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Normality Assumption in Health Sciences Research: What Is the Strongest Test? How to Calculate It?

Supuesto de normalidad en la investigación de ciencias de la salud: ¿Cuál es la prueba más potente? ¿Cómo calcular?

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Dear Editor-in-Chief,

Researchers, professionals, and students in training in the health and social sciences fields need to make decisions based on sound scientific evidence. Generally, public mental health policies are based on the strength and robustness of scientific findings. A critical aspect of research at the methodological level has to do with statistical analyses.

Often, to test hypotheses from a frequentist model approach, many of the performed analyses are conditioned on the assumption of normality of the data distribution. Therefore, the objective of this commentary is to propose an alternative test, with higher statistical power. Likewise, after a brief review of the literature, we make suggestions to students and junior researchers which may prove useful tools for their work (see figure 1).

It has been suggested that for sample sizes >50 , the Kolmogorov-Smirnov test (K-S) is recommended; alternatively, for $n < 50$, Shapiro-Wilk is preferred. These ideas have generally been widely spread through the use of computer statistical packages (e.g., SPSS). However, computer simulations with different sample sizes call for a reconsideration of this belief. Which test has more power? What does the evidence say?

Study	SH	KS	LF	AD	BS	DA
Ghasemi & Zahediasl ¹			-	-	-	-
Mohd & Bee ²					-	-
Patrício et al., ³			-	-	-	
Ul Islam ⁴			-			-
Yap & Sim ⁵			-		-	

Note: SW= Shapiro-Wilk, KS= Kolmogorv-Smirnov, LF= Lilliefors Anderson-Darling, AD= Anderson-Darling, BS= Bonett-Seier, DA= D'Agostino

Recommendation Level:
 Most powerful
 Moderately poerful
 Least power

Figure 1. Recommendation levels and test comparison to estimate data distribution normality

Studies seem to agree that the most recommended test to validate the assumption of normality is Shapiro-Wilk, while the wide use of the Kolmogorov-Smirnov test should be reconsidered. In conclusion, Shapiro-Wilk seems to be more sensitive in terms of the normality test. However, with small sample sizes, its interpretation must be assumed with caution (1–5).

WHAT SOFTWARE TO USE?

There are different statistical packages available to researchers. For example, from licensed software (e.g., STATA, SPSS), to open access (Jamovi, JASP, Rstudio). To run the Shapiro-Wilk test we recommend JASP®(6). It is a free, flexible, and friendly access software. It is constantly updated and in sync with the R programming language. In addition, for frequentist statistical analyses, it has a main emphasis on Bayesian analysis. Figure 2 shows the estimation of the normality test using Shapiro-Wilk through JASP®.

Steps: 1. Descriptive analysis menu. Descriptive statistics option. 2. Shapiro-Wilk is indicated in the Distribution group 3. Descriptive results and normality test. Note: I have used a database that JASP incorporates by default in the following route (Open – Data Library – Category Descriptives)

Descriptive Statistics	
	extra
Valid	20
Missing	0
Mean	1.540
Std. Deviation	2.018
Shapiro-Wilk	0.946
P-value of Shapiro-Wilk	0.311
Minimum	-1.600
Maximum	5.500

Figure 2. Steps for Shapiro-Wilk Estimation Using JASP®

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