

Two-stage cluster samples with ranked set sampling designs

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Abstract This paper draws statistical inference for population characteristics using two-stage cluster samples. Cluster samples in each stage are constructed using ranked set sample (RSS), probability-proportional-to-size sample, or simple random sample (SRS) designs. Each RSS sampling design is implemented with and without replacement policies. The paper constructs design-unbiased estimators for population mean, total, and their variances. Efficiency improvement of all sampling designs over SRS sampling design is investigated. It is shown that the efficiency of the estimators depends on the intra-cluster correlation coefficient and choice of sampling designs in stage I and II sampling. The paper also constructs an approximate confidence interval for the population mean (total). For a fixed cost, the optimal sample sizes for stage I and stage II samples are constructed by maximizing the information content of the sample. The proposed sampling designs and estimators are applied to California School District Study and Ohio Corn Production Data.

Keywords Intra-cluster correlation coefficient · Adjusted R^2 · Cluster sample · Finite population correction · Without replacement

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