

COSTS AND BENEFITS OF FULL DUAL-FRAME TELEPHONE SURVEY DESIGNS

Prepared for the annual meeting of the American Association for Public Opinion Research
New Orleans, Louisiana May 15-18, 2008

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A growing body of research has indicated that supplementing landline RDD designs with cell-only respondents has negligible effects on national estimates of most attitudes and behaviors (Brick et al. 2006; Keeter et al. 2007; Link et al. 2007), though for certain nonpolitical topics the potential for non-coverage bias is higher (Blumberg and Luke 2007). Several Pew Research Center reports have documented the minimal impact on total estimates of the inclusion of cell-only respondents. A companion report to this paper is Pew's analysis, issued January 31, 2008, which reported on two national political surveys and replicated the finding that neither total estimates, nor estimates for important subgroups such as younger people, are significantly biased by the absence of cell-only respondents (<http://people-press.org/reports/display.php3?ReportID=391>).

Nonetheless, the potential for non-coverage bias continues to increase as the cell-only population grows. Moreover, prior research has not fully investigated another growing segment of the public – those who have a landline but who rely mostly on a cell phone. In this study, we use four national dual frame telephone surveys to explore the separate contributions to survey estimates from interviews with cell-only persons, landline-only persons, as well as dual users reached on a landline, and those reached on a cell phone. The design choice to interview all age-eligible adults reached in the cell sample, including those with landline phones, is assessed with respect to cost, sample composition and weighting as well as the substantive effect on survey results. We also discuss the practical implications of the design choices, including the impact on phone room productivity and the size of reimbursement offered.

The first political survey (October 2007), conducted by the Pew Research Center for the People & the Press, focused on presidential nominations, presidential approval, and the war in Iraq. Analysis confirms that the dual frame approach has little impact on survey estimates. The greater coverage of the cell phone component, however, produces a substantially improved sample composition, reducing the design effect and providing larger samples of key subgroups. A second political study (December 2007) employed a similar dual frame design and focus on

voters' sources of campaign information. The third dual frame study (Fall 2007), conducted by the Pew Internet & American Life Project, covers a wide range of attitudes and behaviors related to technology use. The fourth study, conducted in early 2008 by the Pew Social and Demographic Trends Project, probed economic and social attitudes and behavior, with a special focus on the middle class.

Demographics of the "Dual"

Households

How different demographically are the dual users reached by cell phone from those reached by landline? Using a combined data set of the three of the four surveys, we find that the differences are rather modest. Among the dual users, more males than females were reached by cell phone (56% male, compared with 47% male among dual users reached by landline). And nearly twice as many Hispanics were reached by cell phone (10% vs. 6%). Those reached by cell phone were somewhat younger (58% under age 50, compared with 49% among those reached by landline).

But on other demographic measures, the differences were very minor. Income and education levels of the two groups of dual users were very comparable, and considerably higher than landline-only and cell-only respondents. Religious affiliation was similar as well, with comparable percentages of dual users reached by landline and by cell saying they were unaffiliated (14% each), Catholic (22% and 24%, respectively), or Protestant (54% in the landline frame and 52% in the cell frame).

Demographic Composition of the Landline and Cell Phone Publics (three dual frame surveys combined)

Proportion of U.S. adults ¹	Landline & cell interviewed on...			Cell only
	26%	60%	14%	
	Landline only	Landline	Cell	only
	%	%	%	%
18-29	11	12	17	47
30-49	21	37	41	36
50-64	27	31	29	12
65+	38	18	12	4
Male	47	47	56	61
Female	53	53	44	39
College grad	23	42	40	25
Some college	22	25	24	28
H.S. grad	40	28	29	35
Less than H.S.	14	5	6	12
\$75K or more	14	36	36	18
\$50-74,999	9	16	18	13
\$30-49,999	19	19	20	24
Less than \$30K	37	15	16	37
White	78	83	80	69
Black	14	10	12	18
Asian	1	2	3	5
Other/Mixed	4	4	4	5
Hispanic	8	6	10	15
Protestant	55	54	53	48
Catholic	22	22	24	19
Other	6	8	7	8
Unaffiliated	14	14	14	24
Married	40	63	60	26
Never married	21	15	23	51
Parent of minor	16	32	35	26
Renter	28	15	20	60
<i>Get more calls on...</i>				
Cell phone	-	30	48	-
Landline	-	43	26	-
Both equally	-	27	25	-
Sample size (for most vars)	(1235)	(3020)	(968)	(600)

Figures based on unweighted data from 3 surveys
¹Source: Extrapolated from 2007 National Health Interview Survey conducted by the National Center for Health Statistics through in-person interviewing.

Rates of marriage were similar (63% among landline dual users, 60% in the cell frame), as were the percentage who are parents of minor children in the household (35% among cell respondents, 32% in the landline sample).

These demographic patterns are also seen among younger respondents – those ages 18-29 – though a couple of differences are more pronounced. African-Americans are 18% of the young dual users reached by cell phone, but only 13% among those reached by landline. And Hispanics are 19% of the young dual users reached on a cell, but only 11% of those reached on a landline. The dual users reached by cell are considerably younger – within this young cohort – with 65% between ages 18-24, compared with just 49% among the dual users reached by landline. In keeping with this age difference, fewer of those reached by cell phone are parents (21% vs. 32% among the young dual users reached by landline).

It’s clear that certain hard-to-reach groups of dual users are better represented through the cell frame, but whether the improvement in representation is most effectively obtained through full dual frame surveys is unclear. We will return to this question later in the paper.

Substantive Differences across Frames

On most substantive variables the story is similar to that with respect to demographics. The dual users reached on a landline do not differ very much from those reached by cell phone. Across a range of variables the average difference in response was less than 4 percentage points, with few differences exceeding six points. Notably, key political variables such as party affiliation and ideology differ very little for dual users regardless of how they were reached.

Few of the differences that exist are statistically significant, even with the relatively large sample sizes available for many of the comparisons. Among those that are significant:

Attitudes and Behaviors by Frame				
Proportion of U.S. adults ¹	26% 60% 14%			
	Landline only	Landline & cell interviewed on...		Cell only
	%	Landline %	Cell %	%
Natl. satisfaction [^]	23	27	31	34
Democrat/lean [^]	53	48	46	53
Republican/lean [^]	29	41	42	32
No lean [^]	18	11	12	15
Conservative [^]	38	37	40	31
Moderate [^]	35	39	37	37
Liberal [^]	17	21	19	26
Registered voter [^]	76	84	78	57
Approve Bush job [*]	26	33	37	27
Iraq right decision [*]	31	40	44	34
Bring troops home [*]	57	48	48	55
<i>Regularly get campaign info from...#</i>				
Internet	13	26	23	35
Local TV news	45	42	38	35
Network news	38	34	28	28
Cable news	39	40	40	40
Daily newspaper	33	36	38	25
Use social networking sites	10	16	22	38
Internet user [^]	40	80	76	77

Based on unweighted data
[^]Oct & Dec 07 political surveys + 2008 economics survey.
^{*}Oct & Dec 07 political surveys.
[#] Dec 07 political survey
¹Source: Extrapolated from 2007 National Health Interview Survey conducted by the National Center for Health Statistics through in-person interviewing.

voter registration (84% for duals reached by landline, 78% for those reached by cell), and satisfaction with the way things are going in the U.S. (four points higher among those reached by cell phone). Measures of information sources for campaign information show few differences by telephone mode between the dual-user samples.

Technology Ownership and Use

We might expect mode of access to the dual users to matter most on questions directly related to technology. A fall 2007 dual frame survey by the Pew Internet & American Life Project focused on technology ownership, use, and attitudes. On several questions, significant differences were found between dual users reached by landline and those contacted by cell phone.

In particular, duals reached by cell were significantly more likely to report having a digital camera, a laptop computer, an iPod or MP3 player, and a Blackberry or similar device. They were also significant more likely to report playing games online. In general, duals reached by cell phone were more positive about the impact of technology on several aspects of their life, and far more said that it would be “very hard” to give up their cell phone, their internet access, or e-mail. Duals reached on a landline were significantly more likely to say it would be very hard to give up their landline.

Yet as with most of the political content discussed in Pew’s January 2008 report, on nearly every item in the technology survey, the total survey

estimates are only minimally affected by the exclusion of the cell phone respondents. Despite the fact that cell-only respondents – and the duals reached by cell phone – are considerably more

	Landline	Cell-	Blended	<i>Landline and cell</i>	
	<u>sample</u>	<u>only</u>	<u>(total)</u>	<u>Landline</u>	<u>Cell</u>
	%	%	%	%	%
Tech assets					
Cell phone	78	100	75	100	100
Broadband*	77	81	77	77	79
Desktop computer	68	55	65	77	81
Digital Camera	62	70	62	70	80
Video Camera	42	45	41	47	49
DVR	39	38	38	46	51
Laptop computer	35	52	37	41	49
iPod/MP3	32	52	34	34	44
Webcam	15	21	15	16	21
Blackberry/PDA	11	16	11	12	19
Behaviors					
Has SNS profile	30	52	33	24	27
Play games online	21	34	23	21	28
Attitudes					
<i>% who said ICTs improved “a lot” their ability to ...</i>					
Keep in touch with family/friends	62	77	65	61	70
Learn new things	49	56	52	48	57
Do their job	40	43	41	38	45
Share ideas	30	40	33	29	36
<i>% who say it would be “very hard” to give up specific device (among those with each one)</i>					
Television	44	37	43	44	40
Cell phone	44	66	51	42	57
Internet	41	50	45	43	51
LL telephone	40	--	40	39	26
Email	34	39	37	37	45
Sample size	1554	221	2054	1198	279
* Based on those with online access at home					
Note: Sample sizes are unweighted. The landline and blended sample percentages are weighted. Other columns are unweighted.					

likely to report owning many types of devices than are landline respondents, reported levels of ownership are only slightly different when the landline sample is combined with the cell phone. Similarly, the percentage who say that they have a social networking profile, and who play games online, are different by only 3 and 2 points respectively in the blended sample compared with the weighted landline sample.

There are somewhat larger differences between the blended estimates and the landline estimates on a question that asked the owners of several types of devices how hard it would be to give up the device. The percentage saying it would be “very hard” to give up their cell phone was 7 percentage points higher in the blended sample than the landline sample, a difference that is statistically significant. For the percentage saying it would be very hard to give up the internet, the blended sample estimate was four points higher than the landline estimate – but this difference is not significant.

Are Some Dual Users “Functionally Cell-Only”?

Methodologically, the easiest way to handle dual users – adults who can be reached either by cell phone or landline phone – is to limit cell phone interviewing to the minority of respondents who are “cell only.” This eliminates the possibility of double-coverage of the dual users because they are included only in the landline sampling frame, and excluded from the cell phone sampling frame.

The data reviewed to this point strongly suggest that the dual users as a whole reached via cell phone and those reached via landline are not so different as to create, in effect, a coverage bias in surveys that use only a landline sample to reach this segment of the population. Yet the question remains as to whether there is a subset of dual phone users who are very unlikely to be reached by landline and therefore may be missed in a landline sample supplemented with a cell only frame. In short, if some dual users are “functionally cell only” they may not be covered by designs that combine landline samples with cell-only respondents.

To gain some traction on the phone usage habits of dual users, the October 2007 and December 2007 political surveys included an additional question asking respondents to identify whether they get more of their telephone calls on their cell or landline phones. Nearly half (47%) of the dual user respondents reached by cell phone say they get more of their calls over their cell

Where you receive more of your calls?	Dual users reached by...	
	Landline %	Cell %
On my cell phone	30	47
A lot more	25	40
A few more/DK	5	7
On my landline phone	43	26
A lot more	35	20
A few more/DK	8	6
Both about equally	26	25
Don't know	1	1
	100	99
N (Oct & Dec combined)	1923	529

phone. In fact, the vast majority of them (40% of all dual users reached by cell) say they get “a lot more” of their calls on their cell phone, not just “a few more.”

Yet it is not at all clear that these respondents are “functionally cell only.” Notably, of the dual users reached on their landline phones, 30% also said they get most of their calls on their cell phone, and 25% said “a lot” more. The fact that they were reached on their landline phone suggests that it is possible, though perhaps more difficult, to reach these respondents on their home phone. Receiving “more calls,” even “a lot more calls” on one’s cell phone does not preclude access over the landline.

Dual Access at the Time of the Call

The December 2007 political survey also included a second question aimed at identifying the accessibility of dual users. Those reached by cell phone were asked “If I had called you just now on your landline phone, would I have been able to reach you?” Those reached on their landline phones were asked the same about being reached on their cell phones “just now.”

The results were nearly identical across samples– 54% of cell phone respondents said they could have been reached at that moment on their landline phone, and 55% of landline phone respondents said they could have been reached at that moment on their cell phones. Even among

	Access Right Now?				
	<i>Dual phone reached by...</i>		<i>Among reached by cell</i>		
	<u>Landline</u>	<u>Cell</u>	<u>Mostly cell</u>	<u>about equal</u>	<u>Mostly land</u>
Could I have reached you <u>just now</u> on your other phone?	%	%	%	%	%
Yes	55	54	47	63	63
No	44	45	52	33	33
Don't know	<u>1</u>	<u>1</u>	<u>1</u>	<u>3</u>	<u>4</u>
	100	100	100	99	100
N (December only)	806	213	102	60	51

cell phone respondents who “receive more calls on their cell phone” than on their landline phone, 47% said they could have been reached at that moment on their landline telephones. When the analysis is narrowed further to those who say they get “a lot more” of their calls on their cell phone (N=87), 44% could have been reached at their landline number at that moment. Even though these duals users are clearly “cell oriented” in their phone habits, many appear to be accessible over their landline phones as well.

Not surprisingly, there is a strong correlation between phone habits and age among dual users. The youngest respondents are far more likely to receive the bulk of their calls on their cell phones, and are substantially more likely to be accessible by cell phone at any given time. For example, 74% of the dual users under age 30 who were reached on their cell phones say they get more calls on their cell phone than on their landline phone. Even so, fully 50% of these respondents say they could have been reached on their landline at that very moment.¹

Moreover, 58% of the younger dual users reached by landline say they get the bulk of their calls on their cell phone. The fact that we reached them on their landline phone suggests that while they are cell oriented, they are not “functionally cell only.”

Young Dual Users Are Least Accessible on Landlines						
	----- Dual users -----					
	Reached by landline			Reached by cellphone		
	18-	30-	50+	18-	30-	50+
Where you receive more of your calls?	<u>29</u>	<u>49</u>	<u>50+</u>	<u>29</u>	<u>49</u>	<u>50+</u>
	%	%	%	%	%	%
Cell phone	58	40	17	74	53	32
Both about equally	25	30	24	16	26	28
Home phone	16	30	58	9	21	38
Don't know	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>0</u>	<u>2</u>
	100	101	100	100	100	100
N (Oct & Dec combined)	240	655	1003	88	212	225
Could I have reached you <u>just now</u> on your other phone?						
Yes	67	56	51	50	49	63
No	33	42	48	50	49	35
Don't know	<u>0</u>	<u>2</u>	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
	100	100	100	100	99	100
N (December only)	98	275	424	42	73	94

Phone Room Effort to Reach Cell Oriented Dual Users

While most dual users can be reached through landline interviewing, an analysis of phone room records finds that the telephone habits of dual users are related to how much effort it takes to reach them. On average, it took 3.7 call attempts to reach each landline respondent in the October 2007 and December 2007 political surveys (both used a 10-call design, with the October survey in the field for 5-nights and the December survey in the field for 15 nights). But those who were landline-only or who were dual users but receive most of their calls by landline were substantially easier to reach. It took, on average, 3.5 attempts to reach landline-only respondents and 3.4 to reach dual users who get

Phone Habits Related to Ease of Contact		
	Avg # of attempts	N
Landline sample	3.7	2596
No cell phone (landline only)	3.5	654
Has cell phone (dual users)	3.8	1923
Most calls on landline	3.4	829
About equal	3.8	510
Most calls on cell phone	4.3	572
Cell phone sample	4.2	841
No landline (cell only)	4.2	312
Has landline (dual users)	4.1	526
Most calls on cell phone	4.0	251
About equal	4.2	132
Most calls on landline	4.3	139

¹ Though note that the sample size of the young group getting this question was very low.

most calls on their landline. By comparison, it took an average of 4.3 attempts to reach dual users who receive most of their calls on their cell phone.²

There is less of a relationship between cell habits and ease of contact within the cell phone sample. Overall, more attempts are necessary to complete the typical cell phone survey (4.2) than the typical landline survey (3.7). While dual users who receive most of their calls on their cell phone were slightly easier to reach than those who get most of their calls on their landline, the differences are not significant.

Overall, while people with both landline and cell phones have diverse phone-use habits, there is no strong evidence that a landline-only sample cannot reach the vast majority of these dual users. Even those who express the strongest orientation toward their cell phones are reachable by landline, with enough phone room effort.

Practical Considerations in Conducting Interviews on Cell Phones

The surveys described here, as well as earlier ones conducted by the Pew Research Center and other survey organizations, demonstrate that it is feasible to conduct random sample surveys by cell phone. But the process is costly, requiring significant additional effort by the survey field house and some additional work in data processing and weighting. Exclusive of the fixed study costs such as CATI programming, pre-testing surveys, and creating demographic banners, cell phone interviews in these surveys cost at least twice as much as the comparable landline interviews.

The size of the cost differential remains in flux and varies across survey vendors. This is a result of the fact that survey field houses are still experimenting with call schedules, interviewer training, appropriate language for introducing the survey, and how persistent to be in trying to make contact with a potential respondent. In the four Pew surveys described here, Princeton Survey Research Associates International reported that interviewer productivity rose significantly from the first of the studies in October 2007 to the

Interview Features		
	Landline <u>sample</u> auto	Cell <u>sample</u> manual
Dialing		
Voice mail message	Yes	Yes
Approximate cost factor	1.0	>2.0
Reimbursement		
October 07 political	none	\$10 or \$20
All others	none	\$10
Mean number of calls for completions [^]		
October 07 political	4.0	4.0
October 07 gadgets	3.5	3.6
December 07 political	3.4	4.3
Underage cases*		
October	0.0% (0/1991)	41.7% (513/1231)
December	0.0% (0/1483)	42.0% (419/997)
Median length		
December	20.0	21.0
*Those under age 18 as a percentage of cooperating numbers. [^] Completed cases only.		

² This analysis is based only upon completed interviews and does not take into account overall levels of effort reflecting refusals, non-contacts, and ineligible cases.

most recent one conducted in January and February of this year. PSRA now estimates that the cost of adding a cell phone component to a survey is roughly twice the cost of the landline component on a per-interview basis. The marginal cost of additional cell phone interviews, once a cell phone component has been established, is also about twice the marginal cost of a landline interview.

In terms of reaching the most critical “cell-only” respondents, previous studies suggest that such interviews cost four to five times more than comparable landline interviews, largely because of the additional screening necessary to locate cell-only respondents.

The cost differential for calling cell phones is a result of several operational differences between calling in the landline and cell sample frames. One of the largest differences results from the fact that, due to federal regulations, telephone numbers in the cell frame must be manually dialed by the interviewer. For landline numbers, an “auto-dialer” is used to take a number from the sample and actually dial it before transferring the call to the interviewer.

Another difference is that a significant number of people reached in the cell frame turned out to be under the age of 18 and thus ineligible for the survey. In fact, more than four-in-ten (42%) of the cell phone respondents who were willing to cooperate with the two political surveys could not be interviewed because they were under the age of 18. None of the cooperating households in the landline frame was excluded because they contained no adults.³ This aspect of the cell sample, along with the fact that the cell phone frame reaches a higher percentage of individuals who do not speak English, meant that the percentage of contacted individuals eligible for the survey was far lower in the cell frame – just 45% and 40% in October and December, respectively, compared with 86% and 85% in the landline frame.

Similar Cooperation and Response Rates		
	Landline <u>sample</u> %	Cell <u>sample</u> %
Response rate		
October political	23	23
October gadgets	21	21
Dec. political	18	22
Mar. 08 economy	18	19
Cooperation rate		
October political	27	28
October gadgets	26	27
Dec. political	23	26
Mar. 08 economy	22	24
Contact rate		
October political	84	83
October gadgets	82	79
Dec. political	82	84
Mar. 08 economy	84	81
Breakoff rate		
October political	12	10
October gadgets	11	23
Dec. political	13	15
Mar. 08 economy	15	16
Eligibility rate		
October political	86	45
October gadgets	84	54
Dec. political	85	40
Mar. 08 economy	96	52
No. of completes		
October political	(1507)	(500)
October gadgets	(1554)	(500)
Dec. political	(1089)	(341)
Mar. 08 economy	(1659)	(754)
<small>Figures computed according to American Association for Public Opinion Research (AAPOR) standard definitions of Response Rate (3), Cooperation Rate (3), Refusal Rate (2), and Contact Rate (2).</small>		

³ This difference reflects the fact that the basic unit in the landline frame is typically the household, from which an eligible respondent is selected for interviewing, while cell phones are usually considered to be personal devices linked to a specific individual.

A third difference is that respondents in the cell frame were offered a modest cash reimbursement to offset the cost of airtime they might incur while taking the survey. Beyond the expenses incurred, the collection of contact information in order to reimburse respondents, and the attendant administrative and processing costs, adds to the overall cost of interviewing in the cell frame. The vast majority of respondents (85% in October and 80% in December) who agreed to participate in the interview provided the necessary name and mailing address to receive the reimbursement.

Finally, sampling costs are higher for cell phone interviews. The cost of the sample itself for the cell phone frame is higher on a per-number basis than for the landline frame. Moreover, the percentage of cell phone numbers yielding a completed interview (5.6% across the four surveys) was slightly lower than for the landline numbers (6.8%), so more cell phone sample is needed for a given number of completions.

Apart from the eligibility rates and the cost differential, however, there were remarkable similarities between the cell and landline samples in several aspects of the fieldwork. The contact and cooperation rates between the cell and landline samples were nearly identical. Similarly, the breakoff rate – the percentage of people who begin the interview but do not complete it – was the same in the three of the four samples (it was 12 percentage points lower in the cell frame of the gadget survey). As a result, overall response rates were nearly identical in all four samples.

A holistic analysis of final case dispositions illustrates why the response rates are similar despite the large differences in interviewing costs. Only one-in-ten working numbers in the October and December political survey cell samples yielded a completed interview. The rate for the landline samples was nearly two times higher (18%). This disparity is primarily a consequence of the substantial ineligibility rate among working cell numbers.

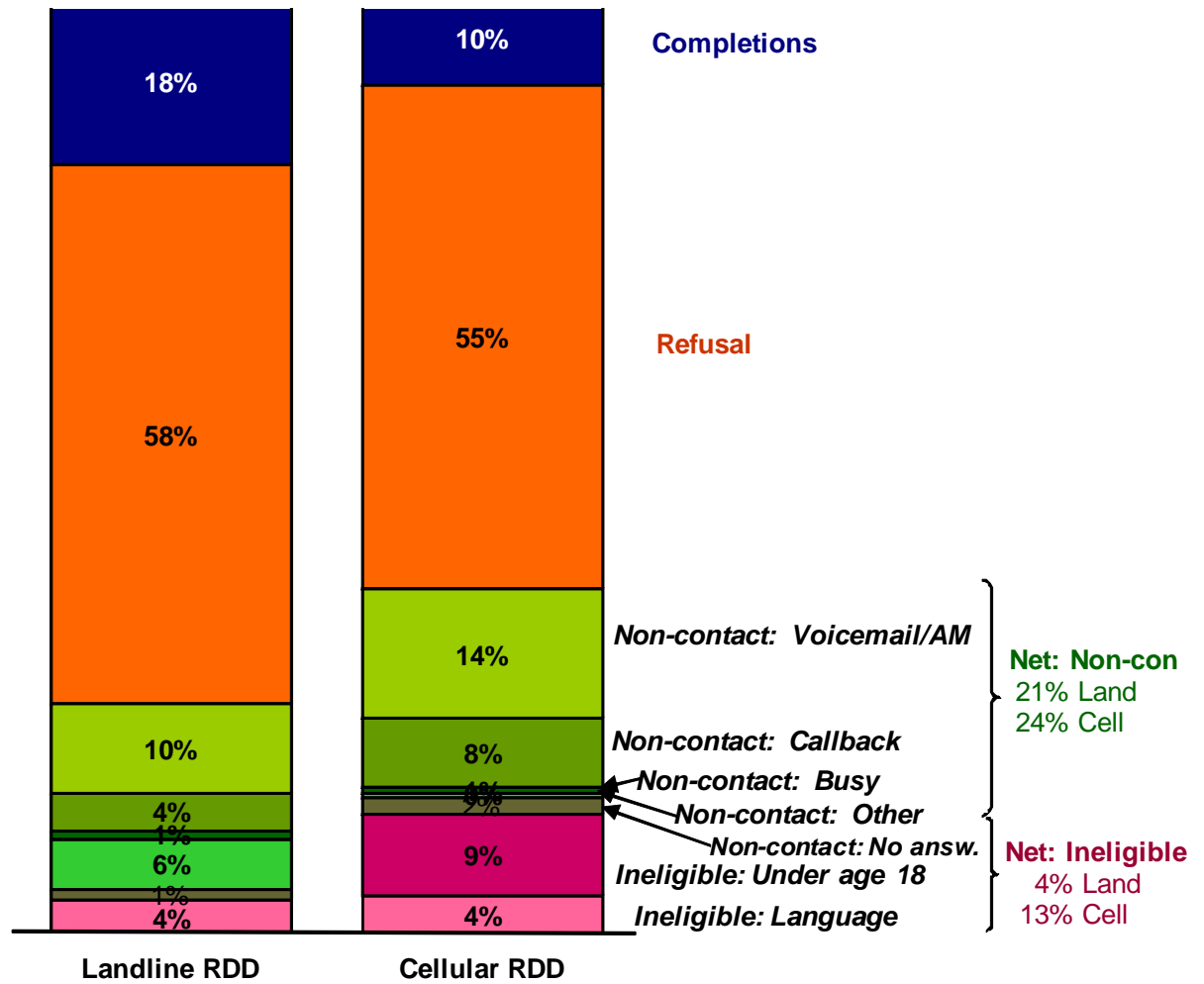


Figure 1. Final Dispositions of All Working Numbers in the Landline and Cell Samples
 Source: Pew October 2007 and December 2007 Political Surveys

Among the remaining numbers, the nature of the nonresponse was quite similar for landline and cell samples. Some 55% of cases in the cell samples explicitly refused to participate, compared to 58% of landline cases. A separate set of cases, which could be thought of as “passive” refusals, are treated as non-contacts in the response rate calculations because eligibility could not be determined. These passive refusals are cases where an answering machine/voicemail message was reached or where the person answering the phone requested that the interviewer call back at another time. Incidence of passive refusing was somewhat greater in the cell samples (14% voicemail, 8% callback) than in the landline samples (10% answering machine, 4% callback).

Interviewer Productivity

A lower eligibility rate and the requirement that cell numbers be hand dialed have the effect of reducing interviewer productivity. We computed a simple measure of productivity by first estimating the total number of hours spent actually conducting interviews (“productive hours”) as the product of the sample size and the average interview length. The interviewer productivity measure is the ratio of the productive hours to the total number of interviewing hours.

Phone Room Productivity by Sample Type

	Total Interviewing Hours	Hours Spent Conducting Interviews ¹	Productivity ²
<u>October Political Survey</u>			
Landline sample	1,291	513	40%
Cellular sample	615	137	22%
<u>December Political Survey</u>			
Landline sample	932	362	39%
Cellular sample	492	120	24%
<u>PIAL Gadgets Survey</u>			
Landline sample	1,271	444	35%
Cellular sample	541	141	26%
<u>2008 Economics Survey</u>			
Landline sample	1,443	616	43%
Cellular sample	901	296	33%
<i>Total for landline samples</i>	<i>4,937</i>	<i>1,936</i>	<i>39%</i>
<i>Total for cellular samples</i>	<i>2,548</i>	<i>694</i>	<i>27%</i>

¹ Average interview length multiplied by the number of interviews.

² Describes percentage of time interviewing respondents, as opposed to time spent dialing phone numbers and screening out contacts.

This interviewer productivity measure was quite stable for landline and cell samples across four recent dual frame surveys conducted for Pew. On average, 39% of interviewer time for landline samples is spent productively on actual interviewing. Interviewer productivity for cell samples is about 27%, nearly a third lower than the landline interviewing mark. This difference in productivity translates directly into higher costs for conducting cell phone samples.

Cell Sample Reimbursement Experiment

The October survey featured an experiment to test the potential impact of different amounts of reimbursement in the cell sample. The experiment was designed to build upon work by Brick and his colleagues (2006) who reported a response rate increase from 18.6% when \$5

was offered to 25.8% when \$10 was offered to cell sample respondents. The October survey tested whether a response rate increase would be achieved with a larger reimbursement. Cell phone respondents were randomly assigned to be offered either \$10 or \$20. There was virtually no difference in the response rate between those offered \$10 and those offered \$20.

In hindsight, the lack of an effect from the reimbursement value may have been attributable, at least in part, to the sequencing of the survey request. In the study reported on by Brick and his colleagues, respondents were notified of the reimbursement very early (the second sentence) in the introduction – before a screener verifying that the telephone number was residential and that the person answering the telephone was at least 18 years old. In the Pew October study, by contrast, the reimbursement was not mentioned until *after* a screener verifying that the respondent was age 18 or older.⁴ Most persons who declined to participate in the October survey did so before answering the age screener. As a consequence, many of the resistant persons who may have been persuaded by a \$10 or \$20 reimbursement were never exposed to the offer. By the time the reimbursement experiment was administered, the pool of persons participating had already been narrowed down to those demonstrating willingness to cooperate by answering the screener question, reducing the effect of the different reimbursement values.

Even though the differential reimbursement did not affect the response rate, there was still a possibility that it influenced the characteristics of the pool of respondents. It would be surprising to observe large differences in the absence of a main effect for the reimbursement level and, indeed, few differences were found. The respondents offered \$10 and those offered \$20 were not significantly different with respect to most demographic characteristics (age, income, race/ethnicity, marital status, parental status) or with respect to telephone usage. The one exception is gender. Just over half (51%) of the respondents offered \$10 were male, but two-thirds (66%) of those offered \$20 were male ($X^2=11.37, p<.001$). Other differences between the two conditions may have emerged had the overall cell sample size been larger. For instance, 29% of those offered \$10 were parents of a young child, compared to 34% of those offered \$20 ($X^2=1.29, p=.25$). Similarly, 23% of those offered \$10 self-identified as Republicans, compared to 28% of those offered \$20 ($X^2=1.38, p=.24$).

A higher reimbursement could also have the effect of motivating respondents to attend more closely to the interview. There was no consistent evidence, however, that those offered \$20 put forth more effort than those offered \$10. Respondents in both conditions were equally

⁴ The sequencing of the reimbursement mention after the age screener precludes random assignment of sample elements to the two conditions. Respondents were not assigned to a reimbursement group until they completed the age screener. As a consequence, separate response rates cannot be computed for the two reimbursement conditions, as reimbursement group assignments do not exist for most of the nonrespondents.

likely to finish the survey, conditional upon answering at least the first question. The completion rate was 90% for both reimbursement groups. Among those who did break-off, there was essentially no difference between the conditions as to where in the questionnaire they terminated the interview. Furthermore, interviewer ratings recorded immediately after each completed interview suggest that respondents in the two reimbursement groups were similar in their levels of cooperation and apparent distraction.

Respondents in the two reimbursement groups were also equally likely to provide a name and address for receipt of the payment. Among those in the \$10 condition, 85% gave their contact information at the end of the survey. The average cost per complete for this group was \$8.45. Similarly, 85% of those in the \$20 condition provided a name and address, which worked out to an average of \$17.02 per completed interview.

Are Dual Frame Designs Worth the Cost?

Although dual frame designs are quite costly, compared with traditional all-landline designs, one potential additional advantage of a dual-frame survey is that it may be more efficient in increasing the representation of the types of respondents who rely more on cell phones. The decline in the number of young respondents – a casualty of the cell-only phenomenon – is one of the most important problems facing the telephone survey community today. Dual frame designs help to correct this problem. For example, 28% of cell phone respondents are under age 30. This is more than double the rate of young adults in landline samples (12%). Thus, a sample of 1,000 cell interviews would yield roughly 280 adults age 18 to 30, while an equally-sized sample of landline numbers would yield roughly 120 adults in this age group. The larger sample sizes greatly improve the precision of estimates based on these groups. The approximate margin of error on an estimate for young adults is 6% with a sample size of 280. With the smaller sample size of 120, the estimate is less reliable and the margin of error is about 9%.

In our January report, we concluded that no mix of landline and cell phone samples could be found that was cost-effective in boosting the representation of certain important subgroups, relative to simply increasing the size of an all-landline sample. At the time, cell phone interviews were estimated to cost approximately three times as much as landline interviews. With the benefit of additional cost and productivity information, we believe that we are now at a break-even point with respect to increasing the yield of young people and Hispanics.

Given the fact that both young adults and Hispanics are approximately twice as likely to be reached in the cell sample, a comparable number of them can be reached using half as many cell phone interviews, holding the total survey costs fixed. The simulation shows two possible dual frame designs – 1,000 landline interviews and 500 cell phone interviews, or 1,200 landline

and 200 cell phone – with a total budget of \$100,000. For this budget, 2,000 landline interviews could be obtained. But the smaller full dual frame study yields more young respondents and about the same number of Hispanic respondents. It does, however, yield fewer African-American respondents, a result of the fact that African Americans are not twice as likely to be reached in the cell phone frame.

A dual frame design with a cell-only sample (1,200 landline, 200 cell-only) can also match the larger landline sample in total yield of young respondents. But it falls a little short in terms of the number of Hispanics interviewed, and significantly short in terms of African American representation.

The other obvious cost of these hypothetical dual frame designs is that the total sample size, and thus the sizes of other important subgroups such as women, registered voters, or older voters, is smaller than in the landline-only design. Thus, coverage of a non-covered segment of the population still comes at a significant cost to the goal of reduction of total survey error. No cost-benefit analysis can decide which side of this tradeoff is more important. But it is worth keeping in mind that one cost of the current all-landline sampling frame design – though impossible to quantify – is to the perceived credibility of survey research in the minds of important constituencies for it, including policymakers, other researchers, the educated lay public, and especially the groups that are, themselves, functionally or actually cell-only.

Over time the cost differential between landline and cell interviews may narrow further. It also is possible that the prevalence of various subgroups may become lower in landline samples and higher in cell samples. Such developments would imply greater sample sizes under a dual frame design (for fixed cost) relative to sample sizes expected under current conditions.

An Illustration: Subgroup Sample Sizes under Landline vs. Combined Designs (budget held fixed)

----- *Landline Sample Only Design* -----
(Budget = \$100,000, Total N = 2,000)

	Expected <i>n</i> landline <u>sample</u>	+	Expected <i>n</i> cell <u>sample</u>	=	Expected <i>n</i> total <u>sample</u>
Total	2,000		0		2,000
Blacks	212		0		212
Hispanics	110		0		110
18-29 yr olds	242		0		242

----- *Combined (Dual Frame) Design* -----
(Budget = \$100,000, Total N = 1,500)

	Expected <i>n</i> landline <u>sample</u>	+	Expected <i>n</i> cell <u>sample</u>	=	Expected <i>n</i> total <u>sample</u>
Total	1,000		500		1,500
Blacks	106		75		181
Hispanics	55		58		113
18-29 yr olds	121		138		259

---- *Dual Frame Design With Cell-Only* ----
(Budget = \$100,000, Total N = 1,400)

	Expected <i>n</i> landline <u>sample</u>	+	Expected <i>n</i> cell-only <u>sample</u>	=	Expected <i>n</i> total <u>sample</u>
Total	1,200		200		1,400
Blacks	127		38		165
Hispanics	66		26		92
18-29 yr olds	145		92		237

Figures are hypothetical and assume a cost ratio of 2-to-1 for the cost of a cell interview versus a landline interview (4-1 for cell-only interviews). The incidence rates of each group in landline and cell samples are based on the October and December political surveys.

ABOUT THESE SURVEYS

The findings in this report are based on four telephone surveys conducted under the direction of Princeton Survey Research Associates International (PSRAI). This table shows field dates and sample sizes for the studies:

Survey	Field dates	Total sample	Landline cases	Cell phone cases
October political	Oct. 17-23, 2007	2007	1507	500
Fall gadgets	Oct. 24 – Dec. 2, 2007	2054	1554	500
December political	Dec. 19-30, 2007	1430	1089	341
2008 economy	Jan. 24-Feb. 19, 2008	2413	1659	754

A combination of landline and cellular random digit dial (RDD) samples was used to represent all adults in the continental United States who have access to either a landline or cellular telephone. Samples were provided by Survey Sampling International, LLC (SSI) according to PSRAI specifications.

Numbers for the landline samples were drawn with equal probabilities from active blocks (area code + exchange + two-digit block number) that contained three or more residential directory listings. The cellular samples was not list-assisted, but was drawn through a systematic sampling from 1000-blocks dedicated to cellular service according to the Telcordia database.

For the landline samples, interviewers asked to speak with the youngest adult male currently at home. If no male was available, interviewers asked to speak with the youngest female at home. This systematic respondent selection technique has been shown to produce samples that closely mirror the population in terms of age and gender. For the cellular samples, interviews were conducted with the person who answered the phone. Interviewers verified that the person was an adult and in a safe place before administering the survey. Cellular sample respondents were offered a post-paid cash reimbursement for their participation.

A two-stage weighting procedure was used to weight these dual-frame samples. A first-stage weight of 0.5 was applied to all dual-users to account for the fact that they were included in both sample frames. All other cases were given a first-stage weight of 1. The second stage of weighting balanced sample demographics to population parameters. The sample was balanced - by form - to match national population parameters for sex, age, education, race, Hispanic origin, region (U.S. Census definitions), population density, and telephone usage. The white, non-Hispanic subgroup was also balanced on age, education and region. The basic weighting parameters came from a special analysis of the Census Bureau's 2006 Annual Social and Economic Supplement (ASEC) that included all households in the continental United States that had a telephone. Based on an extrapolation from the National Health Interview Survey, the cell phone usage parameters were: cell-only = 14%, cell + landline = 60%, landline only = 26%.

The landline sample for the 2008 economy survey also entailed a stratification to increase the number of respondents who were black or Hispanic. The unequal probabilities of selection created by this stratification were corrected in the first stage of weighting for this sample, prior to the application of the sample balancing in the second stage. Where this survey is used in the analysis of unweighted data presented here, the first stage weighting is retained by the second stage weighting is not.

Detailed call disposition and weighting information is available from the authors.

Leah Christian, Research Associate at the Pew Research Center, assisted with data analysis and was a coauthor of the January 2008 Pew cell phone report.

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