Korean J Fam Med. 2013;34:64-65 http://dx.doi.org/10.4082/kjfm.2013.34.1.64

Comments on Statistical Issues in January 2013

Commentary

Yong Gyu Park

Department of Biostatistics, The Catholic University of Korea College of Medicine, Seoul, Korea

In this section, we explain the normality test, which appeared in the article titled, "Effect of sunlight exposure on serum 25-hydroxyvitamine D concentration in women with vitamin D deficiency: using ambulatory lux meter and sunlight exposure questionnaire," published in September 2012 by Lee et al.[1)]

Normality Test

Normality test is used for testing whether the sample data are randomly obtained from a normally distributed population. One of the main purposes of performing a normality test is to choose the statistical testing methods in data analysis, i.e., if the P-value of the normality test is smaller than 0.05, then we use parametric tests such as Student's t-test, one- or two-way analysis of variance, and linear regression. Otherwise, non-parametric tests such as Wilcoxon rank sum test, Kruskal-Wallis test, and Friedman test are used for analyzing the data.

Although there are many kinds of normality tests, we will confine our consideration only to the Shapiro-Wilk test[2)] and Kolmogorov-Smirnov test.[3)] These two tests are usually distinguished according to the sizes of sample. We use the Shapiro-Wilk test when sample size is small (e.g., less than 30 cases) and the Kolmogorov-Smirnov test is used for a large sample size.

Most medical researchers tend to prefer normality tests to other graphical methods such as histogram, Box plot, and normal probability plot, because these tests provide P-values which are easy to understand, and we can make a definite decision about the distribution of data by using them.

However, all the statistical tests have the common property that the powers of test gradually increase as the sample size increases. Taking this characteristic into consideration, we could confront the following circumstances: when the sample size is very small, we obtain a P-value of the normality test greater than 0.05 in most cases, so we conclude that the data are from a normally distributed population even though it apparently looks like a non-normal distribution. And when the sample size is very large, we frequently obtain a P-value less than 0.05 and conclude that the data are from a non-normally distributed population even though it looks very close to a normal distribution.

To resolve this problem, we should not rely entirely on the results of the normality test but should to recall the central limit theorem which appears in most introductory statistics textbooks as follows: for any population (even a non-normal distribution) with mean μ and standard deviation σ, distribution of the sample mean is approximately normal with mean μ and standard deviation σ/sqrt(n) under the condition that the sample size n is sufficiently large.

Therefore, it is proper to use the normality test only when the sample size is less than 30 and use the non-parametric tests if the P-value is smaller than 0.05. When the sample size is less than 30 and the P-value of the normality test is greater than 0.05, we should not hastily conclude that the data are from a normal population, and carefully decide their distributions after referring to the previous research which used the same response variable. Finally, we do not need to perform the normality test and can use the parametric tests when the sample size is sufficiently large.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Lee SH, Park SJ, Kim KM, Lee DJ, Kim WJ, Park RW, et al. Effect of sunlight exposure on serum 25-hydroxyvitamin D concentration in women with vitamin D deficiency: using ambulatory lux meter and sunlight exposure questionnaire. Korean J Fam Med 2012;33:381-9.
2. Shapiro SS, Wilk MB. An analysis of variance test for normality (complete samples). Biometrika 1965;52:591-611.
3. Afifi AA, Azen SP. Statistical analysis: a computer oriented approach. 2nd ed. New York: Academic Press; 1979.