic drugs received significantly less support. We also believe that this is not yet certain due to the lack of relevant clinical evidence. This may represent a future research direction.

Our study has several limitations. The stratified sampling was not used to recruit responders, which might have introduced sample bias. Thus, it is unclear whether our sample represents the entire population of epileptologists nationwide. The reliability of completing online questionnaires via smartphones has not been verified. Additionally, some questions might be too absolute to capture the nuanced views of some epileptologists, potentially leading to deviations in the results. Despite these limitations, our findings provide valuable insights into the promotion of physical exercise and sports among PWEs in China.

6. Conclusion

To our knowledge, this is the first cross-sectional study in China examining epileptologists' attitudes toward physical exercise and sports for PWEs. Epileptologists in China generally demonstrate a positive attitude toward physical exercise and sports for PWEs. They generally acknowledge both benefits and risks of physical exercise and sports for PWEs. They generally recommend that activities with lower risks and higher benefits are prioritized for PWEs. The recommendations for PWEs with a lower likelihood of recurrence and less risky seizure types can be more liberal, such as earlier start and more activity types. However, more evidence and knowledge are needed in this area. Additionally, there is no normative document regarding physical exercise and sports for PWEs in China, prompting a call from epileptologists for relevant normative guidance from governmental and professional bodies.

Ethical statement

All procedures were performed in compliance with relevant laws and institutional guidelines. This study does not require any ethics committee approval.

CRediT authorship contribution statement

Weihao Liao: Writing – original draft, Data curation, Formal analysis, Investigation, Methodology. **Lu Lu:** Formal analysis, Investigation, Writing – original draft. **Weixi Xiong:** Investigation, Writing – review & editing. **Jie Mu:** Writing – review & editing, Conceptualization, Methodology. **Dong Zhou:** Conceptualization, Funding acquisition, Project administration.

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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Appendix A. Supplementary data

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