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Ratio of Coefficients of Variation for Comparing the Dispersions of Several Independent Populations

Abbas Bahrampour[1], Zeynab Avazzadeh[2,] and Mohamad Reza Mahmoudi[3]*

[1]Modeling in Health Research Center, Institute for Futures Studies in Health, Department of Biostatistics and Epidemiology, Faculty of Health, Kerman University of Medical Sciences, Kerman, Iran
[2]Department of Biostatistics and Epidemiology, School of Public Health, Kerman University of Medical Sciences, Kerman, Iran
[3]Department of Statistics, Faculty of Science, Fasa University, Fasa, Iran

Abstract: The coefficient of variation (CV) is an important and useful statistical tool for comparing several populations. In cases where there are multiple populations with different means and variances, the ratio of the coefficients of variation (CVs) is a good way to compare the dispersion of the populations. Because of the possible minor differences between multiple CVs and the lack of a robust interpretation, the ratio of CVs is more accurate than the difference of CVs. When a statistical analysis consists of some simultaneous statistical tests such as equality of several CVs, multiple testing is useful. As an example, the multiple testing about the ratio of CVs is performed to evaluate and compare scale of hand, foot and mouth disease (SHFMD) of 79911 patients between January 2010 and December 2017 in the three Malaysian provinces.

Keywords: Ratio, Coefficient of Variation, HFMD, Test of Hypothesis, Scale of hand, foot and mouth disease(SHFMD), Multiple Testing, Malaysia.

1 Introduction

One of the most typical infectious diseases is hand, foot, and mouth disease (HFMD), which is caused by viruses named category of enteroviruses and the disease's symptoms appear as fever or illness feeling generally. Almost after two days, several smooth spots or even discoloured bumps might blister on the hands, feet and mouth and sometimes groin and buttocks [1]. Normally symptoms become visible after three to six days after exposure by the virus and remove on its own about six-seven days. It is possible fingernails and toenails are lost a few weeks later, but they will regrow by time [2]. The HFMD is specific for human beings and doesn't involve other animals. These viruses are transmitted by close contact person by person. They can be spread by coughing and the faces of an infected people. Normally, specialists diagnose HFMD based on symptoms and occasionally, a throat or stool sample can be helpful to detect the virus [3].

According to the literature, there are three fundamental discriptive criteria whose names are central tendencies, shape tendencies, and dispersion tendencies for a data set. In other words, these three criteria can be used to summarize datasets. One of the well-known tools related to dispersion tendency is the coefficient of variation (CV). CV is obtained by dividing the mean into population's standard deviation, $CV = \sigma/\mu$, and is applicable and suitable statistic which can be benefit to evaluate relative variability. Normally the mentioned statistic is used to compare the dispersion of several groups of data gathered with various units of measurement [4]. CV as a without-dimension parameter is used in diffrent sciences such as agriculture, biology, engineering, finance, medicine, and many others in order to evaluat reliability and variability [5,6,7]. Usually relation between standard deviation and the mean (level of measurement) is vital for researchers. So, it is clear that CV is widely used to evaluate dispersion. Understanding the structure and shape of data is researchers's favorite, therefore, they calculate CVs in order to compare the dispersions of populations. If the means or variances of the two populations are the same, ANOVA and Levens tests can be used to examine the equality of the CVs of populations [8]. In applican, it is possible that researchers need to compare two independent populations's parameters; for instance, proportions [9], means [10], variances [11], correlations [12] and skewnesses [13]. Most comparative tests to date have

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* Corresponding author e-mail: zeynab.evazzadeh@gmail.com