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Letter to the Editor

COVID-19 in patients with neurological disorders

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Corona Virus Disease 2019 (COVID-19) pandemic caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) posed an unprecedented challenge to healthcare communities worldwide. While emerging evidence suggests several neurological complications from COVID-19, it remains unclear if patients with neurological disorders are more vulnerable to COVID-19 (www.cdc.gov/coronavirus; Nalleballe et al., 2020).

De-identified data on COVID-19 in patients with neurological disorder (stroke, epilepsy, movement disorders, neuromuscular disorders, multiple sclerosis (MS), neurodegenerative disorders (dementia), headaches, and sleep disorders) were extracted from TriNetX (www.trinetx.com) "COVID-19 Research Network" on July 4th' 2020 using ICD-10 codes (Appendix 1). TriNetX is a large global health collaborative clinical research platform collecting real-time electronic medical records data related to COVID-19 from a network of healthcare organizations, which is also being used by the Food & Drug Administration (FDA) Sentinel Operations Center at the Harvard Pilgrim Health Care Institute (https://www.fda.gov/safet, 2020). TriNetX does not allow data downloads or individual patient data for review, but queries can be made through an internet browser in real-time (Nalleballe et al., 2020). At the University of Arkansas, TriNetX is managed and maintained by the Arkansas Clinical Data Repository (AR-CDR) and the Department of Biomedical Informatics.

A matched control cohort, without a known neurological disorder, who were diagnosed with COVID-19 after January 20th, 2020, was used for comparisons. One-to-one propensity score matching was done for baseline characteristics and other comorbid conditions. The University of Arkansas Institutional Review Board (IRB) deemed this study to be 'not human subject research' (de-identified data) and gave an exempt status (appendix 1).

16,301/6,709,355 (0.24%) patients with neurological disorders developed COVID-19 (appendix 2**).** After 1:1 propensity matching, 13,166 patients were included each in the study and the control cohort. Patients with pre-existing neurological disorders who developed COVID-19 were more likely to be hospitalized (Odds ratio (OR) 1.28, CI 1.19–1.39), admitted to ICU (OR 1.29, CI 1.14–1.96), get intubated (OR 1.67, CI 1.43–1.96), and had higher mortality (OR 1.15, CI 1.03–1.28) (Table 1).

Among the subgroups, patients with previous strokes had higher ICU admission rate, patients with neuromuscular and sleep disorders had higher risk of intubation, and patients with neurodegenerative disorders (dementia) had higher risk of mortality (Table 1). Clinical outcomes of COVID-19 in patients with headaches, multiple sclerosis, and movement disorders were similar to matching controls.

Clinical outcome of COVID-19 varied between different neurological disorders. Patients with neuromuscular disorders can have respiratory symptoms, and about 45% of patients with sleep disorders have obstructive sleep apnea, and they were more likely to be intubated, which is consistent with previous reports (Feuth et al., 2020). Center for Disease Control and Prevention (CDC) suggested that dementia is possibly a risk factor for COVID-19, and we noted higher hospitalization and mortality from COVID-19 in patients with dementia/neurodegenerative disorders (www.cdc.gov/coronavirus). Living in nursing homes, inability to properly adhere to healthcare policies, and advanced directives with do not resuscitate order may have led to increased death in this cohort (Wang et al., 2020).

In this study, we could not assess the disease severity of COVID-19, and results are based on reported data. Despite limitations, this study showed that patients with some neurological conditions, particularly dementia, are possibly more vulnerable to COVID-19.

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Table 1
COVID-19 in patients with different neurological disorders.

	Demographic data			Odds Ratio of clinical outcomes			
	COVID-19	Age (mean ± SD)	Women n (%)	Hospita-lization	ICU care	Intubation	Death
Any neurological disorders (6,709,355)	13,116 (0.19%)	54.6 ± 18.6	7661 (58.4%)	**1.28** (1.19–1.39)	**1.29** (1.14–1.46)	**1.67** (1.43–1.96)	**1.15** (1.03–1.28)
Stroke (7,62,141)	2194 (0.28%)	68.7 ± 15.2	1098 (50%)	**1.7** (1.47–1.98)	**1.61** (1.28–2.01)	1.24 (0.92–1.68)	1.12 (0.96–1.39)
Epilepsy (5,52,506)	1283 (0.23%)	57.2 ± 18.6	648 (50.5%)	**1.44** (1.68–1.77)	1.13 (0.83–1.55)	1.25 (0.86–1.89)	1.18 (0.881–1.57)
Movement dis-order (6,49,277)	1703 (0.26%)	64.4 ± 19.1	973 (57.1%)	1.09 (0.92–1.34)	0.99 (0.72–1.35)	0.79 (0.51–1.16)	1.02 (0.81–1.29)
Neuromuscular (5,52,506)	3627 (0.26%)	58.9 ± 16.2	2190 (60.4%)	**1.24** (1.09–1.39)	1.1 (0.91–1.33)	**1.88** (1.49–2.37)	0.86 (0.71–1.05)
Multiple Sclerosis (1,50,862)	321 (0.21%)	53.6 ± 15.8	219 (68.2%)	1.27 (0.81–1.98)	1.14 (0.56–2.33)	1.21 (0.51–2.84)	0.93 (0.44–1.96)
Neurodegenerative disorders (4,11,407)	1462 (0.35%)	75.7 ± 15.1	815 (66.75%)	**2.14** (1.77–2.59)	1.25 (0.92–1.69)	1.44 (0.93–2.24)	**1.45** (1.18–1.78)
Headache (4,11,407)	6215 (0.24%)	47.4 ± 16.1	4706 (75.72%)	1.07 (0.95–1.19)	0.84 (0.69–1.02)	0.8 (0.67–1.04)	0.58 (0.46–0.74)
Sleep (2,661,220)	7220 (0.29%)	55.8 ± 16.5	4000 (55.4%)	**1.11** (1.01–1.22)	**1.18** (1.01–1.37)	**1.45** (1.19–1.76)	0.92 (0.8–1.07)

Table 1. Baseline demographics and clinical outcome of patients with different neurological disorders with COVID-19.
[Total number of patients in each type of neurological disorders are shown within parenthesis. Total number patients with COVID-19 in individual types of neurological disorders, based on this table, is greater than 16,301 (the total number of patients with neurological disorder who developed COVID-19), as some patient had more than one neurological disorder. However, propensity matching was done for each group separately.
For the Odds ratios, 95% confidence intervals are shown within parenthesis, SD- Standard Deviation, ICU- Intensive Care Unit].

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Declaration of competing interests

Drs. Onteddu, Nalleballe, Siddamreddy, Jasti, Kovvuru, and Dandu have no conflicts of interest to report.

Dr. Roy reports no conflicts directly related to this work. He has served as a consultant for Alexion Pharmaceuticals.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bbih.2020.100131.

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