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LETTER

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Epileptic discharges in acutely ill patients investigated for SARS-CoV-2/COVID-19 and the absence of evidence

Galanopoulou and coauthors reported that epileptogenic discharges (ED) were frequent in COVID-19 patients with encephalopathy or possible seizures.[1] They found that ED were more prevalent in COVID-19 patients (9/22, 41%) than in patients whose COVID-19 test was negative (1/6, 17%; $P = .37$; Fisher's exact t-test). They rightly concluded that more information was necessary to test whether COVID-19 infection increases the risk of epileptiform abnormalities.

We can learn from small observations and two groups not prespecified but generated during data collection. Is this nonsignificant result evidence of no difference, or only absence of evidence (we need more data)? The Bayes rule can give more insight since it can quantify the uncertainty of a nonsignificant *P*-value.

We have no prior information of EEG abnormalities in COVID-19, but we know that encephalopathic patients in general can have ED because of other confounders (hypoxemia, organ failure). Therefore, the probability of no difference between both groups (null hypothesis) is at least 50%. If there is a difference, each group shares the same chance (25%, H_1, the alternative hypothesis). Based on the summary data in the article, we ran a binomial test in JASP, a powerful yet easy-to-use open-source software with classical and Bayesian capabilities.[2] The Bayes factor for the COVID-19 + group was 1.35 (Table 1), a posterior median of 0.50 (from a prior median of zero), 95% credible interval (95% CrI): −0.89 to 1.88). The low BF_{10} and the wide 95% CrI show that the nonsignificant p-value is due to the need for more information, not to a lack of effect or association (Figure 1).

This example showcases what is happening with the COVID-19 pandemic at all levels. It is a Bayesian paradigm: We learn more as we collect more data. Our knowledge evolves from complete ignorance to a full understanding of biologic phenomena by processing incoming information.

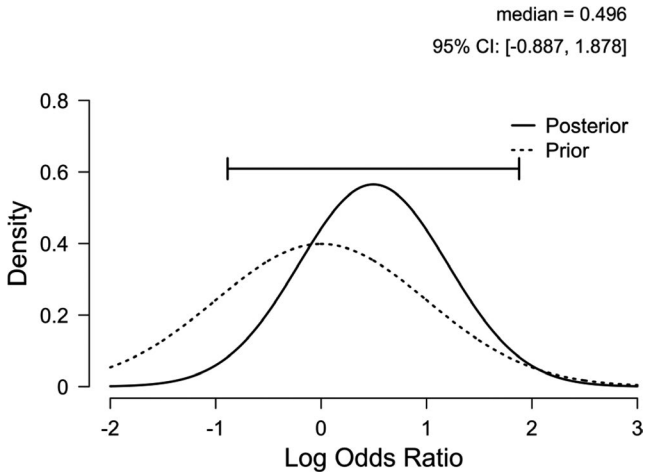

FIGURE 1 Prior-posterior distribution plot. The prior median (before seeing the data) shifted rightward from zero to 0.50 after data input. The horizontal line above distribution curves is the 95% credible interval of the posterior median. The weak effect was related to the small number of COVID- patients in the series

CONFLICT OF INTEREST

No conflict of interest by any of the authors. We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

TABLE 1 Bayesian A/B Test of ED between COVID + and COVID- patients

Models	P(M)	P(M|data)	BF_{10}
Log odds ratio = 0	0.50	0.53	1.00
Log odds ratio > 0	0.25	0.36	1.35
Log odds ratio < 0	0.25	0.11	0.43

Abbreviations: BF_{10}, Bayes factor of COVID+/COVID- groups; ED, epileptogenic discharges; *P*(M), prior probability; *P*(M|data), change in probability after data.

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REFERENCES

1. Galanopoulou AS, Ferastraoaru V, Correa DJ, Cherian K, Duberstein S, Gursky J, et al. EEG findings in acutely ill patients investigated for SARS-CoV-2/COVID-19: a small case series preliminary report. Epilepsia Open. 2020;5(2):314–24.
2. The JASP Team. JASP. Amsterdam: University of Amsterdam; 2020 v. 0.13.