Finding the Optimal Allocation of Sample Sizes in Dual Frame RDD Telephone Surveys

Haci Akcin, MS, PhD
Mathematical Statistician

Denise Bradford
Biostatistician

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Division of Behavioral Surveillance
Office of Surveillance, Epidemiology, and Laboratory Services
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RDD Phone Surveys

- RDD phone surveys are proven way to collect data for public health research and program evaluation.

- Inclusion of cellphone to traditional landline surveys is one way to correct errors due to frame non-coverage.

- Cellphone usage is increasing.

- Especially, cell phone usage among younger adults and minorities is higher.
The Behavioral Risk Factor Surveillance System (BRFSS) is one of the largest state-based RDD phone surveys in the U.S. Collects information on health conditions and risk behaviors in the U.S. since 1984. Data collected monthly in all 50 states, DC and U.S. territories. Starting from 2011, BRFSS released cellphone + landline combined data.
BRFSS 2011

- Cost of cell phone survey is significantly higher than cost of landline surveys.

- Collecting cell phone survey is vital to overcome non-coverage / under-coverage errors.

- Optimal allocation of samples in dual-frame RDD surveys need to be investigated.
Simulation Study
Simulation Study

- Florida 2011 data. Sample size: Landline=10546, Cellphone=1813
- In 2011, cell phone allocation was 14.66%.
- BRFSS screening questions suggest that there were about 27% cell phone only households in Florida.
- We simulated proportion of cell phone survey to be: 20%, 25%, 27%, 30%, 35%, 40%, 45% and 50%.
Simulation Study

- Each simulated settings were generated 1000 times.

- **We obtained demographic indicators:** Age, Sex, Race, Marital Status, Educational Attainment and Insurance coverage.

- **Health indicators:** Smoking, Obesity, NoLTPA, Diabetes, Cardiovascular Heart Disease, Myocardial Infraction, Stroke.
Simulation Study

- Mean of 1000 simulated replicates reported.

- Let $\widehat{\theta}_i$ be the estimate of variable of interest $\theta$ for $i$th replicate, then

$$\bar{\theta} = \frac{1}{1000} \sum_{i=1}^{1000} \widehat{\theta}_i$$

Relative Bias = \frac{(\bar{\theta} - \theta)}{\theta}
Black – NH

- Cost Increase
- Relative Bias
- Reduction in Rel. Bias

Graph showing the relationship between different metrics and percentage values.
Marital Status – Married
Education – Less than HS
Education – More than HS
Education – More than HS

- Cost Increase
- Relative Bias
- Reduction in Rel. Bias

Graph showing cost increase, relative bias, and reduction in relative bias as a function of a percentage variable from 10.0% to 50.0%. The graph indicates a positive correlation between the percentage and cost increase, relative bias, and reduction in relative bias.
Health Coverage

- Cost Increase
- Relative Bias
- Reduction in Rel. Bias
Health Indicators
Current Smoking
No Physical Activity
Diabetes
Chronic Heart Disease

- Simulated
- % Change from base
Conclusions

- Decision of optimal allocation relies on two components: Cost and Accuracy.

- Demographic variables represented better with increasing cell proportion.
  - Age
  - Race (White-NH, Hispanic)
  - Marital status
  - Health coverage (underestimates if less than 30%, overestimates if greater than 30%)
Conclusions

- Educational attainment did not improve.

- Cut-off point 30% is closer to cell only percentages of 27% for most demographic characteristics.

- Unweighted estimates of health indicators showed changes of 5% to 25%.

- Covering younger and minorities in the target population increased.

- Weighted analysis should be done for health indicators to have better picture.
 Questions??

hakcin@cdc.gov

For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA 30333
Telephone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348
E-mail: cdcinfo@cdc.gov  Web: http://www.cdc.gov

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