Title: Epilepsy management during difficult times

Authors: Boulenouar Mesraoua, M.D.[1], J Helen Cross, MB ChB PhD [2], Emilio Perucca, M.D.[3], Ali A. Asadi-Pooya, M.D.[4]

1. Neurosciences Department, Hamad Medical Corporation and Weill Cornell Medical College, Doha, Qatar.
2. UCL NIHR BRC Great Ormond Street Institute of Child Health, & Great Ormond Street Hospital for Children NHS Trust, London UK.
3. Department of Medicine, Austin Health, The University of Melbourne, and Department of Neuroscience, Monash University, Melbourne, Victoria, Australia.
4. Epilepsy Research Center, Shiraz University of Medical Sciences, Shiraz, Iran; Jefferson Comprehensive Epilepsy Center, Department of Neurology, Thomas Jefferson University, Philadelphia, PA, USA.

E-mails: boulenouar.mesraoua@wanadoo.fr; h.cross@ucl.ac.uk; perucca@unipv.it; aliasadi-pooya@yahoo.com

Corresponding author : Boulenouar Mesraoua
boulenouar.mesraoua@wanadoo.fr
ORCID 0000-0001-8625-7365

Running title: Epilepsy during difficult times

Number of characters in the title: 42; number of characters in the running head: 22; number of text pages: 9; number of words: 3502; number of words in the abstract: 185; number of references: 46; number of figures: 0; number of tables: 0.

Abstract

Major disruption in the delivery of healthcare services can occur in exceptional situations such as natural disasters, conflicts, periods of severe economic hardship, and epidemics.

These disruptions typically affect to the greatest extent the most vulnerable segments of the population, including people with epilepsy . Inability to access healthcare services can lead to failure to undergo necessary diagnostic investigations, or to receive needed therapeutic interventions, including epilepsy surgery. Stress and other factors associated with the nature or the cause of the disruption can adversely affect seizure control status, or precipitate the occurrence of psychiatric disorders and other comorbid conditions. Failure to access antiseizure medications is a common occurrence in these situations and can result in loss of seizure control, withdrawal seizures, and status epilepticus. In this article, we provide examples of recent disruptions in healthcare and their implications for people with epilepsy. We discuss the consequences of natural disasters, conflicts, economic sanctions, and focus in greater detail on lessons learnt during the COVID-19 pandemic. We also discuss possible mitigation procedures, focusing in particular on the application of telemedicine to epilepsy care. Finally, we underline the need for governments, healthcare authorities, and international organizations to improve their preparadness to deal with exceptional situations that may arise in the future.

Keywords: Epilepsy; Pandemic; Seizure; Telemedicine; War

1. Introduction

Even in settings where access to healthcare is well organized, there can be circumstances where healthcare services can become suddenly and severely disrupted. Examples of such circumstances include natural disasters, wars and other forms of conflict, events leading to severe economic hardship, and disease epidemics. Depending on the underlying cause, the disruption of healthcare services can be sudden or gradual, short-lived or prolonged, and affected individuals can range from small local communities to entire nations or even worldwide, as recently experienced during the COVID-19 pandemic.

When healthcare services are severely disrupted, the most vulnerable segments of the populations are typically among the most seriously affected, and people with epilepsy (PwE) are no exceptions. For PwE, inability to access healthcare facilities can result in failure to undergo necessary diagnostic investigations, or to benefit from appropriate therapeutic interventions, including epilepsy surgery. Physical and psychological isolation, coupled with the stress related to the underlying cause of the disruption, can contribute to deterioration in seizure control status, and to development or exacerbation of psychiatric comorbidities. For most PwE, regular intake of antiseizure medications (ASMs) is essential to ensure sustained seizure control [1], and failure to access medication can result in recurrence of seizures, including withdrawal seizures and life-threatening developments such as status epilepticus.

In this brief narrative review, we provide examples of difficult humanitarian circumstances that can disrupt the delivery of healthcare to people, including those with epilepsy, and describe mitigation procedures that can be put in place to alleviate their suffering during such difficult times. We will focus in particular to lessons learnt during recent natural and man-made disasters, and during the COVID-19 pandemic, with special emphasis on the application of telemedicine to epilepsy care. The issues discussed are relevant to children as well as adults with epilepsy, although the majority of studies were conducted in adult populations. There are other scenarios of difficulty for humanity (e.g., consequences of climate change [2]) that are beyond the scope of the current review.

2. Man-made disasters

Having access to healthcare in the current world is a privilege, it is not a merit. Many variables may affect and disrupt availability of healthcare, including access to medications. One regrettable common scenario that can significantly disrupt healthcare is man-made disasters.

Man-made disasters affecting access to healthcare include wars (e.g., Yemen, Ukraine), internal conflicts (e.g., Syria, Libya, Afghanistan), and international sanctions (e.g., Cuba, North Korea, Iran, Russia, Somalia, Venezuela, Zimbabwe). These unfortunate situations affect the life of ordinary people significantly and may limit or negate access to basic human rights, including healthcare and medications. The current war in Ukraine is a sad example of such a scenario. Volodymyr, who is a practicing neurologist in Ukraine, sent an email to many epileptologists worldwide making an urgent, heartfelt request: “I am in my hospital helping with patients and organization, but I am getting hundreds of our patients' requests for antiepileptic drugs. They are running out of supplies, especially those not registered in the Ukraine like vigabatrin, rectal diazepam, clobazam, etc. Could you please help us with this?”. The current situation in Yemen is also of great concern, with the country being victim of one of the worst humanitarian crises in the world [3]. Likewise, in Syria, the entire country is hit by a humanitarian crisis [4].

Economic sanctions against many nations have also created serious humanitarian consequences affecting access to healthcare; one recent example being the 2018 re-imposition of international sanctions on Iran [5]. In a 2019 study of 244 patients with epilepsy in Iran, 38% of the surveyed individuals stated that they had significant difficulty obtaining their ASMs, and 15% indicated that their medication(s) were not accessible at all [6].

Purely from a healthcare perspective, it is imperative that political leaders and military personnel take all necessary actions to respect the sanctity of hospitals and other healthcare facilities, and to prevent suffering and hardship of the people affected by injuries or disease 7. Similarly, various approaches can be used to mitigate the healthcare impacts of economic sanctions; one example being the Oil-for-Food Program established by the United Nations in 1995 to allow Iraq to sell oil on the world market in exchange for food, medicines, and other humanitarian needs for ordinary citizens without allowing the government to boost its military capabilities [8]. Other mitigation procedures, especially during wars and internal conflicts, include providing international humanitarian relief efforts and targeted donations of medicines. The International League against Epilepsy (ILAE) [9], the ROW Foundation [10] and other non-governmental organizations [10] have taken initiatives to boost supply and distribution of ASMs to PwE in Ukraine. Hopefully, these actions will go some way to assist Volodymyr and his colleagues in addressing the needs of their patients. It is necessary that such relief actions are extended to other crises in the world, including those occurring inYemen, Syria, Libya, Afghanistan, Cuba, North Korea, Iran, Somalia, Venezuela, Zimbabwe, and other countries.

3. Natural disasters

Natural disasters (e.g., earthquakes, tsunamis, hurricanes, etc.) also affect access to healthcare significantly [11-13]. In a study of 161 physically handicapped patients with epilepsy during the Great East Japan Earthquake in 2011, 68% of patients reported having seven days or less of stockpiled medication when the earthquake struck, and 29% of patients had no medication or almost no medication during the acute phase after the earthquake; six patients had to stop taking their medication and nine patients experienced a worsening of their seizures [12]. Establishment of appropriate countermeasures against interruption of treatment and healthcare services to ascertain medical needs of all people are necessary to prepare for future disasters [14]. In addition to disrupting access to healthcare services, the psychosocial impacts of disasters (man-made or natural) should also be considered. Establishing mental health services that are community-based, family-focused, and culturally sensitive in the post-emergency phase of disasters are among helpful mitigation procedures in such circumstances[15].

4. The COVID-19 pandemic and its influence on PwE

In some ways, the features of the COVID-19 pandemic resemble those of a conflict. By 11 March 2022, approximately, 453 million COVID-19 cases had been reported and the total number of COVID-19-related deaths worldwide climbed to 6,051,397 [16]; This is about 10 times the combined number of military and civilian casualties in all British Commonwealth nations during the second World War[17]. As usual in these situations, communities that are underprivileged due to poverty, disease or vulnerability to stigma, suffered most during the pandemic, and PwE were no exceptions. As the pandemic evolved, many lessons were learnt and important knowledge was acquired not only on the impact of the COVID-19 on PwE, but also on ways to ensure that health systems are better prepared to deal with other emergencies that could occur in the future. A few questions relevant to epilepsy that emerged during the pandemic are addressed concisely in the sections below, as an example of the multifaceted health issues that can arise during difficult times.

4.1. Are PwE at greater risk of developing severe complications of COVID-19, and are they at greater risk of COVID-19 related mortality?

Because the SARS-CoV-2 virus may cause a number of central nervous system (CNS) manifestations, the possible impact of epilepsy on COVID-19 outcomes has been a source of concern. A recent systematic review and meta-analysis evaluated whether PwE are at risk of a poorer COVID-19 outcome (including a higher mortality risk) compared with people without epilepsy [18]. Thirteen studies in a total of 67,131 patients with COVID-19 were included in the meta-analysis. A previous diagnosis of epilepsy was found to be associated with a higher risk of severe COVID-19 outcomes (odds ratio, OR, 1.69; 95% confidence interval, 95%CI, 1.11–2.59) and a higher risk of mortality (OR, 1.71; 95% CI, 1.14–2.56).[10] Similar results were reported by two subsequent studies from Spain[19] and Hungary[20]. Most of the studies had major limitations, including the possible influence of confounders, and inadequate power or information to assess the impact of variables such as type of seizures and epilepsy, degree of seizure control, comorbidities and treatments. Despite these limitations, overall evidence does indicate that, while PwE do not appear to be at greater risk of acquiring COVID-19 [19], they are more likely to have poorer COVID-19 outcomes. To explain these data, it has been hypothesized that the inflammatory reaction to SARS-CoV-2 might be enhanced in epileptic tissue, or that poorer outcomes could arise from COVID-19-related seizure complications (including status epilepticus) or from adverse interactions between ASMs and COVID-19 itself, or its treatment [19].

The risk of poorer COVID-19 outcomes reinforces the recommendation that PwE should have access to COVID-19 vaccines [21]. Of note, a recent study based on the medical records of approximately seven million people vaccinated against the COVID-19 in the UK found that, following vaccination, epilepsy is no longer a risk factor for increased COVID-19-related mortality [22].

4.2. Does COVID-19 cause seizures and does it worsen seizure control in PwE?

COVID-19 can cause a number of neurological manifestations but, among these, seizures are relatively uncommon (<5%) [23]. When they occur, seizures generally consist in acute symptomatic seizures in severely ill patients, as a consequence of hypoxia, stroke, metabolic derangements, or organ failure [24,25]. Epileptiform discharges in the EEG, however, are relatively common in COVID-19 patients [26]. In some individuals, status epilepticus may be seen, which often shows features typical of New-Onset Refractory Status Epilepticus (NORSE), possibly reflecting a pro-inflammatory state in the CNS [27].

There is little or no evidence that in general COVID-19 leads to seizure aggravation in PwE [28]. Worsening of seizures in PwE during the course of SARS-CoV-2 infection does occur in

some individuals, due to factors such as random fluctuation in seizure frequency, mental stress, reduced adherence to ASM treatment, or the same COVID-19 -related factors causing *de novo* acute symptomatic seizures [24,25].

4.3. How did the pandemic affect epilepsy care, and what lessons have we learnt from that?

The impact of the pandemic on epilepsy care in most regions of the world is summarized well by the actions taken at three major centers in Italy and Spain in the first months of 2020: '*activities related to epilepsy care were reduced to less than 10% and were deprioritized. Discharges were expedited and elective epilepsy surgeries…cancelled. Hospitalizations and EEG examinations were limited to emergencies. The outpatient visits for new patients were postponed, and follow-up visits mostly managed by telehealth*.' [29] Those actions were aimed at protecting patient health, and over time many clinical centers worldwide did make adjustments to minimize adverse consequences on the quality of care for PwE.

Based on the lessons learnt during these challenging times, healthcare systems need to ensure that they are be better prepared should other emergencies emerge in the future. Specifically, consideration should be given to a number of actions: (i) opportunities offered by telemedicine (including adequate communication services) should be potentiated. Although telemedicine was implemented at most centers from the very beginning of the pandemic, the range and the quality of telehealth services at many sites left room for improvement. Even in high-income countries, many patients lacked access to the technology needed to facilitate telehealth visits [28]. Issues related to implementation of telehealth services are discussed in the next section of this article; (ii) an organizational structure should be established to ensure continuous access to medicines in emergency settings. This requires creation of effective systems to procure, store and distribute medicines, as allow their home delivery for patients quarantined or otherwise unable to travel; (iii) protected environments should be established to preserve at least a minimum level of hospital visits and in-patient services. Although telemedicine can facilitate greatly epilepsy management even in non-emergency settings, efforts should be made to permit continuation of services, such as EEG recordings, videoEEG monitoring, and epilepsy surgery; (iv) programs should be in place to address the consequences of severe psychological distress, to which PwE are particularly vulnerable in emergency situations such as the COVID-19 pandemic [30]; (v) healthcare personnel should be trained to deal with emergency situations, and should be especially protected to ensure continued delivery of

services throughout crisis situations. In many countries, shortage of personnel caused by long-standing under-investment in healthcare resulted in failure to provide essential services during the pandemic.

4.4. What lessons did the COVID-19 pandemic teach researchers, public health officers, politicians and the general public?

Three general lessons learnt during the pandemic deserve to be briefly mentioned. First, the pandemic taught everyone the immense benefits deriving from scientific research, as shown most notably by the rapid identification of SARS-CoV-2 and the fast development of effective vaccines. Second, the pandemic highlighted disparities in access to healthcare within and across the borders, and how such disparities ultimately affect everyone. As an example, the lack of affordable vaccines in many parts of the world probably contributed to development and spread of more infectious SARS-CoV-2 variants. Lastly, the pandemic highlighted the potential of modern information technology (IT) in addressing public health issues. The benefits of a rapid, correct and effective communication are obvious. However, there have also been examples of suboptimal communication strategies, and even spreading false information leading to serious public health consequences, such as COVID-19 fatalities in people misled by some media into believing that vaccines are ineffective and harmful. All stakeholders need to consider these issues carefully, and ensure that we will be able to effectively address other challenges that may emerge in the future.

5. Telemedicine: An invaluable tool to deliver healthcare in difficult times

Telemedicine has developed over recent years as a useful tool in certain areas of the world, specifically where distances may preclude regular review in healthcare face to face [31-33]. During the time of the COVID-19 pandemic, difficulties in attendance at hospitals forced wider utilization, proving a main point of contact for review of those with chronic disease. Telemedicine may be defined as the delivery of medical care with the aid of telecommunications, through any platform. This may include a bespoke platform, use of any tool over the internet, cellular or telephone media. Tele-neurology is the term applied where this relates to care in neurology. Over recent years this has specifically developed with regard to stroke medicine, where timely acute interventions are now so important. Based on experience acquired especially in North America and Europe, remote consultation with specialty teams following patient arrival in remote hospitals has been effective in reducing time to delivery of thrombolysis [34]. However wider utilization has traditionally met with barriers, not least through lack of confidence of professionals in utilization and concern about malpractice,

technical limitations, security concerns, cost effectiveness and reimbursement limitations. This said there are increasing reports from disparate parts of the world of positive evaluation of telemedicine use, in adults and children with epilepsy, specifically with central tertiary co-ordination to remote rural areas [35,36].

The COVID-19 pandemic led to an unprecedented burden on health care systems throughout the world, restricting access of those with chronic disease to routine care. Several surveys have highlighted the challenges met by patients with epilepsy with regard to accessing health care. There has been a general commonality in results as to reports of cancelled appointments and in patients finding difficulties in contacting their health care teams [37,38]. Professionals focused on keeping individuals out of hospital where possible. This is where telehealth has really been utilized, through whatever platform available.

The International League Against Epilepsy (ILAE) COVID-19 Task Force in collaboration with the ILAE Telemedicine Task Force conducted a survey utilizing a 15 item questionnaire to review change in utilization of telemedicine during the pandemic [39]; 267 responses were received from 53 countries across all regions of the world. Telemedicine use increased during the pandemic; 62.2% professionals who answered utilized telemedicine pre pandemic whereas 87.3% were utilizing it post pandemic. This was through the telephone (44.9%), zoom (39.7%), WhatsApp (37.8%), text (25.1%), SKYPE (14.2%) and FaceTime (5.2%). 47.9% reported no reimbursement was provided, whereas 39.3% reported a cost to the respondent. One third reported difficulties in use, whether this was through poor connections, or internet access, difficulties for the patients in view of age or access, or too many calls taking time. Internet access was reported as good in all areas in 31.8%, good in limited areas but poor in some in 60.7% and poor in most in 5.6%.

When utilizing telemedicine, it is important to consider optimal ways to organize the consultation. A degree of preparation helps both physician and patient. This should include clear information for patients as to how to access the consultation, what information they will need to have ready, and any questionnaires that could aid the consultation e.g., quality of life assessments [40]. There is also a difference to the consultation style that may be required. Key questions may need to be prepared, differing for new and follow-up consultations on seizure information, epilepsy history, personal history, comorbidities and lifestyle. Home video of events can be really helpful. Video consultation has many advantages as opposed to telephone as it may be easier to engage patients and their families, there may be increased interaction, sharing of information and the ability to gauge neurological deficit. However, video may also prove problematic in certain cultures, as well as being limitations in technology

awareness in some patients and families. Certain services such as those for ketogenic diet services have also however reported advantages over face to face consultations, where more family members can become involved, contact with families is generally easier, and there is a greater ability to attend more professional meetings [41]. Surveys have reported a general increased patient and family satisfaction [42].

This said there remains a discussion as to how such services will be utilized in the longer term. A survey of physicians conducted in Japan by the Young Epilepsy Section of the ILAE revealed 29/115 (32.6%) were unwilling to continue use following the pandemic [43]. Age, specialty, the number of COVID-19 risk factors in the participant, the number of COVID-19 risk factors in the cohabitants, COVID-19 epidemic area, consultation time during telemedicine, and workload due to telemedicine were statistically significant in influencing the likelihood of continuing. In the multivariate binary logistic regression analysis, workload due to telemedicine was independently associated with the unwillingness to continue telemedicine. In an online survey to members of Spanish epilepsy society during the pandemic, 88% handled epilepsy clinics by telephone, and 4.5% by videoconference [44]. Changes in ASMs were performed less frequently than during onsite visits by 66.6% of the epileptologists. Scales were not administered during these visits, and certain types of information such as sudden expected unrelated death in epilepsy (SUDEP) were felt to be more appropriate to discuss in person. More than 4 out of 5 of the neurologists (84.8%) stated that they would be open to perform some telemedicine visits in the future.

It is important to recognize a need for telehealth, acknowledging it is not without limitations. WhatsApp is end to end encrypted, but is not compliant, for example, with the Health Insurance Portability and Accountability (HIPAA), and this may be misunderstood in some areas. However, it is important to ensure continuity of care and consequently the benefits of use of such platforms during the pandemic. The use of telehealth is likely to be a requirement of the future so connectivity must also be seen as a priority in primary care settings around the world, acknowledging the need for patient privacy and data security. The United Nations have recognized access to the internet as a human right, acknowledging the global and open nature of the Internet as a driving force in accelerating progress towards development in its various forms [45]. Further they have set out a roadmap for digital cooperation aiming that by 2030, every person should have safe and affordable access to the Internet, including meaningful use of digitally enabled services in line with the Sustainable Development Goals [46]. The epilepsy community should also advocate for improved telehealth infrastructure with appropriate recognition of such consultations as face to face with regard to reimbursement

6. Conclusions

Access to epilepsy care, including ASMs, can be severely disrupted in various circumstances, many of which may be sudden and unpredictable. Although mitigation interventions need to take into account the nature and cause of the disruption, the ability to provide an effective response is largely dependent on the level of preparedness of local health systems and existing infrastructures. Government and healthcare authorities need to ensure that adequate planning/preparations are in place to deal with such emergencies. Application of telemedicine, likely to become a requirement in the future, and other appropriate mitigation procedures, including emergency relief efforts, can offer invaluable assistance during difficult circumstances. The lessons learnt during the COVID-19 pandemic indicate that national communities and international organizations need to be better prepared to address other emergencies that may emerge in the future.

Bullet points

- Epilepsy needs long-term treatment to maintain the goal of seizure-freedom.
- People with epilepsy should have reliable access to medication(s) on a regular basis.
- During man-made or natural disasters, and during serious epidemics, access to epilepsy care can be severely disrupted
- Application of mitigation procedures is necessary during difficult circumstances.

Declarations

Conflict of interest

Helen Cross: JHC has acted as an investigator for studies with GW Pharma, Zogenix, Vitaflo and Marinius. She has been a speaker and an advisory board member for GW Pharma, Zogenix and Nutricia; all remuneration has been paid to her department. Her work is supported by the NIHR Biomedical Research Centre at Great Ormond Street Hospital & University College London.

Emilio Perucca: EP received speaker and/or consultancy fees from Angelini, Arvelle, Biogen, Biopas, Eisai, GW Pharma, PMI Life Sciences, Sanofi group of companies, SKL Life Science, Takeda, UCB Pharma, Xenon Pharma and Zogenix, and royalties from Wiley, Elsevier, and Wolters Kluwers.

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.

Boulenouar Mesraoua: Grant from Qatar National Research Fund (QNRF)

Acknowledgments

This review was presented at the 4th Qatar Virtual International Epilepsy Course, January 13th-15th, 2022 by the authors. We thank Hamad Medical Corporation Medical Education for supporting this event.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors

Authors' contributions

All authors contributed similarly to this manuscript.

References

1. Asadi-Pooya AA, Farazdaghi M. Treatment response in newly diagnosed epilepsy: a syndromic approach. Neurol Res. 2022 Jan 17:1-6.
2. Gulcebi MI, Bartolini E, Lee O, et al; Climate change and epilepsy: Insights from clinical and basic science studies. Epilepsy Behav. 2021;116:107791. doi: 10.1016/j.yebeh.2021.107791.
3. The International Rescue Committee. Crisis in Yemen: Protracted conflict pushes Yemenis deeper into need. https://www.rescue.org/article/crisis-yemen-protracted-conflict-pushes-yemenis-deeper-need#:~:text=%E2%80%9CYemen%20is%20still%20one%20of,and%20development%20manager%20Ebtihal%20Ghanem./ accessed on 11 March 2022.
4. ReliefWeb. 2022 Humanitarian Needs Overview: Syrian Arab Republic (February 2022) - Syrian Arab Republic | ReliefWeb accessed on 21 April 2022.
5. Wikipedia. United States withdrawal from the Joint Comprehensive Plan of Action. https://en.wikipedia.org/wiki/United_States_withdrawal_from_the_Joint_Comprehensive_Plan_of_Action/ accessed on 11 March 2022.
6. Asadi-Pooya AA, Azizimalamiri R, Badv RS, Yarali B, Asadollahi M, Homayoun M, Sharifi S. Impacts of the international economic sanctions on Iranian patients with epilepsy. Epilepsy Behav. 2019 Jun;95:166-168. doi: 10.1016/j.yebeh.2019.04.011.
7. Asadi-Pooya AA, Tavana B, Tavana B, Emami M. Drug adherence of patients with epilepsy in Iran: the effects of the international economic sanctions. Acta Neurol Belg 2016;116:151–5.
8. Wikipedia. Oil for Food Programme. https://en.wikipedia.org/wiki/Oil-for-Food_Programme/ accessed on 11 March 2022.
9. International League against Epilepsy (ILAE). ILAE Actions to Support People with Epilepsy Affected by the Situation in Ukraine. https://www.ilae.org/news-and-media/epilepsy-news-around-the-world/ilae-actions-to-support-people-with-epilepsy-affected-by-the-situation-in-ukraine/ accessed on 11 March 2022.
10. ROW Foundation. Ukraine relief. Available at: https://rowpharma.org/donations/ accessed March 13, 2022.
11. Shibahara I, Osawa S, Kon H, et al. Increase in the number of patients with seizures following the Great East-Japan Earthquake. Epilepsia. 2013;54:e49-52.

12. Kobayashi S, Endo W, Inui T, et al. The lack of antiepileptic drugs and worsening of seizures among physically handicapped patients with epilepsy during the Great East Japan Earthquake. Brain Dev. 2016;38:623-627.
13. Raulji C, Velez MC, Prasad P, Rousseau C, Gardner RV. Impact of Hurricane Katrina on healthcare delivery for New Orleans patients, 2005-2014. Pediatr Blood Cancer. 2018;65:e27406.
14. Murakami A, Sasaki H, Pascapurnama DN, Egawa S. Noncommunicable Diseases After the Great East Japan Earthquake: Systematic Review, 2011-2016. Disaster Med Public Health Prep. 2018;12:396-407.
15. Silove D, Steel Z. Understanding community psychosocial needs after disasters: implications for mental health services. J Postgrad Med. 2006;52:121-125.
16. Worldometer. COVID Live. Coronavirus statistics. https://www.worldometers.info/coronavirus/ (accessed 11 March 2022).
17. Encyclopedia Britannica. Cost of the war. Available at: https://www.britannica.com/event/World-War-II/Costs-of-the-war (accessed January 2, 2022).
18. Siahaan YMT, Ketaren RJ, Hartoyo V, Hariyanto TI. Epilepsy and the risk of severe coronavirus disease 2019 outcomes: A systematic review, meta-analysis, and meta-regression. Epilepsy Behav. 2021;125:108437. doi: 10.1016/j.yebeh.2021.108437. PMID: 34839246
19. Sanchez-Larsen A, Conde-Blanco E, Viloria-Alebesque A, Sánchez-Vizcaíno Buendía C, Espinosa Oltra T, Alvarez-Noval A. COVID-19 prevalence and mortality in people with epilepsy: A nation-wide multicenter study. Epilepsy Behav. 2021;125:108379. doi: 10.1016/j.yebeh.2021.108379. PMID: 34731719
20. Horváth RA, Sütő Z, Cséke B, Schranz D, Darnai G, Kovács N, et al. Epilepsy is overrepresented among young people who died from COVID-19: Analysis of nationwide mortality data in Hungary. Seizure. 2022;94:136-141. doi: 10.1016/j.seizure.2021.11.013. PMID: 34906799
21. International League against Epilepsy. COVID-19 vaccines and people with epilepsy. Available at: https://www.ilae.org/patient-care/covid-19-and-epilepsy/covid-19-vaccines-and-people-with-epilepsy. (accessed January 4, 2022).
22. Hippisley-Cox J, Coupland CA, Mehta N, Keogh RH, Diaz-Ordaz K, Khunti K, et al. Risk prediction of covid-19 related death and hospital admission in adults after covid-19 vaccination: national prospective cohort study. BMJ. 2021;374:n2244. doi: 10.1136/bmj.n2244. PMID: 34535466

23. He Y, Bai X, Zhu T, Huang J, Zhang H. What can the neurological manifestations of COVID-19 tell us: A meta-analysis. J Transl Med. 2021;19(1):363. doi: 10.1186/s12967-021-03039-2. PMID: 34425827
24. Asadi-Pooya AA, Simani L, Shahisavandi M, Barzegar Z. COVID-19, de novo seizures, and epilepsy: a systematic review. Neurol Sci. 2021;42(2):415-431. doi: 10.1007/s10072-020-04932-2. PMID: 33237493
25. Asadi-Pooya AA, Kouhanjani MF, Nemati H, Emami A, Javanmardi F. A follow-up study of patients with COVID-19 presenting with seizures. Epilepsy Behav. 2021;122:108207. doi: 10.1016/j.yebeh.2021.108207. PMID: 34273743
26. Kubota T, Gajera PK, Kuroda N. Meta-analysis of EEG findings in patients with COVID-19. Epilepsy Behav. 2021;115:107682. doi: 10.1016/j.yebeh.2020.107682. PMID: 33342709
27. Dono F, Nucera B, Lanzone J, Evangelista G, Rinaldi F, Speranza R, et al. Status epilepticus and COVID-19: A systematic review. Epilepsy Behav. 2021;118:107887. doi: 10.1016/j.yebeh.2021.107887. PMID: 33743344
28. Albert DVF, Das RR, Acharya JN, Lee JW, Pollard JR, Punia V, et al. The Impact of COVID-19 on Epilepsy Care: A Survey of the American Epilepsy Society Membership. Epilepsy Curr. 2020;20(5):316-324. doi: 10.1177/1535759720956994. PMID: 32942901
29. Granata T, Bisulli F, Arzimanoglou A, Rocamora R. Did the COVID-19 pandemic silence the needs of people with epilepsy? Epileptic Disord. 2020;22(4):439-442. doi: 10.1684/epd.2020.1175. PMID: 32759092
30. Kuroda N, Kubota T. Psychological impact of the COVID-19 pandemic for patients with epilepsy: A systematic review and meta-analysis. Epilepsy Behav. 2021;124:108340. doi: 10.1016/j.yebeh.2021.108340. PMID: 34600283
31. Kissani N, Lengané YTM, Patterson V, et al. Telemedicine in epilepsy: How can we improve care, teaching, and awareness? Epilepsy Behav 2020;103(Pt A):106854. doi: 10.1016/j.yebeh.2019.106854.
32. Wang Z, Gu H. A review of telemedicine in China. J Telemed Telecare 2009;15:23-27
33. Picot J. Telemedicine and Telehealth in Canada: forty years of change in the use of information and communications technologies in a publicly administered health care system. Telemedicine Journal 1996;4:199-205
34. Demaerschalk BM, Miley ML, Kiernan TJ et al Stroke Telemedicine. Mayo Clin Proc. 2009;84(1):53-64.

35. Fortini S, Espeche A, Caraballo R. Telemedicine and epilepsy: A patient satisfaction survey of a pediatric remote care program. Epilepsy Research 2020; 165: 106370
36. Gali K. Joshi S, Hueneke S et al Barriers, access and management of paediatric epilepsy with telehealth. J Telemed Telecare 2022 Apr; 28(3):213-223..
37. Reilly C, Muggeridge A, Cross JH. The perceived impact of COVID-19 and associated restrictions on young people with epilepsy in the UK: young people and caregiver survey Seizure 2021;85:111-114
38. Thorpe J, Ashby S, Hallab A, et al.Evaluating risk to people with epilepsy during the COVID-19 pandemic: Preliminary findings from the COV-E study. Epilepsy Behav. 2021 Feb;115:107658.
39. Cross JH, Kwon CS, Asadi-Pooya AA, et al, on behalf of the ILAE Task Forces on COVID-19 and Telemedicine. Epilepsy care during the COVID-19 pandemic. Epilepsia. 2021;62:2322-2332.
40. International League against Epilepsy. Telemedicine in patients with epilepsy. What to ask for? https://www.ilae.org/files/dmfile/Telemedicine-in-PWE-2020-0925.pdf
41. Kossoff EH, Turner Z, Adams J et al Ketogenic diet therapy provision in the COVID-19 pandemic: Dual-center experience and recommendations. Epilepsy & Behavior 220;111:107181.
42. Semprino M, Fasulo L, Fortini S, et al. Telemedicine, drug resistant epilepsy and ketogenic dietary therapies: a patient survey of a peditric remote care program during the COVID-19 pandemic. Epilepsy & Behavior 2020;112: 107493.
43. Kubota T, Kuroda N, Horinouchi T, et al Barriers to telemedicine among physicians in epilepsy care during COVID-19 pandemic: a national level cross-sectional survey in Japan. Epilepsy & Behavior 2022;126:108487.
44. Conde-Blanco E, Centeno M, Tio E, et al. Emergency implementation of telemedicine for epilepsy in Spain: Results of a survey during SARS-CoV-2 pandemic. Epilepsy & Behavior 2020;111: 107211.
45. United Nations General Assembly. Oral revisions of May 30, 2016. https://www.article19.org/data/files/Internet_Statement_Adopted.pdf accessed 21st February 2022.
46. United Nations. United Nation General Secretary Roadmap for Digital Cooperation. https://www.un.org/en/content/digital-cooperation-roadmap/ accessed 21st February 2022.

MULTIPLE CHOICE QUESTIONS

1) **What are the potential consequences of failure to access antiseizure medications in people with epilepsy?**
    1) Loss of seizure control
    2) Status epilepticus
    3) Death
    4) All of the above

Answer: 4

2) **What circumstances may affect access to healthcare significantly?**
    1) Wars
    2) Indiscriminate international economic sanctions
    3) Natural disasters
    4) All of the above

Answer: 4

3) What is a helpful mitigation procedure in permitting access to healthcare during difficult times?
    1) Telemedicine
    2) Having stockpile of drugs
    3) Establishing mental health services
    4) All of the above

Answer: 4