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A revisit to the Singh, Horn, Singh and Mangat's randomization device for estimating a rare sensitive attribute using Poisson distribution

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Abstract. The crux of this paper is to estimate the mean of the number of persons possessing a rare sensitive attribute based on Singh et al. [24] randomization device by utilizing the Poisson distribution in survey sampling. It is also shown that the proposed models are more efficient than Land et al. [6] in both the cases when the proportion of persons possessing a rare unrelated attribute is known and that when it is unknown. Properties of the proposed randomized response model have been studied along with recommendations. Numerical illustrations are also given in support of the present study.

Keywords: Randomized response technique, estimation of proportion, rare sensitive characteristics, relative efficiency

AMS Subject Classification: 62D05.

1. Introduction

Socioeconomic investigations often relate to certain personal features that people wish to hide from others in comprehensive inquiries, detailed questionnaires include numerous items. Data on most of them are frequently easy to procure merely by asking. But a few others may be on sensitive issues for which people are not inclined to state honest responses, for example, most people prefer to conceal the truth regarding their savings, crimes, trade in contraband goods, susceptibility to intoxication, expenditures on addictions of various forms, humus-sexuality, and similar issues which are customarily disapproved by society. Open or direct queries often fail to yield reliable data on such confidential aspects of human life. Non response or false or evasive responses to attempt direct queries about such private matters are so pronounced in practice that it is difficult to measure and control their effects to make an effective use of the acquired data from samples to reach a correct and fair conclusion about populations. So, instead of open surveys, alternative procedures are needed if we are to procure reliable data on such confidential matters, especially the sensitive ones, believed to carry reprehensible stigmas. Randomized response (RR) survey techniques introduced by Warner [26] provide such an alternative to meeting the twin objectives of generating enough reliable data to yield fruitful inference and creating a feeling among respondents that their privacy is protected despite their truthful replies to cleverly designed questions. Since the work by Warner [26], a huge literature has emerged on the use and construction of different randomization devices to estimate the population proportion of a sensitive attribute in survey sampling.

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