

Implications of the Growing Use of Wireless Telephones for Health Care Opinion Polls

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Objective. To assess the effect of wireless telephone substitution in a survey of health care reform opinions.

Data Source. Survey of New Jersey adults conducted by landline and wireless telephones from June 1 to July 9, 2007.

Study Design. Eighty-one survey measures are compared by wireless status. Logistic regression is used to confirm landline–wireless gaps in support for coverage reforms, controlling for population differences. Weights adjust for selection probability, complex sample design, and demographic distributions.

Principal Findings. Significant differences by wireless status were found in many survey measures. Wireless users were significantly more likely to favor coverage reforms. Higher support for government-sponsored universal coverage, income-related state coverage subsidies, and an individual mandate remain after adjustment for demographic variables.

Conclusions. Opinion polls excluding wireless users are likely to understate support for coverage reforms.

Key Words. Survey research, state health reform, wireless substitution

Opinion polls have become a staple of American political and public policy discourse. Dozens of polls sponsored by national news organizations, private foundations, and interest groups were conducted in the run-up to the 2008 presidential election (e.g., CBS News 2007; AARP 2008; Blendon et al. 2008; Harvard 2008; Kaiser 2008). Opinion polling has also figured prominently in state-level health reform discussions (e.g., Blendon et al. 2006). Rising aspirations for reform make it likely that health reform polls will be with us for the foreseeable future. This article examines one important issue underlying the validity of estimates from surveys of health care opinions and support for reform: the role of wireless telephone substitution.

Traditionally, landline telephone sampling frames have been used for health and other public opinion polls. Sample coverage in landline frames was strong until the early 2000s, when it began to erode rapidly. In the first half of 2004, 4.4 percent of adults were “wireless only,” an estimate that reached 17.0 percent by 2008 (Blumberg and Luke 2008). In addition, nearly as many adults (14.4 percent) live in households with landline telephones but receive all or most of their calls on wireless phones (Blumberg and Luke 2008). Combined, these estimates suggest that nearly one in three adults is excluded from or may be underrepresented in traditional landline-only surveys.

There is limited research on the impact of wireless substitution on estimates of opinions about health care reform. One study found no difference between landline and wireless-only respondents in opinions about whether health care would be an important issue in their 2008 presidential vote (Pew 2008a). Available research on correlates of wireless substitution suggests that there may be bias in health reform opinion polls that exclude cellular phone users. Data from the National Health Interview Survey (NHIS) documents that wireless-only users are more likely than those with landlines to be Hispanic or black, low income, young, and medically uninsured (Blumberg and Luke 2008). Wireless-only users also report more health care access barriers, mental health problems, and are more likely to engage in binge drinking and smoking (Blumberg and Luke 2008; Currivan, Roe, and Stockdale 2008). Research on the 2008 election showed a small bias in political ideology and preferences in polls excluding cell phones (Pew 2008b).

Those who have landlines but receive “all or almost all calls . . . on cell phones” fell between wireless-only and landline groups in measures of health behaviors, access, and coverage in the NHIS (Blumberg and Luke 2008). Adults with both landlines and wireless phones who were reached by wireless phone in preelection polls held similar preferences as the wireless-only group (Pew 2008b). These results suggest that individuals with access to landlines but who rely mainly on their wireless phones may be underrepresented in traditional landline-only samples.

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The magnitude of bias arising from wireless substitution depends on the size of the population that cannot be reached by landline and the extent of differences in opinions between landline and wireless groups. This article draws on a 2007 health reform opinion poll conducted in New Jersey to provide an estimate of the size of the population excluded from a landline sample and to measure differences in a broad range of questions between wireless and landline populations. After quantifying the extent of differences across all poll domains, we focus on possible bias in measures related to support for coverage strategies that have been advanced in reform debates at the national and state levels.

METHODS

Data Collection

Data for this analysis are from the New Jersey Health Care Opinion Poll conducted from June 1 to July 9, 2007. A detailed description of sampling, field methods, and the full poll questionnaire is available elsewhere (see <http://www.cshp.rutgers.edu/Downloads/7520.pdf>). In brief, random-digit-dial samples were drawn for landline and wireless telephones. Persons reached by wireless phone were eligible for interview if they lived in New Jersey and said that they did not have a landline phone or relied mainly on their wireless phone. Unlike the NHIS, which asks about the proportion of calls received on wireless phones, respondents with both landline and wireless phones who were reached by cell phone were classified in our poll as “wireless mainly” based on their reported likelihood of answering their landline. Respondents who said they are “not at all likely” or “somewhat unlikely” were classified “wireless mainly.” The poll was developed by the Rutgers University Center for State Health Policy, conducted by Abt SRBI Inc., and funded by the Robert Wood Johnson Foundation. The study instrument and design were approved by the Rutgers University Institutional Review Board.

Adults aged 18 and older were eligible for interviews, which averaged about 20 minutes. Interviews were conducted in English and Spanish. To the extent possible, questions were drawn from major published health reform polls. Respondents were asked about their own health and coverage status, nonhealth concerns (e.g., crime), health-related concerns (e.g., losing coverage), the need for health reform, how closely they followed health reform, values and priorities for reform, support for specific reforms, and sociodemographic characteristics. Within these domains, a total of 78 questions were

asked. Because wireless users typically pay for incoming calls, they were paid US\$10 response incentives. Incentives were not offered to landline respondents. Response rates (RR3, American Association for Public Opinion Research 2008) were similar for the landline (34.4 percent) and wireless (36.2 percent) samples.

A total of 1,104 interviews were completed, including 197 wireless-only and 103 wireless-mainly cases. Weights were developed to account for probability of selection, which varied by number of telephone lines and number of eligible individuals in the household, in both the landline and wireless phone samples. The wireless-only portion of the sample was weighted to an estimate of the proportion of wireless-only adults in the Northeastern United States, trended to 2007 using estimates from the second half of 2004–2006 NHIS (Blumberg and Luke 2007a). Because no population parameter is available for the share of “wireless-mainly” adults, the weight for this segment of respondents was based on the ratio of proportions of wireless-mainly to wireless-only respondents. Weights for those reached by cell phone who reported being “somewhat unlikely” to answer their landline were assigned a weight 0.5 times the landline sample to account for the possibility that they could be reached by landline. The landline sample was weighted to its population parameter minus the estimated size of the wireless-mainly (very unlikely and not at all likely to answer their landline phone). Finally, the resulting weights were adjusted to reflect census distributions of age, sex, and education.

Analysis

Comparisons between the landline and wireless samples are made for 81 measures (78 poll questions plus substate region, urban location, and whether the interview was conducted in Spanish or English). All statistical tests adjust for the complex sampling design using *STATA/SE* version 10.1. Study variables are analyzed in categorical form, and missing values are excluded for most. Where item nonresponse exceeds 5 percent (22 questions), a separate response category is included in the analysis. Comparisons by wireless status of responses to each poll variable are performed using χ^2 -tests. Because of the large number of comparisons, emphasis is given to highly significant differences (e.g., $p < .001$).

Logistic regression is then conducted on reform-related variables for which we observed a significant landline–wireless gap to determine whether the gaps remain significant after controlling for respondent characteristics. Models controlling for variables typically used for demographic weight

adjustment (age, sex, race/ethnicity, and education) are fit, and a second set of models adds adjustments for coverage and health status variables with highly significant ($p < .001$) landline–wireless differences in bivariate analysis.

FINDINGS

We estimate that 22.7 percent of the New Jersey adult population relied exclusively (17.2 percent) or mainly (5.5 percent) on wireless phones at the time of the interview. Of the 5.5 percent that is wireless-mainly, 3.9 percent report that it is “not at all likely” and 1.5 percent report that it is “somewhat unlikely” that their landline would be answered if it rang.

Of the 81 poll measures, we find 11 (13.6 percent) highly significant differences ($p < .001$) between landline and wireless samples. Another 12 (14.8 percent) variables are significant at $p < .01$ and 11 (16.0 percent) at $p < .05$ (Table 1). Sociodemographic variables are most likely to show significant landline–wireless gaps, including half of those variables significant at $p < .001$. There are also highly significant differences in the “respondents’ own health, cost, and coverage” and “need for/following reform” domains. There are no highly significant landline–wireless differences in coverage-related questions, but several are significant at lower levels (i.e., $p < .01$). In comparisons between the wireless-only and wireless-mainly subgroups, only four variables showed significant differences at the $p < .01$ level (none at $p < .001$). (Tabulations of all study variables by landline–wireless and wireless subgroup status as well as full regression findings are available in Appendix SA2.)

Table 1: Number of Significant Differences by Wireless–Landline Status and Poll Domain

Poll Domain	Number of Poll Variables	% Reaching <i>p</i> -Value Threshold		
		$\leq .001$	$\leq .01$	$\leq .05$
Sociodemographic status	16	50.0	6.3	25.0
Own health, cost, and coverage	8	25.0	12.5	37.5
Need for and following reform	7	14.3	14.3	0.0
General worry	7	0.0	42.9	14.3
Priorities for reform	14	0.0	21.4	0.0
Coverage reforms	12	0.0	16.7	25.0
Health worry	7	0.0	14.3	0.0
Other health reforms	10	0.0	0.0	0.0

Source: New Jersey Health Care Opinion Poll (2007).

Table 2 illustrates the sociodemographic, coverage, and health variables that reached the $p < .001$ level of statistical significance in comparisons of wireless–landline differences. The wireless population is disproportionately low income, younger, nonwhite, not married, not living with other adults, self-

Table 2: Sociodemographic, Coverage, and Health Variables with Highly Significant Differences ($p < .001$) by Wireless Status

	<i>Total</i>	<i>Landline</i>	<i>Wireless</i>	<i>p-Value</i>
Income for household				
< US\$35,000	22.5	19.4	33.1	< .0001
US\$35,000–US\$70,000	37.2	36.7	38.9	
Over US\$70,000	40.3	43.9	28.0	
Age group				
18–29	19.5	12.7	42.5	< .0001
30–49	41.1	40.5	43.0	
50–64	23.1	26.0	13.2	
65 and over	16.4	20.8	1.3	
Race/ethnicity				
White, non-Hispanic	63.3	67.8	48.3	< .0001
Black, non-Hispanic	11.7	11.5	12.3	
Hispanic/Latino	18.7	15.6	29.1	
Other	6.3	5.1	10.4	
Marital status				
Married or living with partner	60.7	66.8	39.8	< .0001
Single, never married	24.4	17.7	47.5	
Widowed	6.8	8.4	1.2	
Divorced or separated	8.1	7.1	11.6	
Number of adults in household				
One	17.5	14.4	28.2	< .0001
Two	51.4	53.4	44.5	
Three or more	31.1	32.2	27.3	
Employment status				
Full-time employee	46.2	43.2	56.4	< .0001
Self-employed	10.2	10.6	8.6	
Part-time employee	13.2	13.1	13.6	
Retired	16.6	20.1	4.7	
Not working for pay	13.8	12.9	16.8	
Noncitizen in household	12.0	9.0	22.3	< .0001
Spanish interview	8.1	5.8	15.6	.0001
Health insurance status				
Uninsured	13.9	7.9	34.1	< .0001
Public	19.0	21.9	8.9	
Private	67.2	70.2	57.0	
Number of prescriptions				
0 prescriptions	52.0	47.1	68.6	< .0001
1–2	26.6	28.1	21.4	
3+	21.4	24.8	9.9	

Source: New Jersey Health Care Opinion Poll (2007).

employed or not in the labor force, living with at least one noncitizen, interviewed in Spanish, uninsured, and have no prescription drugs. While reaching significance only at the $p < .01$ level, wireless respondents were also more likely to report difficulty affording health care (and prescription drugs) and to be worried about violent crime, being able to pay their rent or mortgage, and losing their job. Among wireless respondents, those with lower incomes, younger respondents, those interviewed in Spanish, and those most worried about a terrorist attack are more likely ($p < .01$) to be wireless-only.

Three variables reflecting attitudes toward health coverage reform achieved a landline–wireless difference at the $p < .01$ level (Table 3): first, nearly three-fourths of the wireless sample voice support for government-sponsored universal coverage, compared with just under 60 percent of the landline group. Second, nearly half of wireless and about a third of landline respondents voiced “strong support” for a state coverage mandate in which “people with higher incomes who do not have coverage would be required to buy insurance, and the government would help pay for insurance for those who cannot afford it.” Third, nearly three-fourths of wireless users while only about two-thirds of landline respondents favor the proposition that New Jersey should “use tax dollars to help low-income people pay for health insurance.”

To examine whether these findings are explained by underlying population differences, we calculated the relative odds of support for each of the three coverage reforms by wireless status. In models adjusting only for variables typically used in demographic weighting, disproportionate support among wireless users remains significant for all three reforms, with adjusted

Table 3: Reform-Related Variables with Significant Differences ($p < .01$) by Wireless Status

	<i>Total</i>	<i>Landline</i>	<i>Wireless</i>	<i>p-Value</i>
Current system or universal program				
A universal health insurance program	62.4	59.1	73.8	.0003
The current health insurance system	30.7	33.2	21.9	
“Don’t know” or refused	6.9	7.7	4.4	
Individual mandate with subsidies				
Strongly favor	37.4	34.7	46.5	.0068
Somewhat favor	38.6	39.5	35.8	
Somewhat oppose	12.3	13.6	8.0	
Strongly oppose	11.7	12.3	9.7	
State subsidies for low-income uninsured	64.6	62.2	72.6	.0064

Source: New Jersey Health Care Opinion Poll (2007).

odds ratios of 1.51 (favor subsidizing low-income uninsured) to 1.69 (strong or somewhat favor an individual coverage mandate). In models adding controls for additional factors, the relative odds for wireless status drops below significance for support each of the reforms, except public subsidies. Among independent variables in these models, only minority race/ethnicity is consistently associated with support for each of the reforms. In addition, being uninsured is associated with greater likelihood of support for universal coverage and the individual mandate. (Complete regression findings are available in Appendix SA2.)

DISCUSSION

New Jersey residents relying exclusively or mainly on wireless phones are significantly more likely to support government-sponsored universal coverage, income-related state coverage subsidies, and requiring all individuals to have coverage. Differences in support for these policies were 1.7–3.3 percentage points higher in the combined landline–wireless sample than the landline sample alone. These differences remain statistically significant after controlling for factors typically used in weight adjustment, although the gap in support is no longer significant for universal coverage or an individual mandate after adjustment for additional population differences. Other research has shown that demographic adjustment attenuates but does not eliminate wireless substitution bias in health behavior measures (Blumberg and Luke 2007b). Most other wireless–landline population differences that we observed are consistent with prior literature. We found few differences between wireless-only and wireless-mainly samples, although we had limited power to detect such differences.

We estimate that up to nearly a quarter (22.7 percent) of adults in New Jersey would have been missed in a landline-only poll in mid-2007. Most of this population lives in households without landline telephones, but about a quarter of our wireless sample (5.5 percent of adults) is “wireless-mainly.” Our estimate of the size of the New Jersey wireless-mainly population is lower than the national “wireless-mostly” estimate (14.0 percent) for an equivalent period from the NHIS (Blumberg and Luke 2008). This discrepancy may stem in part from the wording of screening questions; the NHIS asks the share of calls received on wireless phones, while we asked about the likelihood that the landline would be answered. It may also reflect regional differences. While we believe that our approach to assuring coverage of the population with both

landlines and wireless phones is reasonable, more research is needed to identify the optimal strategy for polling this population.

There are several other limitations to our analysis. Our results are limited to a single state in a region of the country with lower-than-average wireless substitution. While the response rates of our landline and wireless samples are similar, it is nonetheless possible that there is differential nonresponse bias between our samples. We do not have a way to precisely calculate the probability of selection of our wireless-mainly group or to adjust for the possibility that these respondents could be interviewed in the landline sample. To the extent that this group is represented in both samples, the observed differences potentially would be reduced.

There are additional design considerations facing sponsors of state health opinion polls. First, wireless interviews can cost two to five times more than landline cases (Keeter et al. 2008). The cost differential varies by screening strategies, the amount of response incentives, and other design decisions. Second, wireless telephone numbers are portable across state lines. Interstate portability appears to have been small in our study; only 1.1 percent of wireless users screened were ineligible because they lived outside New Jersey. Nevertheless, this problem is likely to grow over time. Finally, we included wireless-mainly respondents on the premise that they are likely to be underrepresented in landline-only surveys, but our sample size was too small to support analysis of their impact on estimates. Including this group has the potential to reduce the impact of landline frame undercoverage and possibly reduce wireless phone screening costs, but more research on these points is needed.

Wireless substitution has grown rapidly since 2004, and indications are that this trend will continue (Pew 2008b). We find that support for high-profile health reforms would have been biased in our poll had we not sampled wireless users. While the magnitude of the observed bias was modest, we believe that our results suggest that it is prudent to include wireless samples in health opinion polls. Close scrutiny of wireless substitution is called for in light of the dynamic environments of both health care reform and telephone technology.

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REFERENCES

- AARP. 2008. "Divided We Fail's Swing Voter Battleground State Survey." Research Report [accessed on December 18, 2008]. Available at http://www.aarp.org/research/legis-polit/elections/swing_voters.html
- American Association for Public Opinion Research. 2008. "Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys" [accessed on December 14, 2008]. Available at http://www.aapor.org/uploads/Standard_Definitions_07_08_Final.pdf
- Blendon, R. J., D. E. Altman, C. Deane, J. M. Benson, M. Brodie, and T. Burh. 2008. "Health Care in the 2008 Presidential Primaries." *New England Journal of Medicine* 258 (4): 414–22.
- Blendon, R. J., T. Buhr, C. Fleischfresser, and J. M. Benson. 2006. *The Massachusetts Health Reform Law: Public Opinion and Perception*. A Report for the Blue Cross Blue Shield of Massachusetts Foundation, Harvard School of Public Health.
- Blumberg, S. J., and J. V. Luke. 2007a. "Wireless Substitution: Early Release of Estimates Based on Data from the National Health Interview Survey, July–December 2006." National Center for Health Statistics [accessed on December 18, 2008]. Available at <http://www.cdc.gov/nchs/nhis.htm>
- . 2007b. "Coverage Bias in traditional Telephone Surveys of Low-Income and Young Adults." *Public Opinion Quarterly* 71 (5): 734–49.
- . 2008. "Wireless Substitution: Early Release of Estimates from the National Health Interview Survey, January–June 2008." National Center for Health Statistics [accessed on December 18, 2008]. Available at <http://www.cdc.gov/nchs/nhis.htm>
- CBS News and the New York Times (CBS News). 2007. "CBS News/New York Times Poll: U.S. Health Care Politics" [accessed on December 18, 2008]. Available at http://www.cbsnews.com/htdocs/CBSNews_polls/health_care.pdf
- Currivan, D., D. Roe, and J. Stockdale. 2008. *The Impact of Landline and Cell Phone Usage Patterns Among Young Adults on RDD Survey Outcomes*. Paper presented at the 2008 Conference of the American Association for Public Opinion Research, New Orleans, LA.

- Harvard School of Public Health and Harris Interactive (Harvard). 2008. *Debating Health: Election 2008*. Press release, October 1, 2008 [accessed on December 18, 2008]. Available at <http://www.hsph.harvard.edu/news/press-releases/2008-releases/hsph-harris-poll-obama-mccain-healthcare-plans.html>
- Kaiser Family Foundation/Harvard School of Public Health (Kaiser). 2008. "Pre-Election Poll: Voters, Health Care and the 2008 Election." Publication #7829 [accessed on December 18, 2008]. Available at <http://www.kff.org/kaiserpolls/upload/7829.pdf>
- Keeter, S., M. Dimock, C. Kennedy, J. Best, and J. Horrigan. 2008. *Costs and Benefits of Full Dual-Frame Telephone Survey Designs*. Paper presented at the 2008 Conference of The American Association for Public Opinion Research, New Orleans, LA [accessed on April 1, 2009]. Available at <http://pewresearch.org/assets/pdf/cellphone-peoplepress.pdf>
- Research Center for the People and the Press (Pew). 2008a. *The Impact of "Cell-Onlys" on Public Opinion Polling: Ways of Coping with a Growing Population Segment*. Press release, January 31, 2008 [accessed on July 16, 2008]. Available at <http://peoplepress.org/report/391/the-impact-of-cell-onlys-on-public-opinion-polling>
- Research Center for the People and the Press (Pew). 2008b. *Calling Cell Phones in the '08 Pre-Election Polls*. Press release, December 18, 2008 [accessed on December 19, 2008]. Available at <http://pewresearch.org/pubs/1061/cell-phones-election-polling/>

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.

Appendix SA2: Implications of the Growing Use of Wireless Telephones for Health Care Opinion Polls.

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