Contents lists available at ScienceDirect

## Statistics and Probability Letters

journal homepage: www.elsevier.com/locate/stapro

# A dexterous randomized response model for estimating a rare sensitive attribute using Poisson distribution

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#### ARTICLE INFO

Article history: Received 3 December 2013 Received in revised form 15 January 2014 Accepted 18 March 2014 Available online 26 March 2014

MSC: 62D05

*Keywords:* Randomized response technique Estimation of proportion Rare sensitive characteristics

#### 1. Introduction

The collection of data through personal interview survey on sensitive issues such as induced abortions, drunk driving, use of marijuana, tax evasion, illicit drug use, shop lifting, child abuse, family disturbances, cheating in exams, HIV/AIDS, sexual behavior and family income is a serious issue. Warner (1965) suggested an ingenious method of collecting information on sensitive characters. According to the method, for estimating the population proportion  $\pi_1$  possessing the sensitive character "A", a simple random with replacement sample of *n* persons is drawn from the population. Each interviewee in the sample is furnished an identical randomization device where the outcome "I possess character A" occurs with probability *P* while its complement "I do not possess character A" occurs with probability (1 - *P*). The respondent answers "Yes" if the outcome of the randomization device tallies with his actual status otherwise he/she answers "No". Later several modifications have been made by various authors including Cochran (1977), Fox and Tracy (1986), Mahmood et al. (1998), Mangat (1994), Mangat and Singh (1990), Singh et al. (2003), Singh and Mangat (1996), Tracy and Mangat (1996), Chaudhuri and Mukerjee (1988), Chaudhuri (2011), Ryu et al. (1993), Singh (2003), Mahajan (2005–2006), Mahajan et al. (2007), Ryu et al. (2005–2006), Hong (2005–2006), Javed and Grewal (2005–2006), Grewal et al. (2005–2006), Sidhu and Bansal (2008), Perri (2008), Zaizai et al. (2008), Singh and Tarray (2012, 2013, 2014) and the most recent research in this area is listed in Chaudhuri and Christofides (2013).

Greenberg et al. (1969) provided theoretical framework for a modification to Warner's model proposed by Horvitz et al. (1969). The proposed method consisted in modifying the randomization device where the second outcome "I do not possess the character A" was replaced by the outcome "I possess the character Y" where "Y" was unrelated to character "A". This modified model is now known as 'unrelated question model, or U-model'. This model has been further investigated by

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http://dx.doi.org/10.1016/j.spl.2014.03.019 0167-7152/© 2014 Elsevier B.V. All rights reserved.

#### ABSTRACT

Taking the clue from the pioneer work of Land et al. (2011), we have suggested an unbiased estimator of the mean number of persons possessing the rare sensitive attribute in presence of the known proportion of persons possessing a rare unrelated attribute. The variance expression is derived. The empirical studies performed and graphical representation show that the new model is more efficient than the one recently considered by Land et al. (2011). © 2014 Elsevier B.V. All rights reserved.





