How Abraham Lincoln Can Improve Your Survey: The Costs and Implications of Offering an Incentive and Mixed-Mode Survey

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ABSTRACT

This paper describes the results of a mixed-mode survey administered to residential customers as part of an ongoing effort since 2002 to monitor the lighting market for the Massachusetts ENERGY STAR® Lighting Program Administrators (PAs) and the Energy Efficiency Advisory Council (EEAC) consultants. The 2014 survey experimented with a prepaid incentive and mixed web/phone data collection method to determine what effect these factors have on response rates, data collection costs, and response bias. This paper reviews the results of the test with prepaid incentives and its impacts on overall survey costs and examines possible explanations for the observed statistically significant differences between web and phone respondents. The analysis of potential response bias explores whether web respondents differ from phone respondents in important demographic ways, and what the nature of the bias suggests for future web/phone survey efforts in lighting and other areas. The paper concludes with a discussion on the advisability of continuing prepaid incentives and mixed-mode data collection approaches.

Introduction

Since 2002, the PAs and EEAC consultants have fielded phone surveys with Massachusetts consumers almost annually (and sometimes semi-annually). While the content and population of interest for these surveys have varied, they have yielded the longest continuous time series of data on residential consumer awareness, understanding, purchase, and use of energy-efficient lighting in the nation.[1] Much of this data will ultimately contribute to revisions of program savings estimates, while other data contribute to a broader assessment of the market as the Energy Independence and Security Act of 2007 (EISA) implementation moves forward. The survey results allow the Massachusetts PAs and EEAC consultants the opportunity to understand impacts associated with the implementation of EISA and the introduction into the market of omnidirectional LEDs designed to replace incandescent bulbs in Massachusetts's residential lighting market.

The 2014 wave of the consumer survey sought to test the effect of two data collection methods: 1) using a prepaid five-dollar incentive and 2) using mixed-mode delivery—i.e., either by phone or web-based survey. The evaluation team randomly assigned respondents to one of four experimental groups: 1) web/phone, no incentive; 2) web/phone, five-dollar prepaid incentive; 3) phone only, no incentive; and 4) phone only, five-dollar prepaid incentive. The purpose of this experimental manipulation was to test the impact of the different data collection methods on response rates and to determine whether responses differed for any of the assigned groups.

Design and Methodology

The evaluation team obtained customer lists from the PAs and randomly selected approximately 3,000 households using a stratified sample design based on the proportion of the population served by

[1] The 2014 survey effort was part of the 2014-2015 residential lighting evaluation conducted by a team of evaluators led by Cadmus; NMR served as the lead subcontractor on this effort, with Tetra Tech leading the survey data collection.

each PA. The evaluation team then randomly assigned respondents to one of the four experimental groups mentioned above.

All potential respondents received an advance letter explaining the purpose of the survey, asking them to participate, and providing phone numbers to call for more information. Respondents assigned to the prepaid incentive groups also received a five-dollar bill with their advance letter. Individuals assigned to the web/phone survey group received an advance letter that included a link to a website where the respondent was required to enter a unique ID to complete the survey online, and he or she had roughly ten days before being contacted to complete the survey via phone. When calling potential respondents, we made a minimum of eight attempts over different times of the day, days of the week, and weeks of the month in an effort to increase the response rate and achieve as representative a sample as possible. To further increase response rates and population coverage, we fielded the survey in Spanish as well as English.

The team weighted the consumer survey data by education and home ownership status so that the reported results would better reflect the characteristics of all households in the state. This weighting scheme was comparable to those used in previous survey waves. Where applicable, the team tested differences among groups defined by several variables, including survey recruitment method and survey completion method, for statistical significance. These findings, among others, are presented below. The remainder of this section discusses the impact of these different data collection methods on response rates, survey cost-effectiveness, and survey responses.

Response Rates

The final survey data represented 940 households, with an overall response rate of 20% and a 2.7% sampling error.[2] Table 1 below shows response rates by recruitment groups. Offering a prepaid incentive appears to have doubled response rates (29% vs. 14%), but the survey mode (i.e., whether the respondent was offered the web/phone or phone-only option) did not seem to have an effect (about 15% for each survey mode). Moreover, the overall refusal rate for those who received an incentive was slightly lower (11%) than for those who did not receive an incentive (15%).[3]

An examination of key lighting market indicators in the survey (such as bulb familiarity and use) revealed some statistically significant differences across the four data collection groups. For the most part, the differences observed across these groups occurred between the phone and web/phone subsamples. Further analysis indicated that these differences were largely due to the mode by which respondents completed the survey (i.e., by web or by phone), as described in more detail in the Response Bias section of this paper. The results did not exhibit consistently significant differences in responses related to whether or not the respondent received the prepaid incentive, so it appears that offering the incentive introduced little or no bias toward individuals' responses to the survey questions.

[2] Twenty percent of the initial starting sample consisted of households where the team could not find a working telephone number after directory assistance. If these cases are dropped from the starting sample, the response rate was 25%.

[3] The survey asked to talk with the person associated with the account. This is the same person to whom the incentive was mailed.

Table 1. Survey Recruitment Group and Response Rates

Recruitment Group	Number Sampled	Number Complete	Response Rate
Web/phone, incentive	1,039	322	31%
Web/phone	1,200	185	15%
Phone only, incentive	760	198	26%
Phone only	1,701	235	14%
Total	**4,700**	**940**	**20%**
Incentive Group	*1,799*	*520*	*29%*
Non Incentive Group	*2,901*	*420*	*14%*

Cost-Effectiveness

Based on the actual rates of completion for the web/phone recruitment groups with and without an incentive, we estimate that achieving a total of 600 completions without an incentive would have cost $47,200 (or $79 per completed survey), whereas reaching the full 600 completions with the group receiving the incentive would have cost $27,244 (or $45 per completed survey) (Table 2).[4] In other words, the estimated cost of using a prepaid incentive is about $33 *less* per completed survey when compared to not using the prepaid incentive. Interviewer success rates were far higher with the incentive than without the incentive, making the non-incentive strategy more expensive in the end. Extra costs for the non-incentive group are driven primarily by repeated attempts to secure and complete the survey with respondents. These additional costs cover staff and related resources needed to release more sample and conduct more attempts per sample point, increasing the costs above those of sending the prepaid incentive to all potential respondents. It should be noted that the prices per completions are based on the hourly rates of the evaluation survey firm, its particular calling practices (e.g., number of attempts before dropping a number from the sample), and the number of letters mailed; costs—and cost effectiveness—would differ for firms with different rate structures, calling practices, or study designs.

Table 2. Cost for Web/Phone With and Without Prepaid Incentives – Estimates for 600 Completions

Recruitment Group	Interviewing Hours	Cost			
		Interviewing	Letter, Incentives	Total	Per Complete
Web/phone, no incentive	1,600	$43,200	$4,000	$47,200	$78.67
Web/phone, incentive	564	$15,228	$12,016	$27,244	$45.41

Response Bias

Response bias is a general term meaning that conditions or factors that occur during the process of responding to surveys can affect the way that responses are provided (Lavrakas, 2008). As noted above, an examination of responses based on survey completion group reveal significant differences between web and phone respondents. In general, web respondents were more likely to report higher levels of awareness of and familiarity with CFLs and LEDs, and they generally were more knowledgeable about key lighting concepts; phone respondents reported higher levels of satisfaction

[4] These amounts include direct costs only, namely interviewer time and the costs of mailings and incentives. Costs for protocol development, programming, training, etc., are in addition to these but also fairly consistent between web/phone and phone only designs.

with CFLs and LEDs. Based on the differences in these areas, we further explored whether there were any demographic differences between the two completion groups. We found that web respondents were more likely to live in single-family homes, own their residence, and have higher levels of education. The results regarding self-reported income were mixed due to a high proportion of web respondents who chose not to answer the question regarding their household income; phone respondents had the same option to refuse to answer such questions but did not do so. While there were some differences when comparing results of the incentive and no-incentive groups, these differences did not indicate a consistent pattern.

Bulb Familiarity. The consumer survey included a series of questions regarding respondents' awareness of and familiarity with energy-saving bulbs (see Figure 1). Respondents were first asked to indicate whether they were aware of CFL bulbs. If they stated that they were not aware of CFLs (with either a "no" or "don't know" response), they were read a description of a CFL and asked to confirm whether or not they were aware of this bulb. Web respondents had an additional opportunity to confirm whether they were indeed aware after being shown a picture of a CFL. If respondents indicated that they were aware of these bulbs, they subsequently were asked how familiar they were with CFLs.[5] All respondents were asked to report how familiar they were with LED and halogen bulbs. Individuals who completed the survey via the web were additionally shown a picture of each bulb as a visual aid when responding to the questions regarding their familiarity with LED and halogen bulbs.

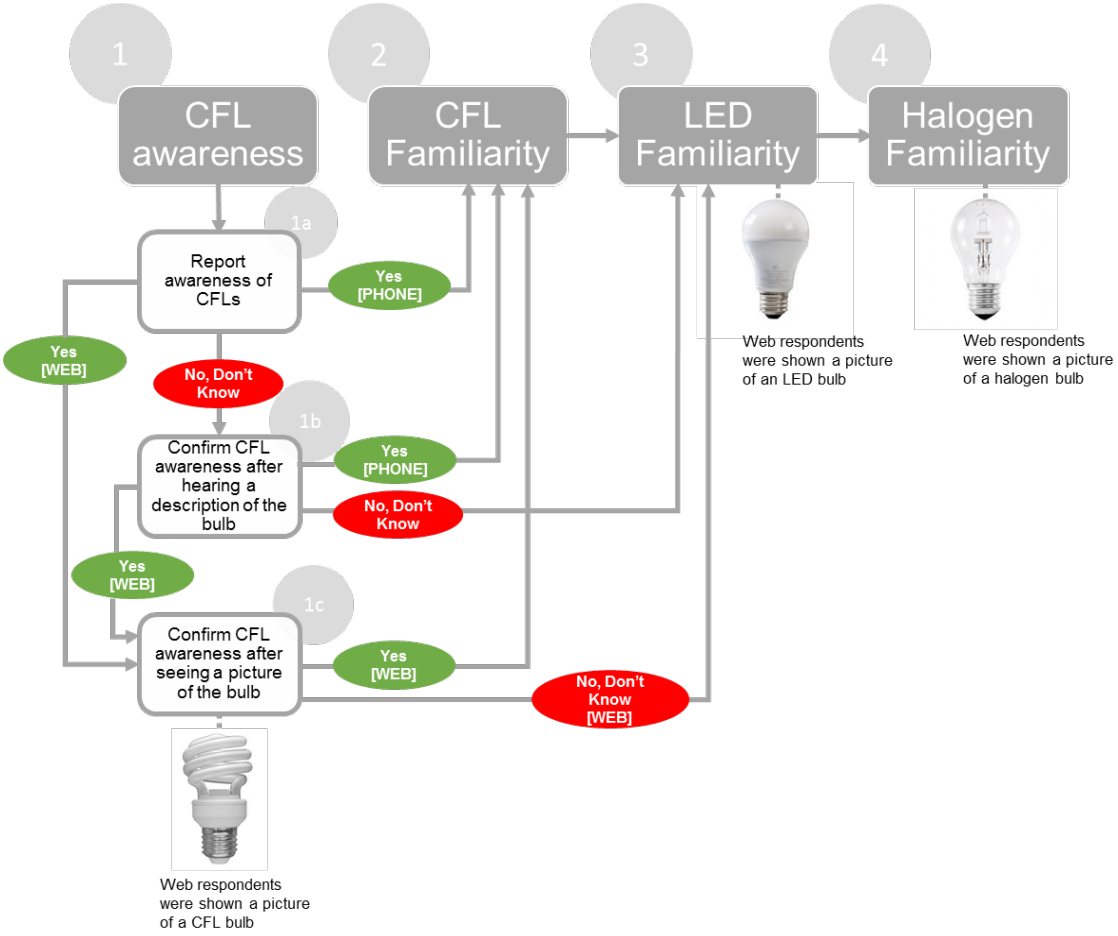

Figure 1. Structure of Survey Items Pertaining to Bulb Awareness and Familiarity

[5] Just one individual changed his/her response from "yes" (aware) to "no" (unaware), which is reflected in the results presented here.

Individuals who completed the survey via the web were significantly more likely than those who completed the survey via the phone to report having higher levels of awareness of CFLs and familiarity with both CFLs and LEDs (see Figure 2). Ninety-eight percent of web respondents compared to 85% of phone respondents reported that they were aware of CFLs. Analysis of the follow-up question regarding CFL familiarity showed that 77% of web respondents compared to 62% of phone respondents stated that they were somewhat or very familiar with CFLs. Web respondents similarly reported statistically significant higher levels of familiarity with LEDs. Seventy-one percent of web respondents compared to 50% of phone respondents stated that they were somewhat or very familiar with this bulb. The team initially posited that this significant difference in results between web and phone respondents might have been associated with web respondents being shown a picture of the bulbs. However, the fact that web respondents had already voiced higher awareness of CFLs *before* being shown the picture raised doubts about this explanation (see 1b in Figure 1 above). Results from a subsequent survey wave has confirmed that these and other disparities in findings are more likely a result of differences between the characteristics of phone and web respondents, as explained in more detail later in this paper.

In contrast to CFLs and LEDs, the proportion of web and phone respondents who were somewhat or very familiar with halogens was very similar (61% versus 59%). The lower levels of familiarity may be due to consumers' inability to distinguish halogen bulbs from incandescents because of their similar appearance. The team was not able to determine why web and phone respondents' results regarding the familiarity of halogens did not diverge as they did with CFLs and LEDs.

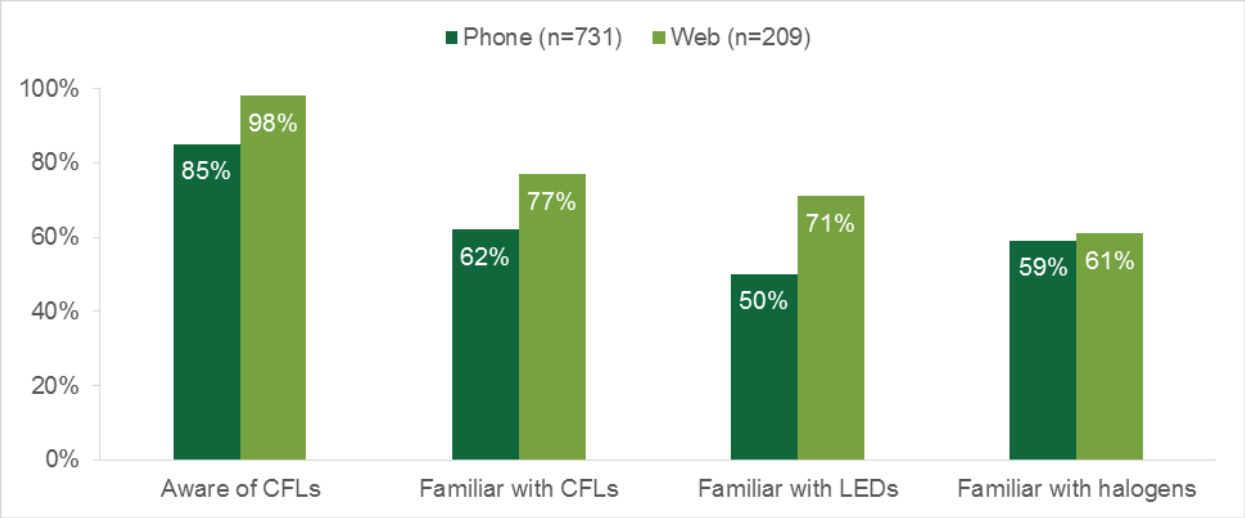

Figure 2. Awareness of and Familiarity with Energy-Saving Bulb Type by Survey Completion Group[6]

Judgments about Relative Energy Use. As a further assessment of respondents' bulb awareness and familiarity, individuals who indicated that they were somewhat or very familiar with both CFLs and halogens were asked which bulb type used less energy to produce light. The majority of both phone and web respondents correctly noted that CFLs use less energy than halogens (Table 3); however, web respondents were significantly more likely to provide the correct response (74% vs. 64%) and significantly less likely to state that halogens use less energy (4% vs. 13%). Although more phone respondents were slightly more likely to say that the bulbs use about the same amount of energy or that they did not know the correct response, these differences between phone and web respondents were not statistically significant.

[6] Web respondents' answers regarding CFLs and LEDs are significantly different from phone respondents' at the 90% confidence level.

Table 3. Judgments about Relative Energy Use by Survey Completion Group

Response Option	Completion Group	
	Phone	**Web**
Sample size	331	104
CFLs use less energy*	64%	74%
Halogens use less energy*	13%	4%
They use about the same	12%	7%
Don't know	11%	15%

Items marked with an asterisk indicate categories where results of web respondents are significantly different from those of phone respondents at the 90% confidence level.

EISA Awareness. The consumer survey asked respondents whether they were aware of EISA, which restricts the sales of incandescent bulbs. Web respondents were significantly more likely to state that they were aware of this law. As Figure 3 shows, 65% of web respondents compared to 49% of phone respondents indicated that that they were aware of EISA.

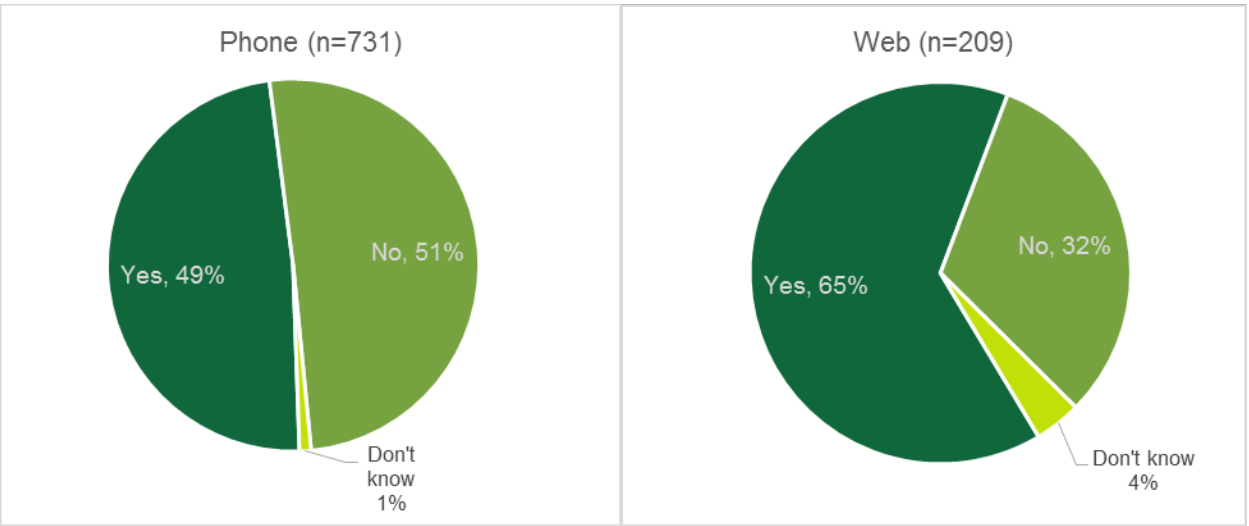

Figure 3. Awareness of EISA Law by Survey Completion Group[7]

Bulb Satisfaction. Although web respondents reported overall higher levels of familiarity with CFLs and LEDs as well as greater lighting knowledge, phone respondents were more likely to report higher levels of overall satisfaction with these energy-saving bulbs. The consumer survey asked respondents who indicated that they currently or previously used CFLs to rate their satisfaction with CFLs. As shown below, web respondents were less likely to indicate that they were "very satisfied" with CFLs (27% vs. 37%, respectively) and equally likely to say they were "somewhat satisfied" with CFLs (38% for each).

Individuals who reported using LEDs were also asked about their satisfaction with these bulbs (see Figure 4). While just under one-half of both web and phone respondents indicated that they were "very satisfied" with LEDs, the two groups diverged in terms of whether they said they were "somewhat satisfied" or "neither satisfied or dissatisfied," suggesting that at least some web respondents have mixed feelings about LEDs.

[7] Results for web respondents are significantly different from those of phone respondents at the 90% confidence level.

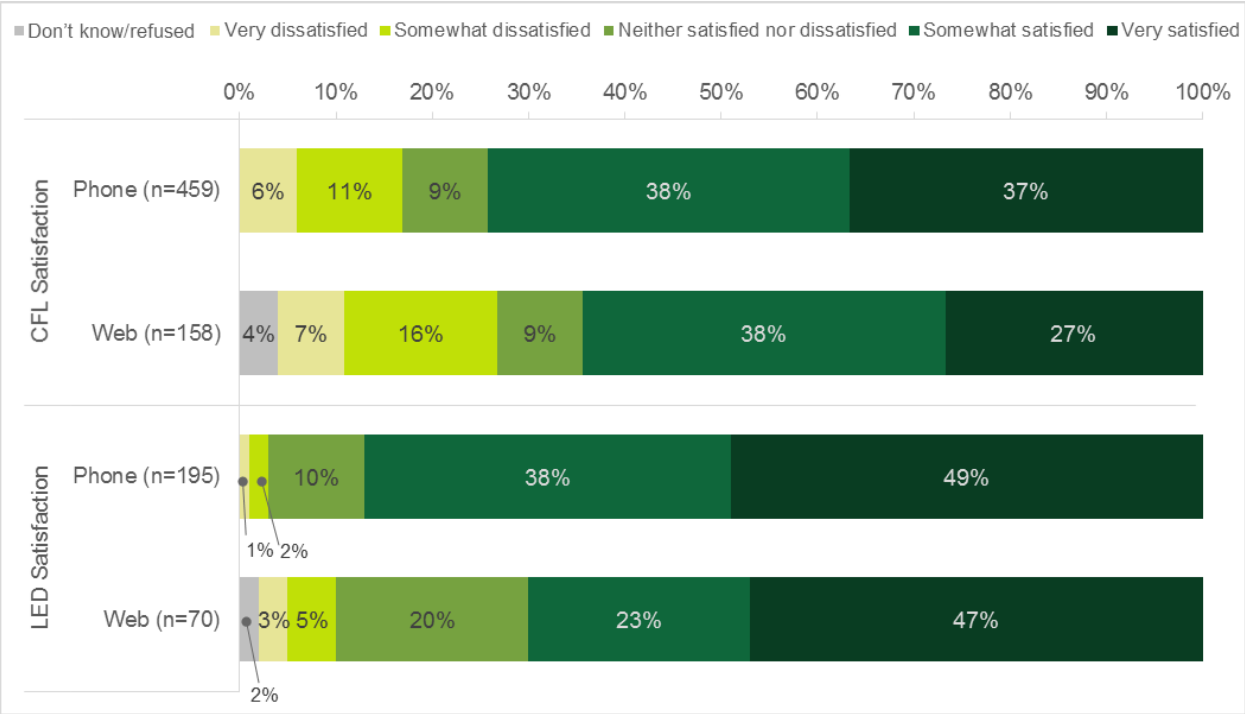

Figure 4. Bulb Satisfaction by Bulb Type and Survey Completion Group[8,9]

Demographic Differences. In light of the differences in responses between web and phone respondents, we explored whether there were any demographic differences between the two samples. The consumer survey collects a standard battery of demographic questions that help assess the nature of the sample. Examining a series of questions regarding respondents' housing, education, and income reveals a few patterns.[10] Web respondents were more likely to live in single-family homes, own their homes, and have obtained higher levels of education. Although a greater proportion of phone respondents reported lower levels of income, the significantly higher proportion of web respondents who chose not to report their income makes it difficult to draw a firm conclusion on differences in income between these two groups. Research has shown that internet access is strongly correlated with household income (as well as educational attainment and age) (Zickuhr, 2013).

The consumer survey asked respondents about the type of home in which they live. As Figure 5 reveals, a statistically significant portion of web respondents compared to phone respondents reported living in a single-family detached house (59% and 40%, respectively), although equal proportions reported that they lived in a single-family attached house (9% for each group). In contrast, phone respondents were statistically more likely than web respondents to report living in a multifamily dwelling—either an apartment building with two to four units (21% vs. 13%) or a building with five or more units (24% vs. 15%).

[8] For CFL satisfaction, phone respondents who reported "very satisfied" or "don't know" are significantly different from web respondents at the 90% confidence level.

[9] For LED satisfaction, phone respondents who reported "somewhat satisfied," "neither satisfied nor dissatisfied," or "very dissatisfied" are significantly different from web respondents at the 90% confidence level.

[10] In order to reflect the actual demographic makeup of the sample, these results were not weighted.

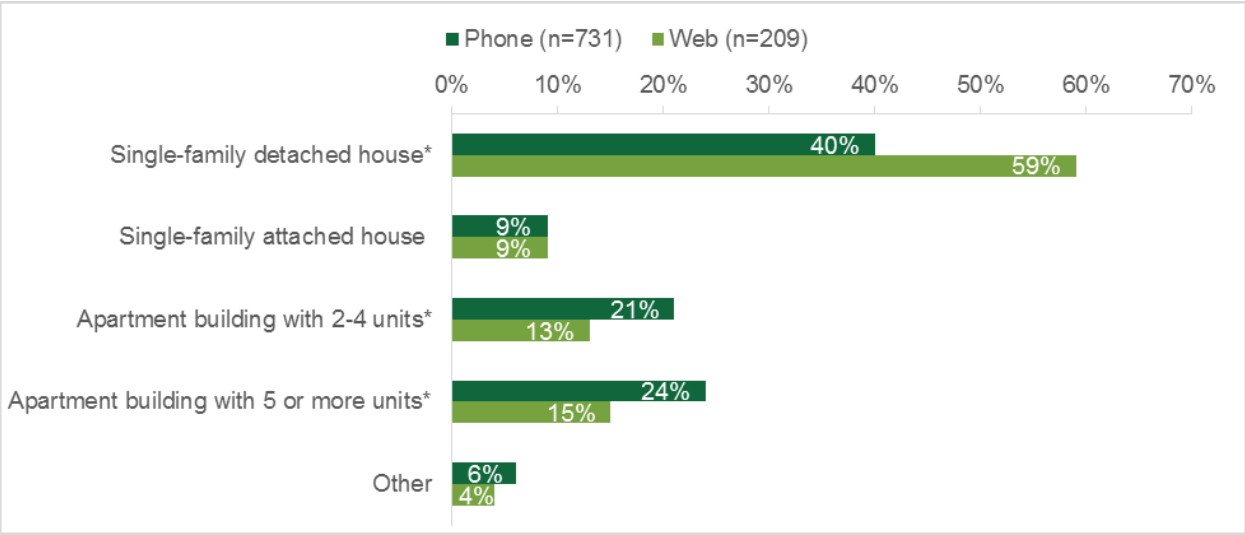

Figure 5. Type of Home by Survey Completion Group[11]

As expected, based on responses to the survey item regarding the type of home in which the respondent resides, the survey results also revealed that web respondents were more likely than phone respondents to report owning their home. Seventy-three percent of web respondents compared to 61% of phone respondents stated that they own or were in the process of buying their home. On the other hand, 23% of web respondents compared to 38% of phone respondents indicated that they rent or lease their residences.

Table 4. Ownership of Occupied Homes by Survey Completion Group

	Completion Group	
Housing Tenure	**Phone**	**Web**
Sample size	731	209
Own/Buying*	61%	73%
Rent/Lease*	38%	23%
Occupied without Payment or Rent	1%	1%
Refused*	0%	1%

Items marked with an asterisk indicate categories where results of web respondents are significantly different from those of phone respondents at the 90% confidence level.

When asked about their educational attainment, web respondents reported higher levels of education than phone respondents (Figure 6). Sixty-nine percent of web respondents compared to 57% of phone respondents reported having a bachelor's degree or higher.

[11] Items marked with an asterisk indicate categories where results of web respondents are significantly different from those of phone respondents at the 90% confidence level.

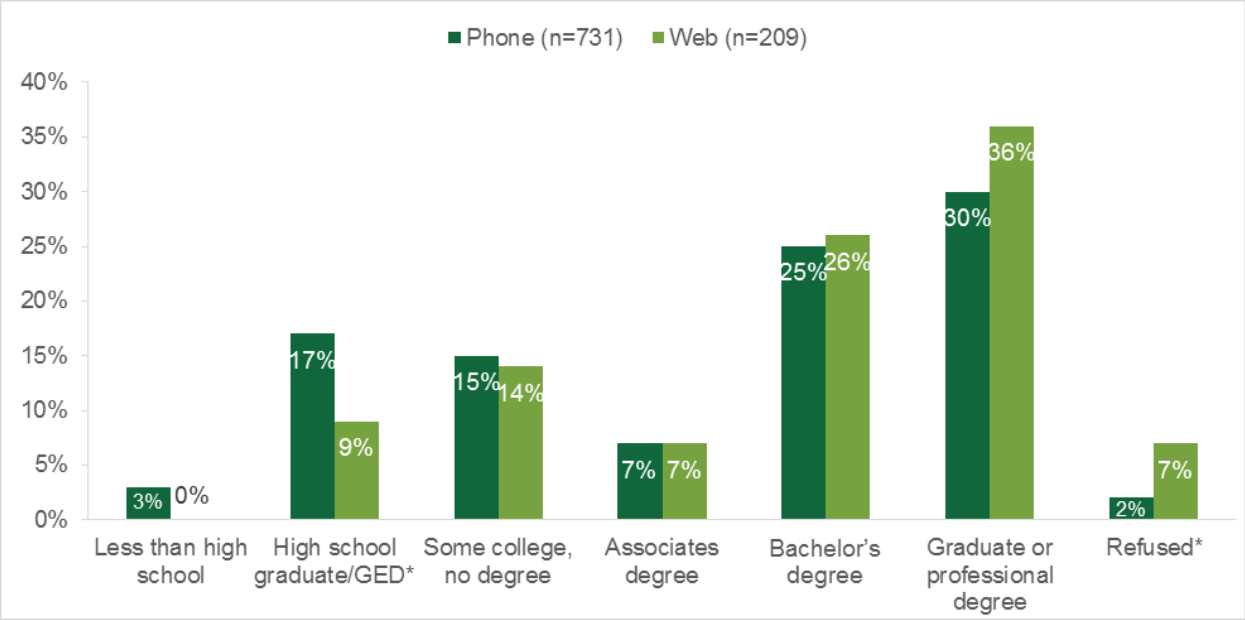

Figure 6. Highest Level of Education by Survey Completion Group[12]

The results from respondents' self-reported income are mixed. The consumer survey asked individuals to report their household income in two ways. First, using the eligibility requirements for the Massachusetts Low Income Heating Assistance Program (LIHEAP), we designated a number of cutoff points for low-income and non-low-income households. When individuals responded to the survey, they were asked, based on the size of their household, if their total household income was above or below these thresholds. The second way that respondents reported their income was to indicate whether their income fell within a range of listed income levels.

As Figure 7 and Table 5 show, a greater proportion of phone respondents fell into the low-income category and reported incomes at the lower end of the scale. However, the proportion of phone and web respondents who were designated as non-low-income and at the higher end of the income scale are fairly comparable. In both instances of the income-related questions, a sizable proportion of web respondents chose not to self-report their income level. Thirty-one percent of web respondents compared to 16% of phone respondents chose not to answer the first income question. Forty-four percent of web respondents compared to 16% of phone respondent refused to answer the second income question.

[12] Items marked with an asterisk indicate categories where results of web respondents are significantly different from those of phone respondents at the 90% confidence level.

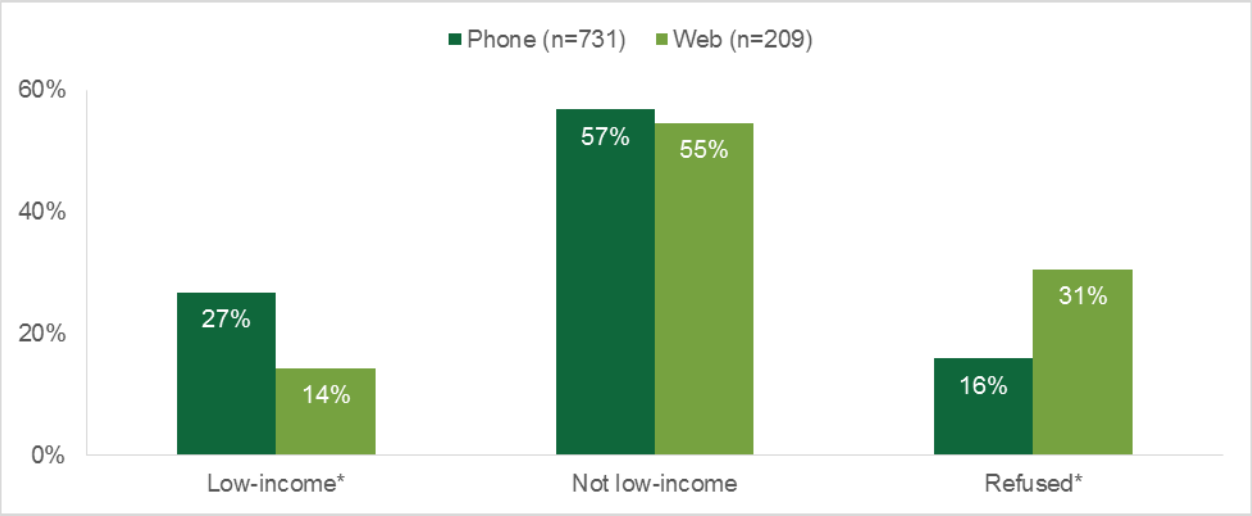

Figure 7. Income Level by Survey Completion Group[13]

Table 5. Household Income by Survey Completion Group

	Completion Group	
Housing Tenure	**Phone**	**Web**
Sample size	*731*	*209*
Less than $15,000*	6%	2%
$15,000 - $20,000	5%	2%
$20,000 - $30,000*	9%	2%
$30,000 - $40,000	7%	4%
$40,000 - $50,000	8%	8%
$50,000 - $75,000*	16%	7%
$75,000 - $100,000	11%	9%
$100,000 - $150,000	13%	11%
≥ $150,000 or more	8%	11%
Refused*	16%	44%

Items marked with an asterisk indicate categories where results of web respondents are significantly different from those of phone respondents at the 90% confidence level.

Results from Additional Research

A more recent survey effort sought to clarify and explain the differences between phone and web respondents (NMR, 2015). For the 2015 survey wave, the evaluation team continued using the prepaid incentive and multi-mode survey, but administered two versions of the web-based survey—one that included pictures of the various bulbs and one that did not. Removing the image of the bulbs from the web survey was a way to test the impact of the image on responses and compare both web groups with phone survey respondents. In addition, the evaluation team included items to collect additional demographic information and to assess respondents' comfort with and use of technology in general. Results from the 2015 survey mirrored the 2014 findings related to the disparities in results between web and phone respondents for bulb awareness and familiarity, general lighting knowledge, and bulb

[13] Items marked with an asterisk indicate categories where results of web respondents are significantly different from those of phone respondents at the 90% confidence level.

satisfaction. Importantly, the results from this effort indicate that the pictures of the bulb on the web survey **did not** influence results for web respondents—that is, web respondents differed from phone respondents on key indicators, but web respondents did not differ on such responses regardless of whether they were shown a picture of the bulbs. Instead, the 2015 survey results show that these variations are most likely due to demographic differences between the two groups. There is also preliminary evidence that web respondents are slightly more tech-savvy than phone respondents, which may influence their responses to certain questions regarding their knowledge and use of energy-efficient bulbs. Future efforts may further tease out the distinctions between phone and web respondents.

Conclusions

The design of this study provides valuable information regarding the use of prepaid incentives and multiple data collections modes for a traditional telephone survey. The prepaid incentive nearly doubled response rates (37% vs. 19%) and improved the overall cost-effectiveness. The higher response rate means that the estimated cost of using a prepaid incentive is about $33 *less* per completed survey when compared to not using the prepaid incentive. However, the cost-effectiveness depends in large part on the firm used and the study design, so the approach may not be cost-effective in every case. The multi-mode administration revealed evidence of response bias among the subsamples because the web and phone respondents exhibited statistically significant differences on key indicators such as familiarity with and knowledge of energy-efficient lighting. Overall, the data indicated that differences among subgroups were related to the mode by which the respondent completed the survey and were not due to the incentive.

Through this study, the evaluation team has shown that prepaid incentives result in superior response rates at a lower cost, which is consistent with established literature that demonstrates that cash incentives can be cost-effective and maximize survey response across varied populations and survey designs (Dillman, 2000; Singer, 2002). It is also consistent with energy efficiency research regarding experiments with incentives and survey delivery mode (Pom & Rathbun, 2013; Buhr, Greco, & Arnold, 2015). Ultimately, response rate and cost alone should not determine survey design or the selection of mode. The quality of the sample frame, representativeness of achieved samples, questionnaire content and complexity, and the importance of an interviewer to elicit thorough responses are just a few of the factors that should inform survey design.

This study raises key considerations for survey research. Prior to starting survey research that uses prepaid incentives, it is important to estimate the range of costs based on differential response rates and the amount of the incentive. When collecting data via phone and web, researchers may want to take steps to achieve representative results from the sample and reduce biased results. This could be done in a number of ways. When designing the sample, the research team could target certain groups based on demographics or other characteristics to ensure comparable representation between web and phone respondents. When designing the instrument, the research team could include demographic screening questions that a respondent is likely to answer early in the survey; these questions could serve as proxies for other desired targeted demographics for either subsample. For example, educational attainment and housing type will likely be highly correlated with age, home ownership, and income. During the analysis, the data could be proportionally weighted by demographic or other respondent characteristics to ensure the expected representation of either subsample. This study adds to the growing body of research showing the opportunities and challenges with using prepaid incentives and multi-mode surveys, topics that survey researchers will undoubtedly continue to explore as they seek to understand better the implications of these data collection methods and their potential applications to other areas of energy efficiency evaluation.

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