Assessing the Impact of Methodological Enhancements on Different Subpopulations in an Experiment on the Behavioral Risk Factor Surveillance System

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Abstract

Methodological enhancements intended to improve response rates in telephone surveys may have differential impacts on sub-populations. An understanding of these differential impacts will inform the decision to apply the enhancements, and may lead to better comparisons to data collected in prior years. This paper assesses the impact of the use of lead letters as methodological enhancements to the Behavioral Risk Factor Surveillance System (BRFSS) survey design. The data come from an experimental study with 2,686 respondents conducted as part of the ongoing data collection for the BRFSS in the spring of 2003. The results of the experiment were examined to assess the impact of the enhancements on the sample composition and population estimates of the survey.

1.0 Background

The research presented here provides results from an experiment conducted as part of the Behavioral Risk Factor Surveillance System (BRFSS).[1] The BRFSS is the world's largest ongoing telephone study, with more than 200,000 surveys collected per year, tracking health risks in the United States. The experiment was designed to test the effects of sending lead letters on survey participation in studies with a random-digit dial (RDD) design. The experiment was embedded in routine, monthly data collections in five states conducting the BRFSS. The preliminary findings of this experiment were reported in an earlier paper (Link et al., 2003) which demonstrated that lead letters were an effective way of increasing survey participation. This paper expands the analysis of the experimental data to determine if the gains in response rates were consistent across population sub-groups. In addition, this paper examines the potential for differential reporting as a result of the use of lead letters in RDD studies.

There is evidence that the use of lead letters in telephone studies can improve cooperation rates and reduce initial refusals (Kennedy et al., 1998; Camburn et al., 1995; Smith et al., 1995; Haggard and Gray, 1994). Although lead letters are effective in survey research as a whole, they can be especially effective when conducting telephone research (Dillman and Salant 1994).

Lead letters and other methodological enhancements can impact the sample composition and the population estimates generated from the survey (Gfroerer et al., 2002; Eyerman et al., 2001, 2002; Singer et al., 2000). Sample composition can change as the result of differential increases in the response rates of sub-groups. For example, lead letters may be more effective with older respondents who may place a greater value on the receipt of an advance letter than younger groups. Sample composition can also change if the enhancement is applied differentially to sub-groups in the sample. For example, lead letters in RDD studies can only be delivered to households that are successfully address-matched. These differences may impact the estimates for population sub-groups if they are related to the subject of the survey (Eyerman and Crew, 1999). However, in most cases the differences can be addressed through post-survey weighting.

The population estimates may also change if the respondents vary their answers as a result of the presence of the enhancement (Wright et al., 2002). For example, the lead letters may decrease the perception that the survey process is anonymous and thereby discourage the reporting of socially undesirable traits. This is a far greater threat than changes in sample composition because it reduces the prevalence estimates of socially undesirable behaviors and cannot easily be adjusted with post-survey techniques.

2.0 Experimental Design

The BRFSS is a collaborative project of the U.S. states and territories and the Centers for Disease Control and Prevention's (CDC's) Behavioral Surveillance Branch. The BRFSS is an ongoing data collection effort designed to measure behavioral risk factors in the adult population 18 years of age or older living in households. The survey is conducted monthly in all 50 states as well as the District of Columbia, Puerto Rico, Guam, and the Virgin Islands.[2] The objective of the BRFSS is to collect uniform, state-specific data on preventive health practices and risk behaviors that are linked to chronic

[1] We thank all of the BRFSS State Coordinators for their assistance in obtaining information about each state's operational protocols as well as the staff of the states and contracting organizations who assisted in implementing this experiment.

[2] The term "state" is used here to refer to all areas participating in the surveillance system, including the District of Columbia, Guam, the Virgin Islands, and the Commonwealth of Puerto Rico.

diseases, injuries, and preventable infectious diseases in the adult population. Factors assessed by the BRFSS include tobacco and drug use, health care utilization, HIV/AIDS knowledge and prevention, physical activity, and fruit and vegetable consumption (Mokdad et al., 2003). Respondents are advised that they have been randomly selected for the study, that no unique identifiers will be collected, and that all information will be kept confidential.

The section below provides a brief description of the lead letter experiment. More details about the experimental design are available in Link et al., (2003).

An experimental design was laid over the main study data collection for the BRFSS in five states in the spring of 2003. The five states (Idaho, Mississippi, North Carolina, South Carolina, Virginia) were selected to participate in the lead letter experiment based on three conditions: no current use of lead letters; number of completed interviews collected monthly; and 2001 Council of American Survey Research Organizations (CASRO) response rate for each state. Only states that were not currently using lead letters were considered for the experiment. This sub-set was stratified into high, medium, and low categories based on the 2001 response rates, and five states were selected: one low, three medium, and one high.

The samples for each of the states were drawn by GENESYS according to standard, previously approved and CDC-monitored, BRFSS protocol. The telephone numbers were then reverse-matched against a database of address information and the address-matched cases identified. Each address-matched case was then randomly assigned to either the treatment group (targeted to receive a lead letter) or control group (no lead letter). Lead letters were generated on the respective states' letterhead and mailed in their envelopes. Letters were mailed approximately 3 days before the cases were released for telephone interviewers to contact.

3.0 Impact on Cooperation

Tables 1 and 2 contain the completion and initial refusal rates for the treatment and control groups. The tables also contain the rates for the samples elements that were not included in the experiment because we were not able to match an address to the phone number (No Address). As expected, the completion rate was significantly higher for the treatment group than the control in all states except North Carolina, where the increase was not significant. A similar pattern holds for the initial refusal rates, with the treatment group significantly lower than the control group in all states.

Table 1: Completion Rates by Lead Letter Experiment Status

	N Completion %		
	Treatment: Sent Letter	Control: No Letter	No Address
State	A	B	C
Idaho	286 58.4 [b,c]	284 47.2 [a,c]	522 37.7 [a,b]
Mississippi	295 49.5 [b,c]	296 38.9 [a,c]	349 29.8 [a,b]
North Carolina	559 54.6 [c]	550 50.7 [c]	722 41.3 [a,b]
South Carolina	518 40.7 [b,c]	517 30.9 [a,c]	765 23.3 [a,b]
Virginia	320 53.8 [b,c]	298 39.3 [a,c]	531 29.0 [a,b]

Note: Completion percentage calculated as completes / completes + known eligibles + eligibility unknowns.

a. Indicates that cell is statistically different than the cell in the same row in column A at the $p < .05$ level based on Chi-square tests.

b. Indicates that cell is statistically different than the cell in the same row in column B at the $p < .05$ level based on Chi-square tests.

c. Indicates that cell is statistically different than the cell in the same row in column C at the $p < .05$ level based on Chi-square tests.

Table 2: Initial Refusal Rates by Lead Letter Experiment Status

	N Initial Refusal %		
	Treatment: Sent Letter	Control: No Letter	No Address
State	A	B	C
Idaho	286 24.8 [b]	284 32.4 [a]	522 27.4
Mississippi	295 32.9 [b]	296 42.2 [a,c]	349 35.2 [b]
North Carolina	559 17.7 [b]	550 22.5 [a,c]	722 15.2 [b]
South Carolina	518 46.9 [b,c]	517 52.4 [a,c]	765 38.8 [a,b]
Virginia	320 31.6 [b]	298 41.9 [a,c]	531 33.1 [b]

Note: Initial refusal percentage is calculated as total initial refusals / completes + known eligibles + eligibility unknowns.

a. Indicates that cell is statistically different than the cell in the same row in column A at the $p < .05$ level based on Chi-square tests.

b. Indicates that cell is statistically different than the cell in the same row in column B at the $p < .05$ level based on Chi-square tests.

c. Indicates that cell is statistically different than the cell in the same row in column C at the $p < .05$ level based on Chi-square tests.

It should be noted that the control group completion rates were significantly better than those of the No Address group, but the initial refusal rates were significantly lower for the No Address group than for the control. This

is because the denominator for these calculations includes cases with unknown eligibility. We expect that the No Address group includes more of these than the control or the treatment group, which deflates both the completion and the initial refusal rates for these groups.

4.0 Impact on Sample Composition and Responses

We examined the impact of the lead letters on the sample composition and population estimates using contingency tables and logistic regression. We used contingency tables to examine the distribution of respondents on a series of self-reported demographic characteristics: age, Hispanic, race, marital status, number of children in the household, education, employment status, and income. Tables 3 and 4 show the demographic distributions that were significantly different between the Address and No Address groups and the treatment and control groups.

As shown in Table 3, there is no consistent pattern of significant differences between the Address (treatment and control) and No Address groups across all states. However, the distributions for age and race were significantly different between Address and No Address groups in three states each, and several other variables were significant in one or two states. Table 4 shows only one significant difference in the sample composition between the treatment and the control groups. Taken together, Tables 3 and 4 demonstrate that the sample composition changed as a result of the use of the lead letters due to the differences between the Address and No Address groups. That is, the differential application of the lead letters to only those addresses that could be matched resulted in a different sample composition than would have been realized without the use of lead letters. However, Table 4 demonstrates that the lead letters did not have differential impacts on sub-groups within the Address group.

Table 3: Significantly Different Demographic Distributions Between Address and No Address Groups

Demographic	ID	MS	NC	SC	VA
Age	●		●	●	
Hispanic					
Race		●		●	●
Marital Status			●	●	
Children		●		●	
Education		●			
Employment			●		
Income					

[1] ● Significance based on Chi-square tests. Cells with bullets indicate that the distribution of responses on the variable for that state was significantly different between the Address and No Address groups at the $p < .05$ level.

Table 4: Significantly Different Demographic Distributions Between Treatment and Control Groups

Demographic	ID	MS	NC	SC	VA
Age					
Hispanic					
Race			●		
Marital Status					
Children					
Education					
Employment					
Income					

[1] ● Significance based on Chi-square tests. Cells with bullets indicate that the distribution of responses on the variable for that state was significantly different between the Treatment and Control groups at the $p < .05$ level.

Tables 5 and 6 present the results of logistic regression models used to measures the impact of lead letters or address matching on responses provided to socially sensitive questions, while controlling for the demographic variables contained in Table 4. Table 5 contains the estimates of the probability that the respondent would answer "No" to the question of interest if the respondent was successfully address matched. Table 6 contains the estimates of the probability that the respondent would answer "No" to the question of interest if the respondent received the lead letter. The models in Table 6 were estimated only with those respondents who were successfully address matched and included in the experiment in either the control or treatment groups.

We selected a series of socially sensitive questions from the BRFSS that were likely to have stigma associated with them (see Figure 1). We expected that the Address group may provide different responses than the No Address group due to differences related to their ability to be address- matched (see Table 3). In addition, we expected that respondents may be more likely to respond "No" to questions about socially undesirable behavior if they know that the data collection firm or sponsoring agency has some individually identifiable information about them, such as home address.

There was little evidence of a systematic difference in reporting between the Address and No Address groups, with only three significant indicators. As seen in Table 5, "past month exercise" was positive and significant for Idaho and North Carolina, meaning that the Address group was more likely to answer "No" when asked about past month exercise. The Virginia Address group was also more likely to report "No" when asked if they were ever tested for HIV.

Figure 1. BRFSS Questions Used as Potentially Socially Undesirable Questions

Q11.1	Have you smoked at least 100 cigarettes in your entire life? NOTE: 5 packs = 100 cigarettes
Q3.1	During the past month, other than your regular job, did you participate in any physical activities or exercise such as running, calisthenics, golf, gardening, or walking for exercise?
Q20.8	I'm going to read you a list. When I'm done, please tell me if any of the situations apply to you. You don't need to tell me which one.
	You have used intravenous drugs in the past year
	You have been treated for a sexually transmitted or venereal disease in the past year
	You have given or received money or drugs in exchange for sex in the past year

There was also very little evidence of underreporting of socially undesirable behaviors for the treatment group (Table 6), with only two significant indicators, for reporting past month exercise. South Carolina respondents who received the lead letter were more likely than the control group to report that they did not exercise in the past month. Mississippi respondents who received the lead letter were less likely to report that they did not exercise.

Tables 5 and 6 demonstrate little evidence of a systematic difference in the response to socially sensitive questions between the Address and No Address groups, and between the treatment and control groups. This suggests that the demographic differences between the Address and No Address groups may be adequately adjusted using the demographic controls in the model. This may inform the eventual weighting process. In addition, the use of the lead letters did not reveal a systematic underreporting of socially sensitive behaviors in this evaluation.

Table 5: Logistic Regression Model of the Impact of Address Matching on Responses to Socially Undesirable Questions (Probability that response = No)

State	Estimate	P-value
Lifetime smoking		
South Carolina	-0.4055	0.08
Mississippi	-0.1672	0.59
Virginia	-0.2423	0.35
Idaho	-0.0392	0.87
North Carolina	-0.0183	0.92
Past month exercise		
South Carolina	0.3645	0.18
Mississippi	0.0186	0.95
Virginia	0.0094	0.97
Idaho	0.6852	**0.04**
North Carolina	0.5659	**0.01**
Drugs, STD, $ for sex, anal sex		
South Carolina	1.0374	0.08
Mississippi	0.6811	0.28
Virginia	0.2639	0.76
Idaho	0.3621	0.55
North Carolina	0.2525	0.65
Ever tested for HIV		
South Carolina	0.0753	0.77
Mississippi	0.1728	0.59
Virginia	0.8019	**0.00**
Idaho	0.3062	0.23
North Carolina	0.0613	0.78

[1] Logistic regressions were estimated for each state using the demographic measures listed in Table 3 and a dichotomous indicator of Address match (match= 1).

Table 6: Logistic Regression Model of the Impact of the Lead Letter on Responses to Socially Undesirable Questions (Probability that response = No)

State	Estimate	P-value
Lifetime smoking		
South Carolina	-0.038	0.86
Mississippi	-0.559	0.07
Virginia	0.151	0.61
Idaho	0.323	0.29
North Carolina	-0.028	0.89
Past month exercise		
South Carolina	0.6423	**0.04**
Mississippi	-0.667	**0.05**
Virginia	0.2615	0.41
Idaho	0.3506	0.34
North Carolina	0.3249	0.19
Drugs, STD, $ for sex, anal sex		
South Carolina	-0.8371	0.42
Mississippi	-0.586	0.58
Virginia	0.8141	0.49
Idaho	0.8847	0.37
North Carolina	-0.1297	0.88
Ever tested for HIV		
South Carolina	0.4473	0.16
Mississippi	0.3495	0.32
Virginia	0.5043	0.11
Idaho	0.219	0.52
North Carolina	-0.0651	0.80

[1] Logistic regressions were estimated for each state using the demographic measures listed in Table 3 and a dichotomous indicator of lead letter (letter = 1).

5.0 Conclusions

As expected, the use of lead letters for the BRFSS showed improvements in the cooperation and initial refusal rates. However, the differential application of the enhancement to only those households that could be addressed matched produced changes in the sample composition. These changes had little effect on the response provided to questions examined in this study. In addition, the use of the lead letter did not seem to impact the responses to questions that may be socially sensitive.

The results presented in this paper are preliminary and suggest that additional research should be performed in this area. Future research should include a more detailed examination of the socially sensitive topics. This should include the expansion of the analysis to examine more questions from the survey, more sophisticated models to explore possible interactions between response and population sub-groups, and an evaluation of the impact of the lead letter on item missing and item refusals to sensitive questions. In addition, the state-level demographics difference between the Address and No Address groups should be examined to inform any post-survey adjustments to the estimates.

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