The Benefits of an Increased Cell Phone Allocation for Dual-Frame Surveys to Target Low Socioeconomic Persons

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Abstract
Research has shown that the rate of movement to majority cellphone use from partial or complete landline use is not proportional throughout subgroups within the U.S. population (see, e.g., Lu, et al., 2014). These studies have found that young persons with children, minorities, and those with income near the Federal Poverty Level have made the shift more quickly than other demographic groups. Therefore, dual-frame telephone studies such as the Ohio Medicaid Assessment Survey (OMAS), which are interested in examining low socioeconomic status (SES) subpopulations, need to increase the allocation of their sample that come from a cellphone frame. Moreover, even though data collection for cellphone samples generally costs more than landline samples, the increased rate of interviewed sample members from key subpopulations mostly negates the cost-per-complete difference. In 2012, 25% of the OMAS sample was randomly chosen from the cellphone frame. For 2015, the sample allocation was increased to 50%. This paper presents the impact of the increased OMAS sample allocation to the cellphone frame on respondent yield and data collection costs and serves as a guide for similar dual-frame surveys.

Key Words: Cell phone, RDD, dual-frame survey, sample design

1. Introduction

The Ohio Medicaid Assessment Survey (OMAS) is periodic survey with the goal of measuring access to health care (e.g., health insurance rates) and health care needs in the state of Ohio. Given these outcomes of interest, certain subpopulations such as households below 100% of the Federal Poverty Level (FPL), households below 138% of FPL, and households with children which may be highly correlated with lack of access to health care are analytic interest. Therefore, the OMAS sample design needs to ensure a sample size large enough to achieve reasonable precision for these subpopulations.

The 2015 OMAS was a dual-frame random digit dialing (RDD) survey of residents of Ohio resulting in over 40,000 completed interviews roughly allocated 50-50 between the landline frame and the cell frame[1]. The most recent state-level estimates of wireless substitution from NCHS showed that in the state of Ohio 45.8% of adults 18 and over live in wireless-only households and an additional 15.4% of adults live in wireless-mostly households (Blumberg et al., 2016). For children under age 18 those numbers climb to 54.4% in wireless-only households with an additional 17.0% in wireless-mostly households.

A random sample of the state would be expected to have the demographic distribution of the state but both frames are known to be skewed demographically (Lu et al., 2014) (see **Figure 1**). Landline respondents are more likely to be older, less likely to have children in the household, and less likely to be minorities. Cell phone respondents are more likely to be young, more likely to have children in the household, and more likely to be minorities.

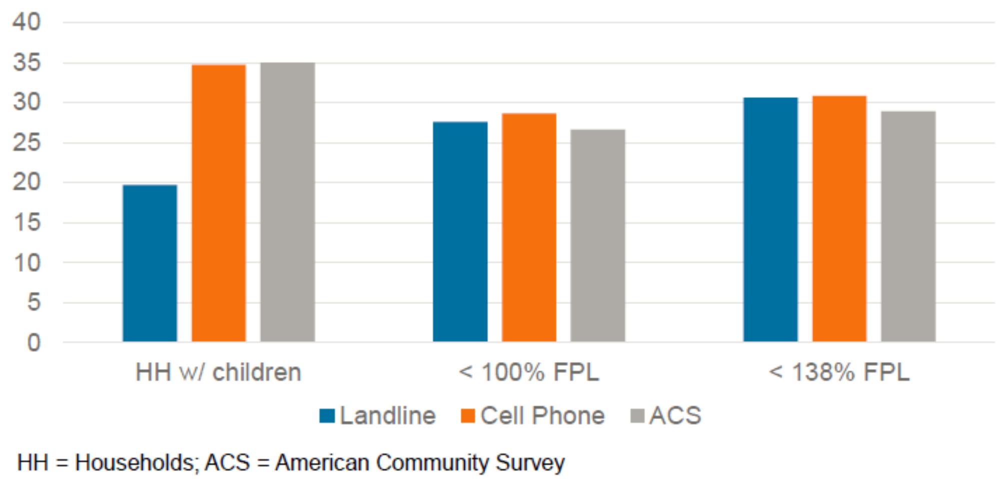

Figure 1. Proportion of population found on landline frame and cell phone frame

1.1 Research Question

As shown in **Figure 2**, households with children are more prevalent on the cell phone frame but there does not appear to be any differences in households below key FPL cutoffs. Insurance status is a key outcome for OMAS. Because all adults aged 65 years and older have access to Medicare precise estimates for insurance status are more important for adults between aged 19 and 65 years and for children.

[1] This was an increase in the allocation to the cellphone frame from 25% in 2012 – when the most recent previous iteration of OMAS was conducted.

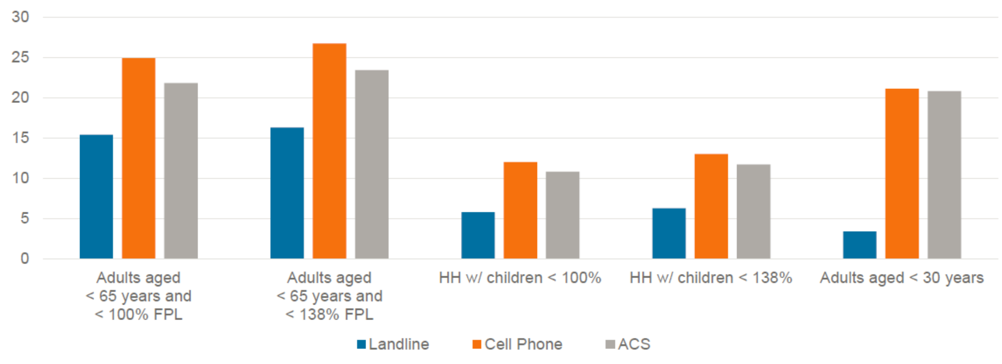

Figure 2. Proportion of population found in ACS, landline frame, and cell phone frame by key characteristics

Breaking out the distributions by frame type for adults aged 65 years and younger and children we see that there is a large difference in the proportion of those subpopulations on the landline frame and on the cell frame. We wanted to examine whether the prevalence of key demographic subgroups differs between the landline frame and the cell frame and if so, what is the impact on cost for increasing the proportion of the sample that comes from the cell frame to greater than 50%.

2. Study Methods

2.1 Design simulation

For a total sample of 50,000 adult interviews allocated 50/50 between the landline frame and cell frame we would expect to obtain (note that these are not mutually exclusive):

- 10,750 adults aged 30 years and under who are in households < 138% FPL and
- 7,313 interviews from households with children below 138% FPL.

To make precise estimates for these subpopulations, we want to oversample them. To maintain the desired distribution between landline and cell completes this requires walking away from potential interviews on the frame with a higher prevalence of the characteristic of interest.

We examined both a 25% oversample and 50% oversample for these key subpopulations. With the current rates of cell-only and cell-mostly usage a general population study design with fewer than 50% of the sample from the cell frame may be too skewed towards landline respondent characteristics (though we include a 75% landline to 25% cell design here anyway). The five design allocations examined (proportion of landline and cell phone): 75-25, 50-50, 25-75, 10-90, and 0-100.

2.1.1 Walk-away cost

We computed the cost of walking away from potential interviews as

$$TotalCost = C_L \times I_L + C_C \times I_C + E_S = C_L \times I_L + C_L \times R_{LC} \times I_C + E_S$$

Where

- C_L is the cost per complete for a landline interview

- I_L is the number of completes from the landline frame
- C_C is the cost per complete for a cell phone interview
- I_C is the number of completes from the cell phone frame
- E_S is the extra cost needed for screening out respondents to maintain the total number of interviews while achieving subpopulation targets
- R_{LC} is the ratio of landline to cell phone cost per complete

We added additional cost when the design fell short of subpopulation targets in order to account for screening out of other populations (e.g., adults over age 65) to not exceed the total desired number of completed interviews. The cost ratios displayed are in comparison to the 50-50 design (shown with a cost ratio of 1).

For example, if we wanted to obtain 14,625 interviews from adults under age 65 who live in households at less than 138% FPL (a 25% oversample) and maintain a 50/50 split between frames, we would need to walk away from nearly 20,000 potential adult interviews from the landline frame and over 2,000 potential adult interviews on the cell frame.

For each of the five designs, we set a fixed number of interviews needed from the key subpopulations. Then, we estimated the total number of screened, eligible cases we would need. And then we computed the number of screened, eligible cases we would have to walk away from to maintain the allocation between frames and hit the oversample target for the subpopulation.

3. Results

The 25% oversample cost ratios and 50% oversample cost ratios are shown in **Figures 3** and **Figure 4** below, respectively.

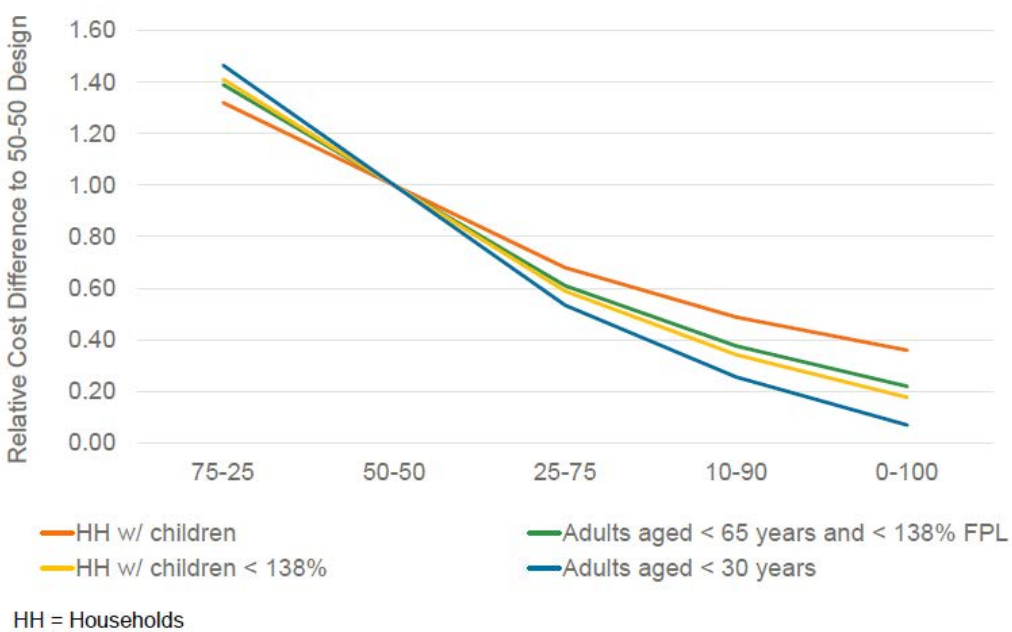

Figure 3: Cost ratios for 25% oversample of key subpopulations

We found that increasing the allocation to the cell frame had the most impact on the cost for attaining respondents under age 30 years. Adults aged 30 years and under are 20.8% of the population in Ohio according to the ACS but were only 3.4% of landline respondents. Moving to a 25% landline and 75% cell allocation reduced the cost for this subpopulation to 53% of the cost of the cost of the 50-50 design.

With a 25% oversample of adults and children in households under 138% FPL moving to a 25/75 landline to cellphone allocation reduced the total cost to 60% of the 50-50 landline to cellphone design.

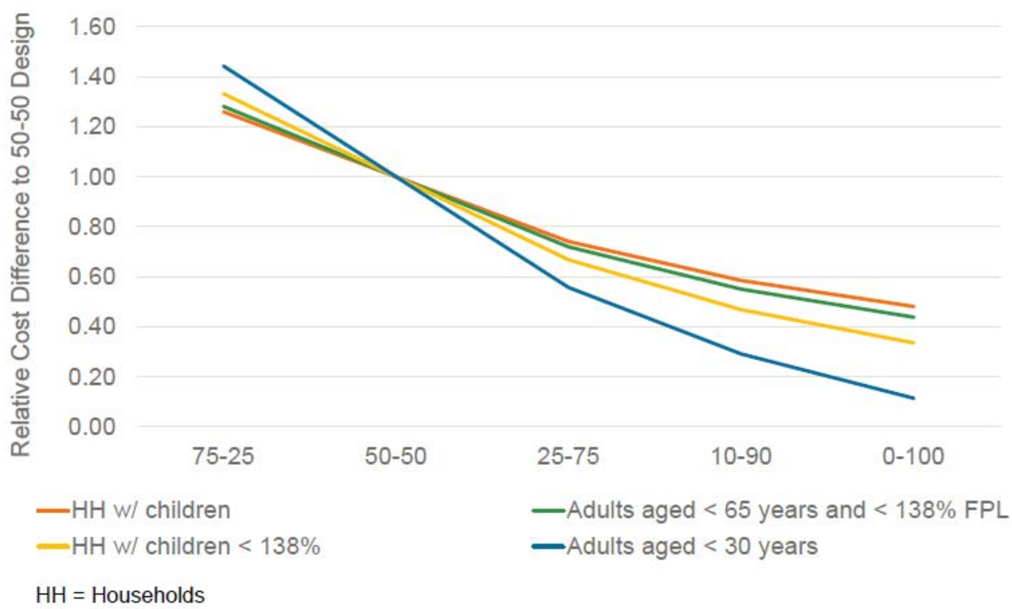

Figure 4: Cost ratios for 50% oversample of key subpopulations

4. Conclusions

Because landline and cell phone costs have gotten closer the cost associated with having a proportion of the RDD sample allocated to the cell frame that mirrors phone usage in the population is not as much of a concern. We found that increasing the allocation to the cell frame beyond 50% is very beneficial for households with children and households with adults < 65 that are < 138% of FPL, a key cut-off for determining Medicaid eligibility.

Increasing the proportion allocated to the cell frame to more than 75% can provide additional cost savings; however, the impact on variance should also be examined. Differential weights between landline completes and cell completes could inflate the variances for key estimates such that additional nominal completes would outweigh cost-savings.

References

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