Can Post-Stratification Adjustments Correct Bias in Traditional RDD Estimates?

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The Problem

- Erosion of sample coverage in traditional landline RDD (TL-RDD) surveys due to rise in cell phone only households (CPOH)
- Conducting CPOH surveys is…
  - Expensive
    - Many states cannot afford
  - Complex
    - Merging CPOH and TL-RDD data to produce a single estimate is not straightforward

Research question

- Can post-stratification adjustments reduce bias associated with not sampling CPOH in TL-RDD health surveys?

- Goal of post-stratification:
  - to adjust the publicly available NHIS person weights so when applied to non-CPOH observations they produce outcome estimates that approximate those obtained from the original weights and the total NHIS sample

Methods

- Data:
  - 2007 NHIS public use data (0-64 year olds only)
- Approach:
  - Remove CPOH from the data
  - Reweight non-CPOH data to NHIS control totals using an iterative process
    - Conventional: region, race/ethnicity, age
    - Less conventional: age by education, home ownership status, adult only 18-30 year old households
  - Examine each iteration and select the most efficient adjusted weight

Overview of analysis

- Contrast the total NHIS, CPOH and non-CPOH estimates for range of health related outcomes:
  - Health insurance coverage, delayed care due to cost, usual source of care, and current smoking status
- After omitting CPOH from the sample, contrast various iterations of post-stratification adjustments (impact on variance and bias)
- Examine the extent to which the adjusted weights reduce bias that was introduced from excluding CPOH

  Definition: non-CPOH include households with landlines, no service, and unknown service
  - CPOH equal 15.1% of the non-elderly weighted Person File
  - CPOH equal 16.1% of the non-elderly weighted Sample File

Table 1. Selected estimates with original public use weights by phone status

Compared to NHIS non-elderly total sample, the non-CPOH subsample (B-A) significantly underestimates all key health related outcomes

Non-CPOH and CPOH subsamples are significantly different on all health related estimates (B-C), with CPOH reporting higher rates on all outcomes

		Total Sample (A)		CPOH Omitted (B)		CPOH (C)		B-A	T-Test	B-C	T-Test
Person File	Sample Size	75,764		65,420	86.3%	10,344	13.7%				
	Pop Estimate	260,725,235		221,406,987	84.9%	39,318,248	15.1%				
		%	SE	%	SE	%	SE				
	Uninsured	16.5%	0.28%	14.9%	0.30%	25.4%	0.68%	-1.59%	***	-10.53%	***
	Delayed Care b/c Cost	8.3%	0.18%	7.5%	0.18%	13.1%	0.49%	-0.85%	***	-5.61%	***
Sample Files	Sample Size	28,227		23,145	82.0%	5,082	18.0%				
	Pop Estimate	260,753,918		218,832,090	83.9%	41,921,828	16.1%				
		%	SE	%	SE	%	SE				
	No Usual Source of Care	13.8%	0.33%	11.7%	0.34%	24.3%	0.83%	-2.02%	***	-12.57%	***
	Current Smoking	21.7%	0.46%	20.1%	0.47%	29.2%	1.12%	-1.55%	***	-9.04%	***

Table 2. Contrast adjustments for selected health outcomes

- Iterative post-stratification adjustments were made to the public use final person weight, sample adult and child weights
- Selection of the weight that performed best was based on Mean Squared Error (MSE) and variance estimates for 4 outcomes:
  - Person file:
    1. Uninsurance
    2. Delayed care due to cost
  - Sample adult/child file:
    3. No usual source of care
    4. Current smoking status
- Weight that adjusts cumulatively for region, age, race/ethnicity, age by education and home ownership (wtenure) had the lowest average MSE
  - slightly overestimates the number of whites

Table 2. Contrast adjustments for selected health outcomes – summary continued

- For the non-CPOH subsample, compared to original unadjusted public use weight
  - variance of adjusted weights increases somewhat
  - bias (MSE) is greatly reduced with the adjusted weight (by a minimum of 48%)

		Non-CPOH (Original unadjusted)	Adjusted (wtenure)
Person File	**Uninsured**		
	Design Effect (DEFF)	3.874	4.070
	% Change in variance		6.91%
	MSE X 100	0.026	0.002
	% Change in MSE		-90.6%
	Delayed Care b/c Cost		
	Design Effect (DEFF)	2.734	2.824
	% Change in variance		2.54%
	MSE X 100	0.007	0.004
	% Change in MSE		-47.97%
Sample File	**No Usual Source of Care**		
	Design Effect (DEFF)	2.695	2.902
	% Change in variance		10.95%
	MSE X 100	0.042	0.009
	% Change in MSE		-77.73%
	Current Smoking		
	Design Effect (DEFF)	2.400	2.450
	% Change in variance		-6.69%
	MSE X 100	0.026	0.012
	% Change in MSE		-55.7%

Table 3. Contrasting non-elderly NHIS sample with unadjusted and adjusted non-CPOH

Contrasting total sample (A) and adjusted Non-CPOH (C)…
- The magnitude of the bias for key outcomes is modest
  - 1.0 or less in terms of the absolute difference,
  - Less than 8% in terms of percent or relative difference
- The direction of the bias is toward underestimating key outcomes

Contrasting unadjusted (B) and adjusted Non-CPOH (C)…
- Weighting reduces the bias for key outcomes

	Public Use Weight				Tenure Adjustment (CPOH Omitted)				
	Total Sample (A)		CPOH Omitted (B)		Adjusted Weight (C)		Bias Reduction (1-((A-C)/(A-B)))	Adjusted-Total (C-A)	Percent Difference (C-A/A)	T-Test
	%	SE	%	SE	%	SE				
Uninsured	16.5%	0.28%	14.9%	0.30%	16.1%	0.31%	75.7%	-0.4%	-2.3%	*
Delayed care b/c Cost	8.3%	0.18%	7.5%	0.18%	7.7%	0.19%	29.7%	-0.6%	-7.1%	***
No USOSC	13.8%	0.33%	11.7%	0.34%	12.9%	0.37%	55.8%	-0.9%	-6.5%	***
Current Smoking	21.7%	0.46%	20.1%	0.47%	20.7%	0.48%	37.8%	-1.0%	-4.5%	***

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Table 3. Contrasting full NHIS and adjusted non-CPOH subsample – summary continued

- The adjusted estimates perform well
  - The magnitude of the bias is modest and the estimates are only moderately different from the total non-elderly sample (gold standard)
  - The direction of the bias is toward underestimating key health related outcomes

- Compared to unadjusted non-CPOH, adjusted non-CPOH estimates reduce the bias by as much as 76% for key outcomes

Conclusions and implications

- Can post-stratification adjustments correct for bias associated with not sampling CPOH in TL-RDD health surveys?
  - **Yes** – although variance increases somewhat, bias is greatly reduced for the re-weighted data
  - For key outcome central to policy reform simulations and funding formulas —**uninsurance**—bias is small yet significantly different from the gold standard
- It may be more cost-effective to rely on adjusted TL-RDD data given the high cost of interviewing CPOH and uncertainty of weighting procedures that merge CPOH and TL-RDD data
- Weighting strategy presented is but one possibility; still tinkering
- Must continue to monitor efficacy of this approach to dealing with coverage bias with changing telephony

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