A Proficient Three-stage Unrelated Randomized Response Model Applying Poisson Distribution Under Probability Proportional to Size Sampling

Chandraketu Singh

School of Sciences, CHRIST (Deemed to be University), Delhi-NCR-201003, India

ABSTRACT

In sample surveys, there are various real problems identified with a gainful interest in various fields of psychiatric, sociological, conservative, and clinical studies in which one needs to collect data on sensitive issues. A large portion of respondents often does not react to the inquiries asked by the questionnaire. In such situations, non-response or missing data related to sensitive issues may cause a biased estimation of unknown population parameters and distract the interpretation of data. Sometimes, we come across the circumstances when study characteristic is sensitive and also falls under the rare category. This study focuses on the issue of estimation of the mean number of people having a rare sensitive attribute presumed to follow Poisson distribution using a three-stage unrelated randomized response model (RRM). We assume that the population contains some different-sized clusters. When the parameter of a rare unrelated attribute is supposed to be known and unknown, the clusters are selected by two sampling schemes: probability proportional to size (pps) sampling and equal probability two-stage sampling. The properties of the suggested estimation procedures are deeply examined. The proposed estimation procedures are found to be highly gainful in terms of percent relative efficiencies over the other discussed procedures. The proposed method is further extended to the case of the stratified population. We have applied stratified probability proportional to size sampling and stratified equal probability two-stage sampling. The properties of the suggested estimation procedures are deeply examined. The proposed estimation procedures are found to be highly efficient in terms of percent relative efficiencies over the other discussed procedures. The results are interpreted, and appropriate recommendations are put forward to the survey practitioners.

Keywords: Randomized response technique; Poisson distribution; Rare sensitive attribute; Rare unrelated attribute.

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