

**Model Based Estimation Of Population Totals Under Two Stage  
Cluster Sampling**

**Christopher Ouma**

**A thesis submitted in fulfilment for the Degree of Doctor of  
Philosophy in Applied Statistics in the Jomo Kenyatta University of  
Agriculture and Technology.**

**2011**

## **ABSTRACT**

We consider a model based approach to statistical inference. In this approach, the main interest is to overcome the problem of robustness under model misspecifications. Earlier researchers constructed bootstrap confidence intervals in model based estimation for finite population totals assuming auxiliary values are available throughout a target population and that the cluster sizes are known throughout the target population. As a follow up, other researchers relooked at the conditions and made extensions to this work.

However, in all cases, earlier research focused on Simple Random Sampling With Replacement, SRSWR, in cases where the auxiliary variables are known for the entire population. We now extend to two stage sampling in which the cluster sizes are known only for the sampled clusters and we therefore predict the unobserved part of the population total.

Our other contribution is that we present a bootstrap approach to inference in two stage cluster sampling with unequal clusters. In this research we apply a general model, in which the auxiliary values are not necessarily independent. We demonstrate that the asymptotic properties of our proposed estimator and its coverage rates are better than those constructed under the model assisted approach.