



## **Quantile Regression and its Key Role in Promoting Medical Research**

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**(Received 11 Aug 2015; accepted 05 Sep 2015)**

### **Dear Editor in Chief**

Central and dispersion indices of statistical distribution of a random phenomenon together show the behavior pattern of that phenomenon (1). In healthcare researches, researchers are mainly interested in examining the impact of various factors on the behavior of a random phenomenon. One of the useful tools to achieve this goal is the use of statistical models such as linear regression model. Linear regression model estimates effect of different factors on the mean of a quantitative response variable, which is the variable that we examine effect of other factors on it (2).

Despite great popularity of linear regression model among the healthcare researchers, sometimes due to the lack of their familiarity with its assumptions, the fitting of data is misleading, which in this case, the results of estimating factors will be misleading and away from reality. The main assumptions for using this model are normality of the distribution of the response variable and the absence of outlier observations. If any one of these conditions does not hold, the use of this model is not recommended (3). In these cases, one of the advanced statistical models that can be a good alternative to linear regression is quantile regression model (4, 5).

Quantile regression was introduced in 1978, but because of its high computational complexity was not used for a long time. Today, with advancements made in sciences and with the help of computers, the practical and important nature of this model has attracted the attention of many researchers so that it has been used as a useful tool in recent researches (6-10). Quantile regression model do all the tasks that the linear regression do as well, but it has not its restrictions in the use so that the lack of normal distribution of the response variable and presence of the outlier observations do not affect the results obtained from this model. It is because that in this model instead of using the mean of the response variable, which in addition to providing little information about the behavior of the response variable considerably affect from the outlier observations, quantiles of distribution such as middle quantile are used (5). Using the quantile regression models, in addition to resolving limitations of the linear regression model and avoiding the remove of outlier observations, which carries out by some researchers mistakenly, provides results that are more reliable. It suggests to the health care researchers that if they want to use the linear regression models in their researches, first to check for the normality of

their response variable through statistical tests such as the Kolmogorov-Smirnov test, and in the case of the lack of its normality to use quantile regression model. This way, by obtaining results with more accuracy they can take important steps for the advancement of medical sciences and reducing the cost of the healthcare system.

One of the main concerns of the Ministry of Health and Medical Education in Iran and its policy makers is reducing the costs of research and increasing productivity and quality of health system researches. Therefore, it suggests to the managers and authorities of the healthcare system to use further of this model with the hope that it will result in savings and reducing high costs of the health system.

## Acknowledgements

The authors declare that there is no conflict of interests.

## References

1. Casella G, Berger RL (2002). *Statistical inference*. 1<sup>st</sup> ed. Duxbury Pacific Grove. United States of America, pp 40-68.
2. Montgomery DC, Peck EA, Vining GG (2012). *Introduction to linear regression analysis*. John Wiley & Sons. Canada, pp 23-35.
3. Seber GA, Lee AJ (2012). *Linear regression analysis*. John Wiley & Sons.
4. Koenker R (2005). *Quantile regression*. Cambridge university press.
5. Fitzenberger B, Wilke RA (2015). Quantile Regression Methods. *Emerging Trends in the Social and Behavioral Sciences: An Interdisciplinary, Searchable, and Linkable Resource*.
6. Farcomeni A, Viviani S (2015). Longitudinal quantile regression in the presence of informative dropout through longitudinal-survival joint modeling. *Statist Med*, 34:1199-1213.
7. Hulmán A, Witte DR, Kerényi Z, Madarász E, Tanczer T, Bosnyák Z, et al. (2015). Heterogeneous effect of gestational weight gain on birth weight: quantile regression analysis from a population-based screening. *Ann Epidemiol*, 25:133-137.
8. Li C, Dowling NM, Chappell R (2015). Quantile regression with a change-point model for longitudinal data: An application to the study of cognitive changes in preclinical alzheimer's disease. *Biometrics*, 71(3):625-635.
9. Lo T, Parkinson L, Cunich M, Byles J (2015). Factors associated with higher healthcare costs in individuals living with arthritis: evidence from the quantile regression approach. *Expert Rev Pharmacoecon Outcomes Res*, 2015;15(5):833-41.
10. Shen X, Li K, Chen P, Feng R, Liang H, Tong G, et al. (2015). Associations of Blood Pressure With Common Factors Among Left-Behind Farmers in Rural China: A Cross-Sectional Study Using Quantile Regression Analysis. *Medicine*, 94(2):e142.