

## Overview of Proposed Changes to BRFSS Cell Phone Sampling Frame

When collecting data using RDD, there are several options for sampling that include landline and cell phone users. The first option is to have completely different dual samples, without any overlap. Persons who were part of one sample are not eligible to be part of the other sample. In 2011, the BRFSS used this type of sample method by coding as ineligible any cell phone respondents who had a landline in the cell phone sample. By ensuring that no respondent has the potential to be in both samples, design weights are easier to calculate, but there are costs to screening out potentially cooperative respondents.

In order to be more cost effective, in 2012 the BRFSS changed the screening process to allow interviewing of an additional portion of cell phone respondents. Cell respondents were eligible, even if they had landline phones, as long as they received at least 90% of all calls on their cell phones. The decision to adopt the 90% rule was promoted by recommendations from Abt Associates which, at the time, was assisting the BRFSS with procedures related to weighting. It was also a subject of discussion by representatives attending the BRFSS Training Workshop held in October 2011. Discussions on the change in method were held with state BRFSS representatives during conference calls and at the BRFSS annual meeting in 2012. State data collectors embraced the protocol change because it resulted in more efficient sampling and cost savings. However, the protocol change also complicated the weighting process, as now there were some respondents in the cell phone sample who had the potential to be included in the landline sample. The “cell mostly” category, created by asking respondents about their phone use, was intended to minimize the potential for overlap, and phone use categories were included in the weighting to account for the sample overlap. The change to allow for some overlap of the frame was feasible in 2012 because of the ability to obtain stable control totals on phone use provided by the National Health Interview Survey (NHIS) at the time of the change (Blumberg and Luke, 2011). NHIS has released estimates on cell phone use since 2007 (NHIS, 2013) and publishes wireless only and mostly estimates for most states.

In September 2013, the BRFSS Expert Panel advised the use of a completely overlapping sample. In this method, all adults contacted through their personal (non-business) phone numbers would be eligible. Using this method, no one is screened out due to phone use in either the landline or the cell phone sample. The fully overlapping frame has been tested in other surveys and survey experiments. In 2010 Pedlow, Xia and Davern explored the differences in health prevalence estimates when four types of frames (landline only, landline with cell only, landline with cell mostly, and full overlap). They found that the overlapping sample was less expensive but bias could result from full overlap. In 2012 Kelly et al examined the cost effectiveness of fully overlapping samples when compared with screening methods. They found not only did costs decline with the full overlap, but the reduction in screening time lead to better interviews and higher completion rates. Their research also determined the overlapping sample affected design weights and increased statistical complexity. Overlapping samples are more useful today than in the past because researchers continue to examine how to account for changes in design weights, estimates of cell phone use by state have improved and cell phone only rates continue to increase (NHIS, 2013). Such samples have been adopted by a number of large scale surveys including the National Immunization Survey conducted by the CDC (NIS, 2013) and new methods of weighting to account for the probability of selection in both samples have been devised (AAPOR, 2010; Boyle et al, 2014).

In a follow-up to the recommendations of the Expert Panel, staff members of the BRFSS requested feedback from the states as to their views on the protocol changes. A total of seventeen states provided feedback. Of those, thirteen states favored the change to an overlapping sample. Three were neutral but

had questions about the impact and one state felt that the new protocol should be adopted in 2015. There were three questions which were posed to the BRFSS staff by the states. BRFSS staff responded to all of the state coordinators with answers to these common questions. The questions and responses were:

1) *Do we have control totals which can be used for the overlapping frame?*

Yes, we have control totals which will be used for weighting. We do not anticipate that this will be a problem.

2) *Are there likely trend breaks that would be associated with the change to overlapping frames?*

The persons who are included in the overlapping frame are not increasing our coverage the way that the cell-only persons did in 2011. If a person is a dual user, they already had a probability to be in our landline frame. The change to overlapping frame has no effect on coverage. Moreover, the trend breaks that occurred in 2011 were more a result of the additional weighting demographics of education, marital status and homeownership. We are not adding new weighting variables.

3) *What will happen if we do not have enough cell only respondents as we go through the year?*

We will monitor the cell only group in each state to see if this is happening. However, since we have already noted the percent of cell only in the cell sample by state (see attached document) we do not think that this will be a problem. Each year it will be less of a problem as more of our respondents are cell only. If we noted that the number of cell only respondents was too small a group for weighting, we might ask the state to increase the number of cell phone interviews, thereby increasing the number of cell only respondents.

It is anticipated that when the BRFSS adopts a fully overlapping sample, it will likely result in more efficiency in the cell phone sample and is likely to raise cell phone sample response rates. States will notice that their interviewers will be allowed to continue interviewing additional cooperative cell phone respondents, which were previously determined to be ineligible. The new sampling method will result in changes in the cell phone screening process, but will not change the landline screening method in any way. Table 1 below illustrates the differences in the screening questions with the new protocol.

Table 1  
Cell Phone Screening Questions for Old and New Protocols

Old Protocol Cell Phone Screening Questions	New Protocol Cell Phone Screening Questions	Screening Result
Is this a safe time to talk with you?	Is this a safe time to talk with you?	“No” responses are scheduled for another calling attempt
Is this (phone number) ?	Is this (phone number)?	“No” responses are redialed
Is this a cellular telephone?	Is this a cellular telephone?	“No” responses are ineligible
Are you 18 years of age or older?	Are you 18 years of age or older?	“No” responses are ineligible
Do you live in a private residence? Do you live in college housing?	Do you live in a private residence? Do you live in college housing?	“No” responses are ineligible Respondents who live in college housing will be considered single adult households in the cell phone sample. They will not be asked the number of adults question.

Are you a resident of ____(state)____? In what state do you live?	Are you a resident of (state)? In what state do you live?	Respondents from other states are interviewed using only the core questions
Do you also have a landline telephone in your home that is used to make and receive calls?	Do you also have a landline telephone in your home that is used to make and receive calls?	This question will remain for use in the weighting process, but will not be used to screen out respondents.
Thinking about all the phone calls that you receive on your landline and cell phone, what percent, between 0 and 100, are received on your cell phone?	Including yourself, how many adults live in your household?	Responses of less than 90% were ineligible under the old protocol; this question is eliminated in the new protocol. The number of adults question in the cell phone screener will allow states to calculate household income without adding to the total number of questions. Respondents who live in college housing will be considered single adult households in the cell phone sample. They will not be asked the number of adults question.

The number of respondents who were previously screened out varies by state, as is shown in Table 2 below.

Table 2

## Percent of 2012 Cell Phone Sample Screened Out Due to Percentage of Calls Questions

State	Received 90% or more of calls on cell		Received Less Than 90% of calls on cell phone	
	N	Percent	N	Percent
Alabama	436	31.5	946	68.5
Alaska	291	32.4	606	67.6
Arizona	426	28.2	1082	71.8
Arkansas	270	31.1	598	68.9
California	446	15.7	2401	84.3
Colorado	565	27.0	1524	73.0
Connecticut	927	26.4	2591	73.7
Delaware	437	32.4	913	67.6
Dist. of Col.	212	29.5	506	70.5
Florida	309	33.6	611	66.4
Georgia	239	34.0	463	66.0
Hawaii	973	35.6	1762	64.4
Idaho	86	26.3	241	73.7
Illinois	210	28.7	522	71.3
Indiana	488	27.2	1303	72.8
Iowa	359	24.8	1090	75.2
Kansas	612	28.0	1575	72.0
Kentucky	411	26.8	1122	73.2
Louisiana	294	39.0	459	61.0
Main	415	24.6	1274	75.4
Maryland	305	34.6	576	65.4
Massachusetts	1264	30.2	2919	69.8
Michigan	606	30.2	1400	69.8
Minnesota	578	24.5	1779	75.5
Mississippi	293	34.9	546	65.1
Missouri	349	29.1	851	70.9
Montana	458	26.1	1298	73.9
Nebraska	929	26.1	2630	73.9
Nevada	250	37.6	415	62.4
New Hampshire	355	24.7	1083	75.3
New Jersey	1085	33.8	2123	66.2
New Mexico	424	22.9	1430	77.1
New York	394	28.8	974	71.2
North Carolina	635	24.1	2002	75.9
North Dakota	205	24.0	648	76.0
Ohio	515	24.8	1561	75.2
Oklahoma	827	37.3	1391	62.7
Oregon	200	26.7	549	73.3

Pennsylvania	1352	27.5	3564	72.5
Rhode Island	380	26.6	1051	73.4
South Carolina	718	25.7	2074	74.3
South Dakota	549	28.8	1357	71.2
Tennessee	293	29.5	701	70.5
Texas	481	37.9	789	62.1
Utah	638	29.3	1536	70.7
Vermont	262	17.4	1240	82.6
Virginia	301	27.9	779	72.1
Washington	1065	27.3	2830	72.7
West Virginia	217	23.0	725	77.0
Wisconsin	169	20.5	655	79.5
Wyoming	197	28.1	505	71.9
Guam	152	28.1	389	71.9
Puerto Rico	399	45.3	481	54.7

In 2012, the state of Minnesota continued to interview respondents who would normally have been screened out using the old protocols. During the BRFSS Expert Panel meetings, representatives from Minnesota presented information to show that the inclusion of persons who did not meet the 90% screening requirement did not have an effect on prevalence estimates for health outcomes, nor did it significantly change the sample demographics. The inclusion did result in lower overall costs and benefits to data collection. Representatives from Minnesota advocated the adoption of a protocol which eliminated the 90% cell phone use screening.

As with any change in methodology, the adoption of the overlapping frame will require that BRFSS staff members monitor the impact of the change. In particular, it is essential that a sufficient number of cell phone only respondents are interviewed to allow for weighting using cell phone only as a category of phone use. In 2012 of all cell phone interviews completed, the number of cell phone only respondents varied by state (as is presented in Table 3), from a low of 59% to a high of 88%. The BRFSS will also monitor any potential change in trends, prevalence estimation or demographic characteristics. States may wish to track sample efficiency and cost benefits which occur after the new protocols are instituted.

Changes to the protocol will be initiated in 2014. As noted above modifications in the cell phone questionnaire would be required, and one question would be removed from the landline version of the questionnaire. Modifications to the cell phone survey would include changes in the screening section. The percent cell phone question would be removed from the landline questionnaire. No changes would be required in any of the other sections of the questionnaires. BRFSS staff members will be able to assist the states if there are any questions on the implementation of the new protocol.

Table 3  
Percent Cell Phone Only of All 2012 Cell Phone Interviews

State	Total number of cell phone interviews	Percent of cell phone interviews from cell only respondents
Alabama	1693	79.70%
Alaska	808	69.60%
Arizona	1552	83.70%
Arkansas	1186	85.20%
California	3416	77.80%
Colorado	2765	82.50%
Connecticut	1623	69.90%
Delaware	977	65.90%
District of Columbia	627	79.10%
Florida	1383	81.60%
Georgia	1148	80.90%
Hawaii	3467	79.40%
Idaho	657	88.40%
Illinois	1038	83.70%
Indiana	2178	81.80%
Iowa	1512	79.60%
Kansas	2513	83.10%
Kentucky	1973	80.50%
Louisiana	1215	78.90%
Maine	1881	82.00%
Maryland	980	75.10%
Massachusetts	3398	72.70%
Michigan	2085	80.90%
Minnesota	3055	79.90%
Mississippi	1545	83.40%
Missouri	1443	81.50%
Montana	1993	81.70%
Nebraska	3990	81.60%
Nevada	1038	79.70%
New Hampshire	934	77.60%
New Jersey	2660	68.60%
New Mexico	2790	87.10%
New York	1415	79.20%
North Carolina	3002	83.50%
North Dakota	913	80.90%
Ohio	2716	83.10%
Oklahoma	2232	74.40%
Oregon	1177	85.10%

Pennsylvania	3881	72.10%
Rhode Island	868	72.80%
South Carolina	2967	81.50%
South Dakota	2170	79.40%
Tennessee	1580	82.90%
Texas	2591	84.30%
Utah	2568	81.00%
Vermont	895	80.60%
Virginia	1313	81.20%
Washington	2558	83.00%
West Virginia	1114	84.40%
Wisconsin	1022	85.90%
Wyoming	900	84.10%
Guam	303	59.70%
Puerto Rico	2966	88.60%

In 2012, the inclusion of cellular telephone respondents who received between 90 and 99 percent of their telephone calls on their cellular telephone required an adjustment to the design weights to account for the overlapping sample frames. From each of the two sample frames, a compositing factor was calculated for the mostly cellular telephone dual sampling frame users. The design weight was multiplied by the compositing factor to generate a composite weight, which is used as the raking input weight. The updated design weight was used as the starting point building the input weight used in the raking process. One method of adjustment to the overlapping sample would follow this same process, but would be applied to all interviews collected from the overlapping frame.

There are four telephone service categories:

1. Landline respondent with a cell phone
2. Cell phone respondent with a landline
3. Landline only
4. Cell phone only.

The compositing factors are based on the size of the effective sample size.

For the overlapping frame telephone service categories (landline respondent with a cell phone, or cell phone respondent with a landline) calculate compositing factor:

$$n_{\text{effective}} = n / deff,$$

Where:

n is the unweighted number of interviews, and

$$deff = 1 + (\text{Standard deviation of design\_wt} / \text{Mean value of design\_wt})^2.$$

For the telephone service category 1 (landline respondent with a cell phone) calculate the composite weight:

Composite\_wt = DESIGN\_WT x (n effective value for category 1 / (n effective value for category 1 + n effective for category 2).

For the telephone service category 2 (cell phone respondent with a landline) calculate:

Composite\_wt = DESIGN\_WT x (n effective value for category 2 / (n effective value for category 1 + n effective for category 2).

Other methods for adjusting the design weights to accommodate the overlapping frame are being reviewed to determine the best fit for BRFSS (AAPOR; Brick, et.al). This could result in a different adjustment method being applied to the design weight for the 2014 data.

## References

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