

Original Article

The Effect of Virtual Learning on Seizure Control Among Epilepsy Patients in Saudi Arabia

Bashaer A. Alharbi ¹, Murouj A. Almaghrabi ¹, Doaa S. Baashar ¹, Moayad N. Iskandar ¹, Wejdan S. Alshehri ¹, Abdulaziz M. Alnemari ¹, Amal M. Alkhotani ^{2*}

¹ College of Medicine, Umm Al-Qura University, Mecca, Kingdom of Saudi Arabia

² Faculty of Medicine, Umm Al-Qura University, Mecca, Kingdom of Saudi Arabia

Correspondence should be addressed to **Amal M. Alkhotani**, Faculty of Medicine, Umm Al-Qura University, Mecca, Kingdom of Saudi Arabia. Email: dr.amalalkhotani@hotmail.com

Copyright © 2022 **Alkhotani**, this is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Received: 3 November 2022, Accepted: 5 November 2022, Published: 7 November 2022

Abstract

Background: The pandemic of COVID-19 has resulted in multiple precautions to control the infection, one of which is transforming students' schools into virtual classrooms. These new situations may pose additional challenges for some individuals such as epilepsy patients who account for 5.5% of school children (6–18 years). This study aimed to determine the effect of virtual learning on seizure control among epilepsy patients.

Methods: This is an online-based cross-sectional study that was performed between 17 February to 27 June 2021 among patients with epilepsy who attend virtual learning classes. The questionnaire was distributed to the patients at a single-center neurology clinic in Mecca, Saudi Arabia. We included all patients who were diagnosed with epilepsy at any hospital, aged between 10 to 30 years, and living in Saudi Arabia.

Results: A total number of 70 patients were included in the study. Patients' gender was nearly equally distributed between the two groups with females predominant (51%). The average time of more than 10 hours spent on screens and electronic devices was remarkably increased during COVID-19 (20.0% to 45.7%). The average number of seizures per year has a double-fold increase during the pandemic for ≥ 7 attacks (increased from 10% to 20%). More than half of the patients had a significant increase in their seizure frequencies during virtual learning (60%). Patients with focal epilepsy, a history of photosensitivity, and patients with disturbed sleep patterns are significant risk factors associated with increased seizure frequencies during virtual learning.

Conclusions: Focal epilepsy, history of photosensitivity, and disturbed sleep pattern associated with increased seizure frequencies during virtual learning. Time spent on screen has no significant relation to increasing seizure frequencies. Identifying the patients' risk and taking a serious step in reducing its sources is important in order to provide a better quality of life.

Keywords: COVID-19, virtual learning, epilepsy, seizure, Saudi Arabia.

Introduction

Coronavirus disease 2019 (COVID-19) is a novel infectious disease caused by a virus from one of the strains of the Coronavirus (1). On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a pandemic (2). Among other countries, Saudi Arabia has implemented multiple strict precautions to protect the community from spreading the infection, such as declaring a nationwide lockdown, restrictions on travel and social gatherings, suspending the Umrah pilgrimage, as well as transforming students' schools into virtual classrooms (3).

All these new situations may pose additional challenges for some individuals, such as epilepsy patients. Epilepsy is a neurological illness characterized by an enduring proclivity for epileptic seizures as well as the neurobiological, cognitive, psychological, and social implications of this illness (4). Some types of epilepsy are associated with photosensitivity most common in children and females (5). Epileptic seizures are generated when a patient is exposed to a photic stimulus, for example, TVs and electronic devices. It is a temporary condition that would disappear in the third decade of life (6).

Epilepsy may affect school-age children as well as college students which may impact negatively on their education and learning process. A previous study published by Hassen O, et. al, have assessed the possible factors that contributed to school absenteeism among school-aged children and adolescents with epilepsy. They have concluded that over two-thirds of children with epilepsy aged 7 to 18 years have reported being absent from school (7). Another study performed in Riyadh city, Saudi Arabia, assessed the quality of life of children patients with epilepsy before the pandemic of coronavirus, they found that Intractable epilepsy had a negative impact on many aspects of life, resulting in a low quality of life (8).

With the new period of changes due to COVID-19, different obstacles and challenges may appear for students with epilepsy. Especially due to the increased need of using electronic devices for long periods of time to attend virtual classes. No studies have been performed on these patients to inspect the new challenges that may appear. Hence, investigations are important to determine the main problems and seek to solve them to improve the learning education process in those patients. This study aimed to determine the effect of virtual learning on seizure control among epilepsy patients.

Methods

Study Design and Population

This is an online-based cross-sectional study performed between 17 February 2021 to 27 June 2021 among patients with epilepsy who attend virtual learning classes. The questionnaire was distributed to the patients at a single-center neurology clinic in Mecca, Saudi Arabia. Thus, we included all students with epilepsy aged between 10 to 30 years who live in Saudi Arabia and attended virtual teaching. The guardians of patients aged below 18 years of age were responsible to answer the questionnaire. We excluded any epilepsy patients who were not able to answer the survey and who were dismissed from virtual teaching.

Data collection

The validity and reliability of our questionnaire were tested. Hence, face validation was applied by three independent consultants in neurology, pediatrics, and family medicine specialties. Then, a pilot study was performed among 15 patients, and the reliability of the questionnaire was tested using Cronbach's test and observed to be reliable (score of 0.68-0.82). For language validation of the questionnaire, a back-to-back technique was used (9). Where two independent native Arabic physicians fluent in English translated the original English version into the Arabic language for the participants, and the Arabic version was then translated back into English by two independent native English physicians fluent in Arabic. The questionnaire was conducted online and created by Google forms, then it was distributed electronically via the treating neurologist at the clinic. Each participant/s was independently answering the survey by scanning the barcode of the questionnaire that the neurologist provides. Generally, the questionnaire consists of the following sections: Demographical data of the participants and general information, and the effect of virtual learning on seizure control among epilepsy patients. The language of the survey was translated to Arabic (the mother language of the participants) and then, it was translated back to English for analysis and publication.

Statistical Analysis

We used SPSS (Statistical Package for the Social Sciences) version 23 to do the data analysis of the study. Absolute frequencies and percentages were used to describe the categorical variables. Chi-square test was used to compare the proportion of categorical data. Also,

a student t-test of independence was performed to compare the numerical data of the study. Statistical significance was set at $P < 0.05$ and Confidence Interval (CI) was set at 95%.

Ethical considerations

Ethical approval was obtained from the Internal Review Board (IRB) at Umm Al-Qura University (UQU), Mecca, Saudi Arabia. Prior to answering our survey, electronic informed consent was taken from each patient. The confidentiality of the patients was ensured, and no personal information was asked from any patient.

Results

Demographic data and general characteristics of the patients

A total number of 70 patients were included in the study. **Table 1** shows the demographic features of the participants. Thirty-six participants were female (51%) and 34 were male (49%). The current educational level of half of the participants was a bachelor's degree (35, 50%), participants with high school/diploma were identified in 18 participants (26%), Elementary/Intermediate School in 16 participants (23%) and lastly, only one participant had a master's degree (1%).

Table 1. Demographic characteristics of the participants (n=70)

Variables	No	%
Gender	Male	34 49%
	Female	36 51%
Age	10-19 years	25 36%
	20-30 years	45 64%
Current educational level	Elementary/Intermediate school	16 23%
	High school/Diploma	18 26%
	Bachelor's degree	35 50%
	Master's degree	1 1%

Table 2 represents the general and clinical characteristics of all epilepsy patients who participated in the study (n=70). In which, more than half of the patients complained of Focal seizure (39, 55.7%) while 31 patients reported generalized seizures (44.3%). The exact number of medications the patients use to treat epilepsy was reported by them, in which nearly half of the patients are using two or more medications (51.4%). Most of the patients were adhering and regularly using their medication (63, 90%) and only seven patients were

not compliant with the medications (10%). An exact number of 30 patients reported a complaint of photosensitivity (42.9%) while more than half of our population did not report any complaint (40, 57.1). We have asked the participants if the frequent use of electronic devices will increase the number of epileptic seizures. And 42 participants answered with 'Yes' while 28 participants answered with 'No' (60% and 40%, respectively).

Table 2. Clinical characteristics of epilepsy patients (n=70)

Variables	No	%	
Type of Seizure	<i>Partial</i>	39	55.7%
	<i>Generalized</i>	31	44.3%
Number of medications for epilepsy	<i>One medication</i>	34	48.6%
	<i>Two medication or more</i>	36	51.4%
Regularly taking medication	<i>Yes</i>	63	90%
	<i>No</i>	7	10%
Complains of Photosensitivity	<i>Yes</i>	30	42.9%
	<i>No</i>	40	57.1%
Loss of consciousness during epileptic seizures	<i>Yes</i>	45	64.3%
	<i>No</i>	25	35.7%
Academic level affection by epilepsy	<i>Yes</i>	33	47.1%
	<i>No</i>	37	52.9%
Increase the number of epileptic seizures in relation to electronic devices use	<i>Yes</i>	42	60.0%
	<i>No</i>	28	40.0%

Patients' characteristics and condition in the period before COVID-19

Table 3 shows the patients' characteristics before the pandemic. The average number of seizures experienced by the patients before the pandemic of COVID-19 was mostly up to three times per year (43, 61.4%). Before the pandemic of COVID-19, patients report the average

time that they spent on electronic devices which was mostly five to ten hours per day (40, 57.1%) followed by one to four hour/s per day (16, 22.9%) and only 14 patients were using the electronic devices for more than ten hours per day (20.0%). Most of the patients have experienced seizures during the school day (54, 77.1%). An exact number of 47 (67.1%) patients had been absent from school due to seizures.

Table 3. Patients' condition before COVID-19 (n=70)

Variables	No	%	
The average number of seizures per year	<i>Up to three times</i>	43	61.4%
	<i>Four to six times</i>	20	28.6%
	<i>Seven times or more</i>	7	10%
The average number of hours spent on screens and electronic devices per day	<i>One to four hour/s</i>	16	22.9%
	<i>Five to ten hours</i>	40	57.1%
	<i>More than ten hours</i>	14	20.0%
Experienced seizures during the school day	<i>Yes</i>	54	77.1%
	<i>No</i>	16	22.9%
Have ever been absent from school due to a seizure	<i>Yes</i>	47	67.1%
	<i>No</i>	23	32.9%

Patients' characteristics and conditions during the period of attending virtual classrooms due to COVID-19

Table 4 shows the patients' characteristics during virtual class teaching. 14 patients reported their average number to be seven times or more per day (20%). 32 patients (45.7%) had more than ten hours spent on screens and

electronic devices. More than half of the participants have not been absent from the virtual classroom due to seizures (37, 52.9%), and have increased anxiety and stress due to the pandemic (43, 61.4%). 40 patients (57.1%) had sleep disturbances. And the most specific sleep disturbance that the patients complained of is decreased sleeping hours (26, 65.0%).

Table 4. The clinical characteristics of epilepsy patients during the period of attending virtual classrooms

Variables	No	%	
The average number of seizures per year	<i>Up to three times</i>	40	57.1%
	<i>Four to six times</i>	16	22.9%
	<i>Seven times or more</i>	14	20.0%
The average number of hours spent on screens and electronic devices per day	<i>One to four hour/s</i>	14	20.0%
	<i>Five to ten hours</i>	24	34.3%
	<i>More than ten hours</i>	32	45.7%
Have ever been absent from the virtual classroom due to a seizure	<i>Yes</i>	33	47.1%
	<i>No</i>	37	52.9%
Increased anxiety and stress during the pandemic	<i>Yes</i>	43	61.4%
	<i>No</i>	27	38.6%
Complained of sleep disturbances during the pandemic	<i>Yes</i>	40	57.1%
	<i>No</i>	30	42.9%
How does your sleep get disturbed? *	<i>Sleeping hours increased</i>	14	35.0%
	<i>Sleeping hours decreased</i>	26	65.0%

* This question is only for those who answered with 'yes' to the previous question.

The association between increased seizure frequency in relation to other variables

Table 5 demonstrates the frequency of increased seizure in relation to the use of electronic devices. Patients with focal seizures had a statistically significant worsening of their seizure with the use of electronic devices (69%

compared to 31%) (P-value = 0.006). Photosensitivity is another statistically significant variable associated with increased seizure frequency in association with device use (p-value of 0.049). No significant relationship between the increase in seizure frequency and the time spent on screen. Sleep disturbance significantly increases seizure frequencies (p-value of 0.04).

Table 5. Frequent increase of seizure in association with the demographics data and clinical characteristics of epilepsy patients during the period of attending virtual classrooms

Variables	Increase in seizure frequency				P-value	
	Yes		No			
	Freq	%	Freq	%		
Gender	Male	20	47.6%	14	50.0%	0.845
	Female	22	52.4%	14	50.0%	
Age (year)	10-19 years	14	33.3%	11	39.3%	0.135
	20-30 years	28	66.7%	17	60.7%	
Type of seizure	Focal	29	69.0%	10	35.7%	0.006*
	Generalized	13	31.0%	18	64.3%	
Complains of Photosensitivity	Yes	22	52.4%	8	28.6%	0.049*
	No	20	47.6%	20	71.4%	
Loss of consciousness during epileptic seizures	Yes	24	57.1%	21	75.0%	0.127
	No	18	42.9%	7	25.0%	
The average number of hours spent on screens and electronic devices (per day)	1-4 hour/s	13	31.0%	5	17.9%	0.47
	5-10 hours	24	57.1%	19	67.9%	
	>10 hours	5	11.9%	4	14.3%	
The average number of seizures (per year)	Up to three times	22	52.4%	17	60.7%	0.38
	Four to six times	10	23.8%	8	28.6%	
	≥ Seven times	10	23.8%	3	10.7%	
Number of medication	One medication	24	57.1%	11	39.3%	0.14
	Two or more	18	42.9%	17	60.7%	
Regularly taking medication	Yes	38	90.5%	25	89.3%	0.87
	No	4	9.5%	3	10.7%	
Patients who have been absent from the virtual classroom due to a seizure		28	66.7%	19	67.9%	0.91
Patients who had increased anxiety and stress during the pandemic		28	6.7%	15	53.6%	0.27
Patients who complained of sleep disturbances during the pandemic		28	66.7%	12	42.9%	0.04*

* $P < 0.05$ (significant)

A multivariate logistic regression analysis was conducted to identify the risk factors associated with increasing attacks during COVID-19 (Table 6). A significant association was observed on the type of

seizure (AOD: 0.007, CI: 1.46 – 11.05). While the significant values of photosensitivity and sleep disturbances were borderline.

Table 6. Multiple logistic regression for the frequent increase of seizures in association with the demographics data and clinical characteristics of epilepsy patients during the period of attending virtual classrooms

Variable	AOR (95% CI)
<i>Type of seizure</i>	
Focal	R
Generalized	0.007 (1.46 – 11.05)
<i>Complains of Photosensitivity</i>	
Yes	R
No	0.052 (0.99 – 7.62)
<i>Complained of sleep disturbances during the pandemic</i>	
Yes	R
No	0.051 (0.99 – 7.14)

AOR: adjusted odds ratio for gender, age and education level, R: reference category, CI: confidence interval.

Discussion

The present cross-sectional study aimed to determine the effect of virtual learning on seizure control among epilepsy patients. The participants reported an increased number of seizures per year (seven times or more). However, the study showed fewer absences from school due to a seizure during the pandemic of COVID-19. This information may not be very accurate, due to the short period of the pandemic compared to the rest of the pre-pandemic school years. In addition, this study revealed a statistically significant p-value between the frequent use of electronic devices and type of seizure as well as photosensitivity (0.006 and 0.049, respectively).

It is known that the prevalence of increased seizures following a stressful event range between 3% and 58% (10–13). While during the COVID-19 pandemic, the increase in seizure frequency was a major challenge for epilepsy patients. This issue was highly reported in literature all over the world (14–16).

Among the total number of patients included in our study, we did not observe any gender-related differences in the results. Exactly, thirty patients reported photosensitivity triggering their epilepsy (42.9%) which indicated the association between the two variables. This result was in agreement with previous studies done among 44 patients in Turkey, as well as a narrative review that all of which agree that light is a stimulating factor in some people with photosensitive epilepsy (6,17). However, our study did not show a significant relation between time spent on screen and an increase in seizure frequency. In addition, our literature search did not find any additional source that supports this finding, which could be a crucial area to search more about it.

Several methods can be used to reduce the risk of seizure in photosensitive epileptic patients. Examples of those

methods include covering one eye, using colour filter or glasses, or sitting 2-3 meters from the screen (6). Patients with photosensitive epilepsy should be advised to use those methods during virtual learning to reduce their risk of developing seizures.

During virtual learning, there was a notable decrease in school absence rate, but the academic performance was not affected by the virtual learning. In addition, this study reported an affection in sleep quality as well as increased anxiety and stress during the era of COVID-19. This may be an expected event given the major challenges that the public has experienced during the pandemic. Where several studies reported a remarkable decrease in sleep quality during COVID-19 among many countries including India, Portugal, Spain, and Turkey, in 2020-2021, hence, all those studies with a total of 1,799 individuals reported a high prevalence of poor sleep quality during COVID-19 (18–21). In addition, prior studies have also reported the impact of COVID-19 on psychiatric health among the general community and had an extremely remarkable effect during the pandemic (22,23). Regarding epilepsy patients, in particular, a previous study done in Spain, in August 2020, have included 255 patients with epilepsy to assess the impact of COVID-19 on those patients, which revealed that 26.7% of them had confinement-related anxiety, and 8.7% with depression (14). Also, a local study was done in Mecca, Saudi Arabia, which was performed to assess epilepsy patients' experience during COVID-19 has included a total of 156 patients, and about 59% of them reported an increased level of stress (24). All those findings were in agreement with those results found in our study which revealed an increased level of anxiety and stress during the era of COVID-19 among our patients. Furthermore, recent evidence has shown considerable psychological distress among epilepsy patients in the pandemic of COVID-19 by using the 6-

item Kessler Psychological Distress Scale which is a validated tool to assess non-specific psychological distress, including symptoms of depression and anxiety, as well as to screen for psychological distress (25).

The current study endorses some limitations, including the risk of bias in the cross-sectional study, the shared-method bias is probable, since the patients were the only reporters for all study variables, a self-report survey was mostly the main tool for data collection and the responsible neurologist was only present for any inquires and extra explanation. Also, an observed limitation was the low response rate due to patients' refusal to participate, which affected the sample size and may increase the chance of errors. Accordingly, we recommend more studies with a larger sample size to confirm our results as well as to avoid the listed above limitations. However, this study is among the first studies conducted in Mecca, Saudi Arabia to determine the effect of virtual learning on seizure control among epilepsy patients. Hoping to be the first step for future studies on the issue.

Conclusion

During virtual learning patients with focal epilepsy, a history of photosensitivity, and patients with disturbed sleep patterns have a significant increase in their seizure frequencies. However, no significant relation between time spent on screen and increase seizure frequencies. Identifying the patients' risk and taking a serious step in reducing its sources is important in order to provide a better quality of life. We recommend epilepsy patients have good sleep hygiene to achieve better control of their seizures. Patients with photosensitivity should try to use various methods to reduce their photosensitivity during virtual learning.

Acknowledgements

None

Disclosure

Statement:

The authors have no conflicts of interest to declare.

Funding:

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

Ethical Consideration:

Ethical approval was obtained from the Internal Review Board (IRB) at Umm Al-Qura University (UQU),

Mecca, Saudi Arabia with approval number: HAOP-02-K-012-2021-02-558. Prior to answering our survey, electronic informed consent was taken from each patient. The confidentiality of the patients was ensured, and no personal information was asked from any patient.

Author contribution

All authors contributed to conceptualizing, data collecting, image interpretation, data drafting and cleaning and final writing of the manuscript.

References

1. Fauci AS, Lane HC, Redfield RR. Covid-19—navigating the uncharted. *Mass Medical Soc*; 2020. p. 1268-9.
2. Deshpande S, Patil D, Dhokar A, Bhanushali P, Katge F. Teledentistry: A Boon Amidst COVID-19 Lockdown—A Narrative Review. *International Journal of Telemedicine and Applications*. 2021;2021.
3. Agency SP. Kingdom's Government Sets Preventive, Precautionary Measures to Prevent COVID-19 Infection Transmission Online: Saudi Press Agency; 2020 [Available from: <https://www.spa.gov.sa/2043855>].
4. Epilepsy I. The 2014 definition of epilepsy: a perspective for patients and caregivers. Available at:(Accessed December 5, 2018) <https://www.ilae.org/guidelines/definition-and-classification/the-2014-definition-of-epilepsy-a-perspective-for-patients-and-caregivers> Date. 2014.
5. Wolf P, Goosses R. Relation of photosensitivity to epileptic syndromes. *Journal of Neurology, Neurosurgery & Psychiatry*. 1986;49(12):1386-91.
6. Da Silva AM, Leal B. Photosensitivity and epilepsy: current concepts and perspectives—a narrative review. *Seizure*. 2017;50:209-18.
7. Hassen O, Beyene A. The effect of seizure on school attendance among children with epilepsy: a follow-up study at the pediatrics neurology clinic, Tikur Anbessa specialized hospital, Addis Ababa, Ethiopia. *BMC pediatrics*. 2020;20(1):1-7.

8. Altwaijri WA, Yahya BJ, Alasmari LB, Alsultan RN, Alsuhaibani SM, Alsemih RM, et al. Quality of life in paediatrics with intractable epilepsy in a large paediatric university hospital in Riyadh, Saudi Arabia. *Journal of Family Medicine and Primary Care*. 2020;9(11):5523.
9. Behr D. Assessing the use of back translation: the shortcomings of back translation as a quality testing method. *International Journal of Social Research Methodology*. 2017;20(6):573-84.
10. Bosnjak J, Vukovic-Bobic M, Mejaski-Bosnjak V. Effect of war on the occurrence of epileptic seizures in children. *Epilepsy & Behavior*. 2002;3(6):502-9.
11. Neufeld M, Sadeh M, Cohn D, Korczyn A. Stress and epilepsy: the Gulf war experience. *Seizure*. 1994;3(2):135-9.
12. Klein P, van Passel L. Effect of stress related to the 9/11/2001 terror attack on seizures in patients with epilepsy. *Neurology*. 2005;64(10):1815-6.
13. Swinkels W, Engelsman M, Kasteleijn-Nolst Trenité D, Baal M, De Haan G, Oosting J. Influence of an evacuation in February 1995 in The Netherlands on the seizure frequency in patients with epilepsy: a controlled study. *Epilepsia*. 1998;39(11):1203-7.
14. Fonseca E, Quintana M, Lallana S, Luis Restrepo J, Abaira L, Santamarina E, et al. Epilepsy in time of COVID-19: a survey-based study. *Acta Neurologica Scandinavica*. 2020;142(6):545-54.
15. Assenza G, Lanzone J, Brigo F, Coppola A, Di Gennaro G, Di Lazzaro V, et al. Epilepsy care in the time of COVID-19 pandemic in Italy: risk factors for seizure worsening. *Frontiers in neurology*. 2020;11:737.
16. Huang S, Wu C, Jia Y, Li G, Zhu Z, Lu K, et al. COVID-19 outbreak: The impact of stress on seizures in patients with epilepsy. *Epilepsia*. 2020;61(9):1884-93.
17. Gül G, Eren F, Kuscu D, Kirbas D. Electroclinical and prognostic characteristics of epilepsy patients with photosensitivity. *Ideggogyaszati Szemle*. 2018;71(1-02):43-8.
18. Pinto J, van Zeller M, Amorim P, Pimentel A, Dantas P, Eusébio E, et al. Sleep quality in times of Covid-19 pandemic. *Sleep medicine*. 2020;74:81-5.
19. Targa ADS, Benítez ID, Moncusí-Moix A, Arguimbau M, de Batlle J, Dalmases M, et al. Decrease in sleep quality during COVID-19 outbreak. *Sleep & breathing = Schlaf & Atmung*. 2021;25(2):1055-61.
20. Duran S, Erkin Ö. Psychologic distress and sleep quality among adults in Turkey during the COVID-19 pandemic. *Progress in neuro-psychopharmacology & biological psychiatry*. 2021;107:110254.
21. Gupta R, Grover S, Basu A, Krishnan V, Tripathi A, Subramanyam A, et al. Changes in sleep pattern and sleep quality during COVID-19 lockdown. *Indian journal of psychiatry*. 2020;62(4):370-8.
22. Rehman U, Shahnawaz MG, Khan NH, Kharshiing KD, Khursheed M, Gupta K, et al. Depression, anxiety and stress among Indians in times of Covid-19 lockdown. *Community mental health journal*. 2021;57(1):42-8.
23. Shah SMA, Mohammad D, Qureshi MFH, Abbas MZ, Aleem S. Prevalence, psychological responses and associated correlates of depression, anxiety and stress in a global population, during the coronavirus disease (COVID-19) pandemic. *Community mental health journal*. 2021;57(1):101-10.
24. Alkhotani A, Siddiqui MI, Almontashri F, Baothman R. The effect of COVID-19 pandemic on seizure control and self-reported stress on patient with epilepsy. *Epilepsy & Behavior*. 2020;112:107323.
25. Hao X, Zhou D, Li Z, Zeng G, Hao N, Li E, et al. Severe psychological distress among patients with epilepsy during the COVID-19 outbreak in southwest China. *Epilepsia*. 2020;61(6):1166-73.