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.

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Letter to the Editor

Estimated effect of COVID-19 vaccine in people with epilepsy

To the editor,

Coronavirus disease 2019 (COVID-19) is a novel infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This disease represents one of the most significant pandemics in human history [1]. Vaccine has recently been developed [2–4] and is being administered in some countries, but its widespread use is not yet sufficient. The distribution strategy should consider estimated effects of the vaccine. Herein, we assess the estimated effect of the COVID-19 vaccine in patients with epilepsy.

First, we modeled the number needed to vaccinate (NNV) to prevent one COVID-19-related death in patients with epilepsy.

To calculate NNV in the general population [5]:

$$NNV = 1/(R * D * E)$$

R: Risk of catching and dying from COVID-19 in a given period
D: Observation duration
E: Magnitude of reduction in mortality rate from COVID-19 due to COVID-19 vaccine

We can estimate the vaccine efficacy to prevent death from COVID-19 when:

$$E = 1 - [(1 - EO) * (1 - ES)]$$

EO: Magnitude of reduction in transmission rate of COVID-19 due to COVID-19 vaccine
ES: Magnitude of reduction in rate of severe outcomes of patients with COVID-19 due to COVID-19 vaccine

In a randomized control trial, a COVID-19 vaccine was reported to have 95% protection against COVID-19 and 89% reduction in severe COVID-19 occurrence [2]. Therefore, we calculated E = 0.9945 (99.45%). Regarding D, we set 90 days, as the original vaccine study reported efficacy for 90 days following the 2nd dose of vaccine [2]. In people with epilepsy, the risk of catching and dying from COVID-19 (within 90 days of COVID-19 infection) was calculated using QCOVID (https://qcovid.org/; Copyright © 2020, University of Oxford) [6]. Based on this NNV model, we created several scenarios, as shown in Table 1.

As Table 1 shows, NNV varies widely among patients with epilepsy, depending on individual risk and other medical conditions. It is worth noting that NNV is much lower in older patients with epilepsy and no other comorbidities (NNV = 137) than in younger patients with epilepsy and other characteristics, such as Down's syndrome, nursing home, use of immunosuppressive drugs, asthma, and severe mental illness (NNV = 961). This result suggests that age is a significant factor for mortality in COVID-19.

This model had some limitations. First, it did not consider genetic disorders specific to epilepsy (i.e., tuberous sclerosis complex). The severity of epilepsy also affected the prognosis of COVID-19 [7]. Second, we used the catching and death rate from COVID-19 based on the database of England [6]; however, the infection rates differed greatly by region/community [5]. Third, we should note that the absolute risks presented, however, will change over time in line with the prevailing SARS-C0V-2 infection rate and the extent of compliance with infection prevention policies, such as social distancing. This is discussed as a limitation in the article of QCOVID [6]. Forth, this model did not consider the impact of the vaccine's side effects. Finally, in the field of epilepsy, where there are many pediatric patients, the fact that the vaccine was not currently approved for use in children under the age of 16 was another limitation [2–4].

In conclusion, we have discussed the importance of estimating the effect of the COVID-19 vaccine on people with epilepsy to maximize the effect of the vaccine in the field of epilepsy.

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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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Table 1
The number needed to vaccinate (NNV) based on each scenario.

People/patients scenarios	Risk of COVID-19 (mortality rate)	NNV
age = 40, male, BMI = 22, White	0.0016%	62845.7
age = 40, male, BMI = 22, Black African	0.0048%	20948.6
age = 40, male, BMI = 22, Black African, epilepsy	0.0078%	12891.4
age = 80, male, BMI = 22, Black African, epilepsy	0.7329%	137.2
age = 80, male, BMI = 22, Black African, epilepsy, stroke, nursing home, DM-2	5.5248%	18.2
age = 80, male, BMI = 28, Black African, epilepsy, stroke, nursing home, DM-2[*1], CKD-3[*2], dementia, heart failure, prior bone fracture[*3]	33.7175%	3.0
age = 19, female, BMI = 22, White	0.0003%	335176.8
age = 19, female, BMI = 22, Black African	0.0005%	201106.1
age = 19, female, BMI = 22, Black African, epilepsy	0.0008%	125691.3
age = 19, female, BMI = 22, Black African, epilepsy, learning disability excluding Downs syndrome	0.0011%	91411.9
age = 19, female, BMI = 28, Black African, epilepsy, Downs syndrome, nursing home, immunosuppressants[*4], asthma, severe mental illness	0.1046%	961.3

BMI: body mass index.
COVID-19: coronavirus disease 2019.
NNV: number needed to vaccinate.
[*1] : Diabetes mellitus type 2.
[*2] : Stage 3 chronic kidney disease.
[*3] : Prior hip, wrist, spine, or humerus fracture.
[*4] : Been prescribed immunosuppressants by a general physician in the last six months.

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