Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
An international study of the effects of the COVID-19 pandemic on characteristics of functional seizures

Ali A. Asadi-Pooya a,b,⇑, Eugen Trinka c,d,e,f,g,h, Coraline Hingray i, Ahmad Fawaz j, Ioannis Karakis k, Nirmeen A. Kishk l, Mohsen Farazdaghi m, Julia Höfler n, Alexis Tarrada o, Abdulaziz Ashkanani p, Aida Risman q, Haytham Rizk r

aEpilepsy Research Center, Shiraz University of Medical Sciences, Shiraz, Iran
bJefferson Comprehensive Epilepsy Center, Department of Neurology, Thomas Jefferson University, Philadelphia, PA, USA
cDepartment of Neurology, Christian-Doppler Medical Centre, Paracelsus Medical University, 5020 Salzburg, Austria
dCentre for Cognitive Neuroscience, 5020 Salzburg, Austria
eAssociated Member of the European Reference Network EpiCARE, Austria
fNeuroscience Institute, Christian-Doppler Medical Centre, Paracelsus Medical University, 5020 Salzburg, Austria
gDepartment of Public Health, Health Services Research and Health Technology Assessment, UMIT – University for Health Sciences, Medical Informatics and Technology, Hall in Tirol, Austria
hKarl Landsteiner Institute for Neurehabilitation and Space Neurology, Salzburg, Austria
iPôle universitaire adulte du Grand Nancy, CNP, Laxou, France
jNeurology Department, Epilepsy Monitoring Unit, IbnSina Hospital, Kuwait
kDepartment of Neurology, Emory University School of Medicine, Atlanta, GA, United States
lDepartment of Neurology, Cairo University Epilepsy Unit (CUEU), School of Medicine, Cairo University, Cairo, Egypt
mEpilepsy Research Center, Shiraz University of Medical Sciences, Shiraz, Iran
nDepartment of Neurology, Christian-Doppler Medical Centre, Paracelsus Medical University, 5020 Salzburg, Austria
oUniversité de Paris, UFR de médecine Paris Centre, rue de l'Ecole de Médecine, 75006 Paris, France
pInternal Medicine Team, New Ahmadi Hospital, Al-Ahmadi, Kuwait
qDepartment of Neurology, Emory University School of Medicine, Atlanta, GA, United States
rDepartment of Neurology, Cairo University Epilepsy Unit (CUEU), School of Medicine, Cairo University, Cairo, Egypt

Article info

Article history:
Received 15 November 2021
Revised 22 December 2021
Accepted 23 December 2021
Available online 29 December 2021

Keywords:
COVID
Coronavirus
Dissociative
PNES
Seizure

Objective: We investigated whether the COVID-19 pandemic has affected the clinical characteristics of patients with functional seizure (FS) (at the time of diagnosis) in a large multicenter international study.

Methods: This was a retrospective study. We investigated all patients with FS, who were admitted at the epilepsy monitoring units at six centers in the world: 1. Shiraz, Iran; 2. Salzburg, Austria; 3. Nancy, France; 4. Atlanta, USA; 5. Kuwait City, Kuwait; and 6. Cairo, Egypt. Patients were studied during two time periods: admitted in 2018–2019 (pre-COVID era) and 2020–2021 (COVID era).

Results: Three hundred and twenty-six patients were studied. Two hundred and twenty-four (68.7%) patients were diagnosed before and 102 (31.3%) persons during the COVID-19 pandemic. Only, a history of family dysfunction was significantly associated with the COVID-19 pandemic era (Odds Ratio: 1.925, 95% Confidence Interval: 1.099–3.371; p = 0.022). A low level of education might also be associated with FS during the COVID-19 pandemic, at least in some cultures (e.g., the Middle-East).

Conclusion: The COVID-19 pandemic has not affected the clinical characteristics of patients with FS (at the time of diagnosis). However, a history of family dysfunction was significantly more frequently associated with FS during the COVID-19 pandemic. Multiagency integration of law enforcement responses, social services, and social awareness is recommended to address family dysfunction and domestic violence and support the victims during this pandemic.

© 2021 Elsevier Inc. All rights reserved.

1. Introduction

Functional seizures (FS), also known as dissociative seizures (DS) or psychogenic non-epileptic seizures (PNES), are often associated with psychological problems [1–3]. Previous studies have shown a higher prevalence of psychopathologies in patients with
FS compared to patients with epilepsy [4]. On the other hand, semiology of FS may be associated with the co-existing neuropsychiatric conditions in these patients. For example, patients with akinetic FS may have fewer co-existing neuropsychiatric problems compared with those who have motor FS [5–7].

While the underlying pathomechanisms of FS are not fully understood yet, some precipitating factors (e.g., relationship difficulties, natural disasters, job loss) may occur over days to months before the onset of FS [1]. Since late 2019, the world has been experiencing a catastrophic and deadly pandemic of severe acute respiratory syndrome coronavirus-2 [Coronavirus disease 2019 (COVID-19)] [8]. This virus is highly contagious and has a high potential for person-to-person transmission. This deadly outbreak has caused more than five million deaths, massive job losses, various psychiatric problems, and increasing numbers of relationship difficulties worldwide (all of which may be considered as potential precipitating factors for FS) [9–12]. Therefore, it is plausible to consider this pandemic as a potentially significant factor that may affect the characteristics of FS. In a previous study, at one of the centers involved in the current study, we observed that patients diagnosed during the COVID-19 pandemic less frequently had generalized motor FS and had higher seizure frequencies. In addition, FS were inversely associated with the education level as a trend during the COVID-19 pandemic [13]. However, this was a single center study with a limited number of patients during the COVID-19 pandemic (24 persons).

In the current study, we investigated whether the COVID-19 pandemic has affected the clinical characteristics of patients with FS in a large multicenter international study. Considering the magnitude of the global impacts of the COVID-19 pandemic and also the prevalence and importance of FS [14], it was important to reproduce the previous study in a larger international multicenter study. Changes in the characteristics of FS have never been studied during other widespread societal traumas/events, to the best of our knowledge. This unique occasion (of COVID-19 pandemic) may have provided an enlightening window for research into the associated factors of FS on a global scale.

2. Methods

2.1. Participants

This was a retrospective study. We investigated all patients with a new diagnosis of FS, who were admitted at the epilepsy monitoring units at six centers in the world: 1. Shiraz, Iran; 2. Salzburg, Austria; 3. Nancy, France; 4. Atlanta, USA; 5. Kuwait City, Kuwait; and 6. Cairo, Egypt. Patients were studied during two time periods: admitted in 2018–2019 (pre-COVID era) and 2020–2021 (COVID era). Patients had a confirmed diagnosis of FS, determined by clinical assessment and video-EEG monitoring with ictal recording of their seizures. There were no exclusion criteria. Written informed consent was obtained at the time of admission at the epilepsy monitoring units from all patients to register their data.

2.2. Data collection

We extracted all the relevant demographic and clinical data from our databases. These included: (i) the demographic characteristics: sex, age at onset, age, duration of illness, marital status, and education level; (ii) the functional seizures characteristics: FS frequency, semiology of FS including aura, loss of responsiveness (LOR), generalized motor seizures, urinary incontinence with FS, prolonged seizures (>10 min), and ictal injury; and (iii) the associated risk factors: a family history of seizures, a history of physical abuse (i.e., corporal punishment or any physical injury resulted from aggressive behavior toward the patient), a history of sexual abuse (i.e., rape), a history of family dysfunction (i.e., divorce, significant family disputes, single parent), a history of medical comorbidities (self-declared), a history of known psychiatric comorbidities (taking psychiatric drugs), and epilepsy comorbidity (based on the clinical history and the results of the video-EEG monitoring). All the data were collected by an epileptologist in an interview with the patient and their care-givers.

2.3. Statistical analyses

Kolmogorov–Smirnov normality test was performed. Values were presented as mean ± standard deviation (SD) or median/interquartile range (IQR) (based on their normality) for continuous variables and as number (percent) of subjects for categorical variables. Fisher’s exact test, Pearson Chi-square test, Mann–Whitney-U test (or t-test), and binary logistic regression analysis model were used (as appropriate) for statistical analyses. Since we have applied a regression analysis on the variables with a p < 0.2 in univariate analyses, application of Bonferroni correction test was not necessary. Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated. A p value (2-sided) less than 0.05 was considered as significant. We investigated the factors in association with the COVID-19 pandemic era in univariate analyses. Variables that had a p < 0.2 in univariate analyses were analyzed in a binary logistic regression analysis model.

2.4. Standard protocol approvals, registrations, and patient consents

The Institutional Review Boards of each center approved this study.

2.5. Data availability statement

The data are confidential and will not be shared.

3. Results

Three hundred and sixty-six patients were studied. Patients were recruited from six centers: 90 (27.6%) from Iran, 55 (16.9%) from Egypt, 46 (14.1%) from Austria, 45 (13.8%) from Kuwait, 45 (13.8%) from the USA, and 45 (13.8%) from France. They included 222 (68.1%) women and 104 (31.9%) men (sex ratio: 2.13). Two hundred and twenty-four (68.7%) patients were diagnosed before and 102 (31.3%) persons during the COVID-19 pandemic.

Table 1 summarizes the clinical characteristics of the patients diagnosed with FS during and before the COVID-19 pandemic in univariate analysis. A history of family dysfunction (i.e., divorce, significant family disputes, etc.) were significantly more frequent among patients diagnosed during the COVID-19 pandemic (42.2%) compared with those who were diagnosed before the pandemic (31.7%) (p = 0.036). Then, the variables with a p < 0.2 in univariate analyses (i.e., duration of illness, a history of family dysfunction, a family history of seizures, receiving psychiatry drugs at diagnosis, and the level of education (below 5 grades vs. above); covariates) were included in a regression analysis model to clarify the role of each variable in association with the time period of FS diagnosis (i.e., during or before the COVID-19 pandemic; the dependent variable). The model that was generated by this test was significant (p = 0.028). Only, a history of family dysfunction was significantly associated with the COVID-19 pandemic era (OR: 1.955, 95% CI: 1.119–3.418; p = 0.019) (Table 2).

In a subanalysis, we categorized the nations into the Western countries (i.e., Austria, France, USA; N = 136) and the Middle-Eastern nations (i.e., Iran, Egypt, Kuwait; N = 190). We performed
Table 1

| Variables in association with the COVID-19 pandemic in univariate analyses. | Before COVID, N=224 | COVID-era, N=102 | P value |
|---|---|---|---|
| Age at onset, years (median, IQR) | 22, 15 | 24, 17 | 0.718 |
| Age at diagnosis, years (median, IQR) | 28, 21 | 29, 17.5 | 0.619 |
| Duration of disease, years (median, IQR) | 2, 6 | 1, 4 | 0.080 |
| Sex (Female) | 158 (70.5%) | 64 (62.7%) | 0.200 |
| Frequency of seizure per months (median, IQR) | 4, 13 | 5, 28 | 0.298 |
| Aura with seizures | 131 (58.5%) | 64 (62.7%) | 0.543 |
| Loss of responsiveness with seizures | 153 (68.3%) | 65 (63.7%) | 0.374 |
| Urinary incontinence with seizures | 24 (10.7%) | 11 (10.8%) | >0.999 |
| Generalized motor seizures | 174 (77.7%) | 77 (75.5%) | 0.885 |
| Ictal injury | 42 (18.7%) | 14 (13.7%) | 0.342 |
| Prolonged seizures (status) | 55 (24.5%) | 19 (18.6%) | 0.255 |
| A family history of seizures | 44 (19.6%) | 30 (29.4%) | 0.118 |
| A history of physical abuse | 44 (19.6%) | 25 (24.5%) | 0.773 |
| A history of sexual abuse | 28 (12.5%) | 17 (16.7%) | 0.493 |
| A history of family dysfunction | 71 (31.7%) | 43 (42.2%) | 0.036 |
| Emotional trigger for seizures | 139 (62.0%) | 71 (69.6%) | 0.209 |
| Medical comorbidity | 60 (26.9%) | 23 (22.5%) | 0.493 |
| Comorbid epilepsy | 60 (26.9%) | 23 (22.5%) | 0.493 |
| Receiving antiseizure medications at diagnosis | 148 (66.1%) | 60 (58.8%) | 0.216 |
| Receiving psychiatry drugs at diagnosis | 47 (21.0%) | 29 (28.4%) | 0.158 |

Significant p values are in bold. Interquartile range (IQR). Some data were missing.

Table 2

| Variables in association with the COVID-19 pandemic in regression analysis. | Odds Ratio | 95% confidence interval | P value |
|---|---|---|---|
| A history of family dysfunction | 1.955 | 1.119–3.418 | 0.019 |
| A family history of seizures | 1.355 | 0.730–2.515 | 0.336 |
| Duration of illness | 0.967 | 0.930–1.006 | 0.092 |
| Receiving antiseizure medications at diagnosis | 0.655 | 0.326–1.318 | 0.236 |
| Level of education (below 5 grades vs. above) | 0.680 | 0.327–1.414 | 0.302 |

Significant p values are in bold.

a series of univariate tests, separately, and then applied the regression analysis on the variables with p < 0.2. Among the Middle-Eastern patients (Table 3), only a low education was associated with the COVID-19 pandemic era. The regression analysis model that included variables with p < 0.2 from the univariate analysis (i.e., a history of family dysfunction, emotional trigger for seizures, and education) was significant (p = 0.015). Only, a low education (below 5 grades vs. above) was associated with the COVID-19 pandemic era (OR: 5.557, 95% CI: 1.571–19.660; p = 0.008) (Table 4). Among the Western patients (Table 5), none of the variables was significantly associated with the COVID-19 pandemic era (many had small values for a reliable statistical analysis).

4. Discussion

In the current study, we observed that a history of family dysfunction was significantly more frequently associated with FS during the COVID-19 pandemic. Otherwise, the clinical and semiological characteristics of patients with FS were similar between patients who were diagnosed before the pandemic compared with those who received the diagnosis during the pandemic. Therefore, we can conclude that while this deadly outbreak has caused significant stress for everyone [9–12], it has not affected the characteristics of FS significantly.

While it was not clear whether family dysfunction circumstances happened during the COVID-19 outbreak or before the pandemic in the current study, the observation that the report of family dysfunction (i.e., divorce, significant family disputes, etc.) was significantly more frequently associated with FS during the COVID-19 pandemic may have important implications. A recent systematic review concluded that domestic violence has been a considerable worldwide issue imposed by the COVID-19 epidemic. The home confinements have led to constant contact between perpetrators and victims, resulting in increased violence and decreased reports [15]. The intimate partner violence could be in various forms: physical, sexual, and psychological [16]. Due to
problems are a risk factor for the development of FS in children and family dysfunction, and FS deserves further studies and study. The nature of the link between the COVID-19 pandemic, the COVID-19 pandemic, family dysfunction, and FS in the current pandemic [17]. Therefore, social services (e.g., social work practitioners, therapists, etc.) for cases of family dysfunction and domestic violence must be resourced during the pandemic [17]. The nature of these studies (survey) and the risk of selection bias associated with their methodology may explain their contradictory results. Importantly, patients with functional neurological disorders (FND) may show higher levels of anxiety, symptoms related to post-traumatic stress disorder (PTSD), and perceived stress compared with healthy controls during the COVID-19 pandemic [24]. Video-telemedicine is a feasible and effective way to provide care for patients with FS during such difficult times as this pandemic [25].

5. Limitations

This study may not represent the full spectrum of patients with FS; the mildest disease forms may not be referred to busy university clinics and therefore, the possibility of selection bias exists. Furthermore, in patients with FS, often some time passes between the onset and the diagnosis. While we can explore and discuss the differences of the characteristic of FS at the time of the diagnosis in the current study, we cannot ascertain any differences at the onset of the disease.

6. Conclusion

The COVID-19 pandemic has not affected the clinical characteristics of patients with FS (at the time of diagnosis). However, a history of family dysfunction was significantly more frequently associated with FS during the COVID-19 pandemic. Multiagency integration of law enforcement responses, social services, and social awareness is recommended to address family dysfunction and domestic violence and support the victims during this pandemic. A low level of education might also be associated with FS during the COVID-19 pandemic, at least in some cultures (e.g., the Middle-East).

Funding

This work was supported by Shiraz University of Medical Sciences. The funding source had no involvement in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication.

Disclosure statement

Ali A. Asadi-Pooya: Honoraria from Cobel Daruo, Tekaje, Sanofi, Actoverco, and RaymandRad; Royalty: Oxford University Press (Book publication); Grant from the National Institute for Medical Research Development.

Eugen Trinka has received personal fees from Arvelle/Angelini, Argenix, UCB, Eisai, Bial, Böhringer Ingelheim, Medtronic, Marinus, MedScape, Everpharma, Epilog, GSK, Biogen, Takeda, Liva-Nova, Newbridge, Novartis, Sanofi, Sandoz, Sunovion, GW Pharmaceuticals, Marinus; grants from Austrian Science Fund (FWF), Österreichische Nationalbank, European Union, GSK, Biogen, Eisai, Novartis, Red Bull, Bayer, and UCB; other from Neuroconsult Ges. m.b.H., outside this work.

Abdulaziz Ashkanani: Honoraria as a consultant/advisor & speaker for Novartis, Eli Lilly, Newbridge, and Hikma Co.

Others: no conflict of interest.

Acknowledgement

We thank Shiraz University of Medical Sciences.

Table 5

| Variables                          | Before COVID, N = 90 | COVID-era, N = 46 | P value |
|------------------------------------|----------------------|-------------------|---------|
| Age at onset, years (median, IQR)  | 21, 20               | 27, 16            | 0.701   |
| Age at diagnosis, years (median, IQR) | 34, 24           | 31, 19.5          | 0.632   |
| Duration of disease, years (median, IQR) | 3, 9            | 1, 3.5            | 0.364   |
| Sex (Female)                       | 67 (74.4%)          | 28 (60.9%)        | 0.177   |
| Frequency of seizure per months (median, IQR) | 5, 27        | 5, 28             | 0.561   |
| Aura with seizures                 | 55 (61.1%)          | 28 (60.9%)        | >0.999  |
| Loss of responsiveness with seizures | 55 (61.1%)        | 27 (58.7%)        | 0.711   |
| Urinary incontinence with seizures | 10 (11.1%)          | 6 (13.0%)         | 0.783   |
| Generalized motor seizures         | 64 (71.1%)          | 35 (76.1%)        | 0.684   |
| Ictal injury                        | 17 (18.9%)          | 7 (15.2%)         | 0.644   |
| Prolonged seizures (status)        | 6 (6.7%)            | 2 (4.3%)          | 0.712   |
| A family history of seizures       | 25 (27.3%)          | 16 (34.8%)        | 0.429   |
| A history of physical abuse        | 34 (37.8%)          | 17 (36.9%)        | >0.999  |
| A history of sexual abuse          | 16 (17.8%)          | 13 (28.3%)        | 0.195   |
| A history of family dysfunction    | 42 (46.7%)          | 22 (47.8%)        | 0.149   |
| Emotional trigger for seizures     | 57 (63.3%)          | 31 (67.4%)        | 0.849   |
| Medical comorbidity                | 36 (40.0%)          | 14 (30.4%)        | 0.348   |
| Comorbid epilepsy                  | 23 (25.6%)          | 10 (21.7%)        | 0.678   |
| Receiving antiseizure medications at diagnosis | 61 (67.8%) | 29 (63.0%) | 0.702 |
| Receiving psychiatry drugs at diagnosis | 36 (40.0%) | 22 (47.8%) | 0.464 |

Interquartile range (IQR). Some data were missing.
Authors’ contributions

Ali A. Asadi-Pooya, M.D.: study design, data collection, statistical analyses, and manuscript preparation.

Others: data collection and manuscript preparation.

None of the authors listed on the manuscript are employed by a government agency. All are academicians. None of the authors are submitting this manuscript as an official representative or on behalf of the government.

References

[1] Reuber M. The etiology of psychogenic non-epileptic seizures: toward a biopsychosocial model. Neurol Clin 2009;27:909–24.
[2] Popkow S, Asadi-Pooya AA, Duncan R, Gigineishvili D, Hingray C, Miguel Kanner A, et al. The aetiology of psychogenic non-epileptic seizures: risk factors and comorbidities. Epileptic Disord 2019;21:529–47.
[3] Asadi-Pooya AA, Brego F, Mildon R, Nicholson TR. Terminology for psychogenic nonepileptic seizures: making the case for “functional seizures”. Epilepsy Behav 2020;104:106895.
[4] Walsh S, Levita L, Reuber M. Comorbid depression and associated factors in PNES versus epilepsy: systematic review and meta-analysis. Seizure 2018;60:44–56.
[5] Griffith NM, Smith KM, Chefft BK, Szafarski JP, Privitera MD. Optimism, pessimism, and neuropsychological performance across semiology-based subtypes of psychogenic nonepileptic seizures. Epilepsy Behav 2008;13:478–84.
[6] Asadi-Pooya AA. Semiological classification of psychogenic nonepileptic seizures: a systematic review and a new proposal. Epilepsy Behav 2019;100:106412.
[7] Rothen HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. J Autoimmun 2020;109:102433.
[8] Jahangiri K, Sahebi A. Social consequences of COVID-19 pandemic in Iran. Acta Medica Iranica 2020;58:662–3.
[9] Chawla N, Tom A, Sen MS, Sagar R. Psychological impact of COVID-19 on children and adolescents: a systematic review. Indian J Psychol Med 2021;43:294–9.
[10] Krishnamoorthy Y, Nagarajan R, Saya GK, Menon V. Prevalence of psychological morbidities among general population, healthcare workers and COVID-19 patients amidst the COVID-19 pandemic: a systematic review and meta-analysis. Psychiatry Res 2020;293:113382.
[11] Cross JH, Kwon C-S, Asadi-Pooya AA, Balagura G, Gómez-Iglesias P, Guekht A, et al. Epilepsy care during the COVID-19 pandemic. Epilepsia 2021;62:3232–32.
[12] Asadi-Pooya AA, Farazdaghi M. Effects of the COVID-19 pandemic on characteristics of functional (psychogenic) seizures. J Psychosom Res 2021;147:110514.
[13] Asadi-Pooya AA. Incidence and prevalence of psychogenic nonepileptic seizures (functional seizures): a systematic review and an analytical study. Int J Neurosci 2021:1–6.
[14] Kourti A, Stavridou A, Panagouli E, Psaltopoulou T, Spiliopoulou C, Tsolia M, et al. Domestic violence during the COVID-19 pandemic: a systematic review. Trauma Violence Abuse 2021;12548380211038690.
[15] Akalin A, Ayhan F. Intimate partner violence against women in Turkey during the COVID-19 pandemic. Issues Ment Health Nurs 2021:1–8.
[16] Xue J, Chen J, Chen C, Hu R, Zhu T. The hidden pandemic of family violence during COVID-19: unsupervised learning of tweets. J Med Internet Res 2020;22:e24361.
[17] Gulati G, Kelly BD. Domestic violence against women and the COVID-19 pandemic: What is the role of psychiatry? Int J Law Psychiatry 2020;71:101594.
[18] Doss J, Caplan R, Siddarth P, Bursch B, Falcone T, Forgey M, et al. Risk factors for learning problems in youth with psychogenic non-epileptic seizures. Epilepsy Behav 2017;70:135–9.
[19] Rawat VS, Dhimun V, Sinha S, Vijay Sagar KJ, Thippswamy H, Chaturvedi SK, et al. Co-morbidities and outcome of childhood psychogenic non-epileptic seizures—an observational study. Seizure 2015;25:95–9.
[20] Reuber M, Qurishi A, Bauer J, Helmstaedter C, Fernández G, Widman G, et al. Are there physical risk factors for psychogenic non-epileptic seizures in patients with epilepsy? Seizure 2003;12:561–7.
[21] Valente KD, Alessi R, Baroni G, Marin R, dos Santos B, Palmini A. The COVID-19 outbreak and PNES: the impact of a ubiquitously felt stressor. Epilepsy Behav 2021;117:107852.
[22] Rosengard JL, Ferastraoaru V, Donato J, Haut SR. Psychogenic nonepileptic seizures during the COVID-19 pandemic in New York City - a distinct response from the epilepsy experience. Epilepsy Behav 2021;123:108255.
[23] Nestic V, Goeta D, Gambini O, Demartini B. The psychological impact of COVID-19 among a sample of Italian patients with functional neurological disorders: a preliminary study. Parkinsonism Relat Disord 2020;78:79–81.
[24] Fredwall M, Terry D, Enciso L, Burch MM, Trott K, Albert DVF. Short-term outcomes in pediatric and adolescent patients with psychogenic nonepileptic events seen by telemedicine during the COVID-19 pandemic. Epilepsy Behav 2021;117:107739.