# The Use of Bayes Factor for Contrasting Statistical Hypotheses in the Health Sciences

**Dear Editor,**

In volume 39, number 3 of this journal, an important article was published evaluating the comparison of the statistical means of the Student t-test according to the classical paradigm (also called frequentist) in 241 adults (1). It was estimated a statistically significant difference according to age in two groups, in favor of patients with an Alzheimer's diagnosis (N=132) in comparison with the control group (N=109). The present letter aims to present a reanalysis of the Bayes factor (2) from the value of the t-test (5,019) and the respective sampling data (1).

The Bayes factor method is the probability of the data under one hypothesis concerning the other (null hypothesis vs. alternative hypothesis) (2, 3). This means that the Bayes factor estimates the quantification of the degree of evidence in which the data support both the null hypothesis and the alternative hypothesis for its contrast (2, 3). This method provides additional information beyond the dichotomous interpretation of the rejection or acceptance of the null hypothesis, whose interpretation is based on the Jefreys (4) classification scheme of values: weak, moderate, strong, very strong, and extreme as shown in table 1.

**Table 1**. Quantifiable interpretation values of the Bayes factor

| >100 | Extreme | Alternative hypothesis |
|---|---|---|
| 30+100 | Very strong | Alternative hypothesis |
| 10+30 | Strong | Alternative hypothesis |
| 3.1-10 | Moderate | Alternative hypothesis |
| 1.1-3 | Weak | Alternative hypothesis |
| 1 | 0 | No evidence |
| 0.3-0,9 | Weak | Null hypothesis |
| 0.29-0.1 | Moderate | Null hypothesis |
| 0.09-0.03 | Strong | Null hypothesis |
| 0.03-0.01 | Very strong | Null hypothesis |
| <0.01 | Extreme | Null hypothesis |

Note: Self-creation based on Jeffreys rating scale (4).

The Bayes factor considers two interpretations which are the following: $BF_{10}$ (in favor of the significant alternative hypothesis) and $BF_{01}$ (in favor of the null hypothesis), with a 95% credibility interval (5). The results obtained for the Bayes factor showed: $BF_{10}$ = 314000, $BF_{01}$ = 7,47e-05 and 95% CI [0,250 – 0,605], with respect to the tests for comparison of means (t Student) of age in the two groups of study. Bayesian inference refers to extreme evidence in favor of the alternative statistical hypothesis of mean differences. These findings support the results reported by Erdal et al. (1).

Also, the maximum Bayes factor parameters ($maxBF_{10}$ = 13532) are reported to determine the stability of the results, whose higher values strengthen the precision of the Bayesian reassessment estimates.

Bayes factor is very useful in other statistical analyses and reanalyses that are based on evidence of significance in clinical investigations (6, 7). This methodological alternative is more appropriate for future articles with small sample sizes, whose estimates have limited statistical power (lower probability of rejecting the null hypothesis when it is false and higher prevalence of obtaining false positives) (8). Therefore, the guidelines for interpreting the values estimated according to the significance tests may be controversial; moreover, these criteria vary among the different fields and subdisciplines of the health sciences due to the type of research, the specific measures used, and the populations of interest (8,9).

In conclusion, Bayesian inference is essential to specify the degree of probative force of statistical hypotheses beyond the aforementioned frameworks, and allows important clinical decisions to be made based on the results obtained on the health of patients in future biomedical experimental studies, clinical trials, etc.

## References


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**Cristian Antony Ramos-Vera, BS**
Research area. Faculty of Health Sciences. Cesar Vallejo University. Lima. Perú. 640 Del Parque Avenue, San Juan de Lurigancho 15434. Lima. Perú. Email: cristony_777@hotmail.com

# Assessment of COVID-19 Vaccination Practices: Correspondence

**Dear Editor,**

We would like to share ideas on the publication "Assessment of COVID-19 Vaccination Practices for 16 Vaccination Providers in Puerto Rico, 2021 (1)." Sánchez-González et al. noted that "o major deficiencies that could jeopardize vaccine viability or patient safety were found. The use of a supportive evaluation tool during assessment visits is helpful to determine needs for vaccine providers retraining and to continue the safe administration of COVID-19 vaccines in Puerto Rico (1)." We agree that it is necessary to have a monitoring on the COVID-19 vaccination practice. During COVID-19 vaccination, adverse problem due to poor vaccination practice is possible and it is important to have preventive actions. For the present study, assessment visit might be a preliminary tool. However, how to have a closely continuous monitoring is a challenge. The incidence of problematic vaccination might be low and it might require a large group study and long -time monitoring (2). Finally, only assessment visit might not sufficient. The exact proficiency test should also be considered.

## References

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**Rujittika Mungmunpuntipantip**,
Private Academic Consultant, Bangkok Thailand,
Email: rujittika@gmail.com;
**Viroj Wiwanitkit**,
Honorary professor, Dr DY Patil University, Pune, India