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Mixed-Mode Surveys Compared with Single Mode Surveys: Trends in Responses and Methods to Improve Completion

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**MIXED-MODE SURVEYS COMPARED WITH SINGLE MODE
SURVEYS: TRENDS IN RESPONSES AND METHODS TO IMPROVE
COMPLETION***

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ABSTRACT

This paper reviews recent trends in modes of conducting surveys and presents results from a series of experiments comparing different approaches for collecting survey data and improving response rates in general population studies. The modes examined include the telephone, mail, and a mixed-mode method which combines mail with Web data collection. A series of studies were conducted by the Oregon State University Survey Research Center from 2006-2014 using probability samples of Oregon residents. Response rates and the percent of respondents completing the questionnaires by Web were compared. The results showed that response rates were increased by modifying the cover letter to emphasize the cost savings of an online response, adding a fifth contact, and limiting instructions for respondents. A mixed-mode approach, providing only a Web link, resulted in more respondents replying by Web as compared with individuals given an option of completing the questionnaire by Web or mail. The demographics of the respondents, as compared with the general population, varied across each mode.

The range of available methods for conducting surveys has expanded greatly over the recent decades (de Leeuw, Jox, and Dillman 2008). Concurrently, theoretical models to describe factors influencing survey response rates and data quality have been developed (Cavusgil and Elvey-Kirk 1998; Dillman 1978; Groves, Singer and Corning 2000). In a general sense, the decision of a recipient to respond to, or to ignore, a survey request is an example of social exchange theory, in which the actions of an individual depend on the balance between the perceived rewards and the costs incurred (Dillman 1978). Recognizing that multiple interacting factors may influence a decision to participate in a survey, Groves et al. (2000)

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proposed a ‘leverage-saliency’ theory of participation that can help explain why particular survey features may attract some recipients to participate but not others. From these theoretical considerations, it follows that there can be advantages in offering a survey in more than one mode, and this may be done either sequentially (e.g., mail followed up with telephone contact to non-respondents) or as a mixed-mode survey (offering completion by mailing a questionnaire or responding online). De Leeuw (2005) reviewed some strengths and weaknesses of mixed-mode survey designs and emphasized the need for carefully designed experiments to investigate factors such as the influence of modes on data quality, the impact of mixed-mode designs on response rate, and bias changes that may be associated with demographics and costs.

In this paper we present results from several experiments conducted within a survey repeated over multiple years. In the experiments we made controlled changes in the survey methodology presented to a randomized fraction of the recipients. Here, we analyze the results to explore influences on unit response rates and demographics, and we discuss our findings concerning the theories mentioned earlier. Before describing the experiments, we review recently emerging challenges in methods used for conducting surveys, discuss the opportunities and disadvantages in using the World Wide Web (i.e., Web) for surveys, and consider the additional benefits of conducting surveys using mixed modes, e.g., Web and mail.

METHODS FOR OBTAINING SURVEY RESPONSES

Telephone Surveys

Over the past few decades, the overall rate of response for all survey methods has slowly decreased (Connelly, Brown, and Decker 2003; Curtin, Presser, and Singer 2005; Dillman, Smyth, and Christian 2014; Pew Research Center 2012; Sinclair et al. 2012). Historically, face-to-face interviews were the preferred mode, but the high expense and inefficiency associated with this mode severely decreases its feasibility (de Leeuw 2005). Telephone surveys using landlines have become common over the last 50 years, but recently more of the population has switched from using a landline to using a wireless telephone. Blumberg and Luke (2015) estimated that approximately 48% of American households had wireless-only telephones during the second half of 2015, and the trend is continuing to increase. Therefore, obtaining a simple random sample that reflects the demographics of the general population from landline telephone surveys is not possible. Demographically, differences exist in wireless-only households. For example,

MIXED-MODE SURVEYS VERSUS SINGLE MODE SURVEYS 9

Blumberg and Luke (2015) show that those living in wireless-only households are more likely to be adults aged 25-34, living with unrelated adult roommates, renting their home, or living in poverty. Survey organizations have addressed the challenges of increasing wireless use by adopting dual frame telephone surveys (AAPOR Cell Phone Task Force, 2010), and more recent telephone surveys include both landline and mobile numbers in their sample with demographic proportions that more closely reflect those of the population using these phone services.

However, there are additional concerns about the use of telephones to conduct national or statewide surveys. Mobile numbers transfer across state lines, and thus a sample of mobile numbers for a particular geographic area, such as a state, would have coverage issues. Selecting numbers based on area codes for that state would miss new residents who had wireless area codes from their previous state of residence, and would include mobile numbers of residents who had moved from the state and should no longer be considered in the target population. In addition, there are federal restrictions on using automatic dialers for wireless numbers. The need to hand-dial wireless numbers results in higher costs in making these contacts (Lavrakas et al. 2007). Telephone surveys, as with other modes of survey data collection, also face declining response rates (AAPOR Cell Phone Task Force 2010; Pew Research Center 2012). The Pew Research Center reported that response rates from 1997-2012 for their standard 5-day surveys were 35% in 1997, 25% in 2003, 15% in 2009, and 9% in 2012 (Pew Research Center 2012). Dillman et al. (2014) argued that one challenge in obtaining responses by telephone is the underlying shift in communication methods due to the development of alternative approaches such as email, texting, and online tools.

Mail Surveys

An increasing number of surveys are using the mail to contact US households (Iannacchione 2011; Lesser and Newton 2007; Lesser, Newton and Yang 2011; Messer and Dillman 2011; Shih and Fa 2007; AAPOR Address-based Task Force 2016). An attractive feature for using the mail is the availability of a known frame of mailing addresses. The United States Postal Service (USPS) maintains and regularly updates a list of US household addresses. Recognizing the concerns over obtaining representative frames for telephone numbers, a recent focus has been on improving the address-based frames to use for survey research (AAPOR Address-based Task Force 2016). Addresses of US households provide a better sampling frame for general population surveys than either landline or wireless telephone sampling frames. The report by the Task Force on Address-based Sampling

prepared for the American Association of Public Opinion Research (AAPOR) concluded that address lists updated by the USPS Computerized Delivery Sequence (CDS) file provide the best possible frames at the current time for household surveys in the US (AAPOR Address-based Task Force 2016). The CDS is also called the Delivery Sequence File (DSF). The DSF is also able to exclude business addresses from the sampling frame, which random digit dialing for landline numbers is not well equipped to do (Dillman et al. 2014).

Beyond the availability of a reliable frame for use in mail surveys, mail surveys cost less than telephone surveys. In a 2005 comparison, Beebe et al. (2005) determined that the cost of a telephone survey was more than twice as much as a mail survey. Since modern telephone surveys need to include samples of wireless numbers to obtain representative samples across all demographic groups, the costs of telephone surveys are likely to have increased further since Beebe's analysis. The Pew Research Center (2015) reported costs for cell phone surveys are substantially higher than for traditional landline surveys, primarily due to the effort needed to screen for eligible respondents. The costs due to interviewer time, which are increasing due to the difficulty of finding a responding household by telephone, are eliminated in mail surveys. In addition, mail surveys achieve reasonable response rates. For example, Link et al. (2008) found that significantly higher response rates were reached in five out of six statewide surveys completed in 2005 using DSF-based mail methodology (with the inclusion of a second questionnaire mailing) than were reached using random-digit telephone dialing.

Web Surveys

With the rapidly increasing access to the Web, and its speed and cost-effectiveness when used as a survey method, there is great interest in determining whether improved response rates can be achieved by offering a Web choice for general population surveys. In spite of the increasing popularity of online surveys, there are caveats. First, no complete list of email addresses exists for general population surveys. In addition, email usage may be declining in the younger generation as texting and social media use are becoming the preferred forms of communication.

To get around the problem of not having a complete list of email addresses, the questionnaire may be put online and the individuals selected for the sample contacted by mail using the frame of addresses from the USPS–DSF file. However, there are subgroup differences in accessing the Internet (Smythe et al. 2010). Perrin and Duggan (2015) reported that currently only about 84% of American adults have

MIXED-MODE SURVEYS VERSUS SINGLE MODE SURVEYS 11

Internet access and that in 2015, 78% of blacks and 81% of Hispanics used the Internet, compared with 85% of whites and 97% of English-speaking Asian-Americans. Recently, great gains have been made in Internet usage by seniors aged 65 and older, with more than half now using Internet browsers or email (Perrin and Duggan 2015; Zickuhr and Madden 2012). Naturally, not everyone that has access to the Internet will choose to respond to a survey via the Internet; this, too, may lead to biased estimates. Therefore, to gain maximum advantage of the cost-effectiveness of the Internet in conducting Web-based surveys, offering another mode of data collection is desirable, such as a mixed-mode survey combining the mail and Web to obtain survey responses.

There has been an increasing amount of interest in utilizing mixed-modes for general population surveys, partly in the hope of increasing response rates without significantly increasing the costs. A key advantage of obtaining responses online is the savings due to reduced data entry, printing and mailing costs. Simultaneously, offering multiple modes provides a choice to individuals in the sample across a range of demographic groups that may favor a specific communication mode. Both Messer and Dillman (2011) and Lesser et al. (2011) found that the representativeness of their mail-only and their Web+mail samples were similar to one another and were more representative of the true population than the Web-only samples. While the inclusion of a mail option will increase the cost as compared with the highly cost-effective Web-only survey, adding mail should improve sample representativeness, given that 16% of American adults do not use the Internet (Perrin and Dugan 2015).

METHODS TO IMPROVE RESPONSE RATES

Several methods have been shown to improve response rates in mail surveys, such as using multiple contacts, including a preletter, personalizing cover letters, and providing financial incentives (Dillman et al. 2014). However, when Web and mail are used in a mixed-mode survey, the usefulness of similar methods to obtain survey responses has not been fully examined (de Leeuw 2005). In this paper, several strategies are explored in experiments nested within statewide surveys.

Multiple Options Vs. Sequential Options

Offering multiple modes provides a choice to individuals in a survey sample across a range of demographic groups that may favor different communication modes. Research has shown that offering multiple response modes decreases response rates as compared with a mail-only mode. A meta-analysis of 16 studies

that combined Web and other mode options conducted by Medway and Fulton (2012) reported that the mixed-mode option response rate was lower than the mail-only response rate for nearly all comparisons. Millar and Dillman (2011) studied offering a multiple response mode and a sequential delivery, (e.g., Web contact followed by a mail questionnaire and a mail questionnaire followed by a Web option) in a student population. They showed that after the mode switched, the final response rates between providing an option at each contact and using sequential modes were nearly equivalent. We wished to extend this research to a general population. We studied a sequential approach, first inviting participants to complete a questionnaire on the Web, and then offering a printed version by mail in a follow-up to non-respondents. We compared this approach (Web+mail) with an option (i.e., choice) mode, offering the option of either completing the questionnaire by Web or using the printed version enclosed at each contact, and a Mail-only mode.

Including Additional Guidance about Accessing Online Questionnaires

Due to the number of questions from potential respondents to our first Web+mail study, we examined the effects of adding an information card that provided additional guidance to access the online questionnaire. We hypothesized that the proportion of responses obtained by the Web mode would increase with the additional information. Messer and Dillman (2011) conducted a series of experiments that included testing the effectiveness of an instruction card for responding by Web. They obtained a response rate of 25.7% when a mixed-mode (Web+mail) and an instruction card providing assistance in Web access was used in the first mailing of the questionnaire. The 25.7% response rate resulted from 13.4% responding by Web and 12.3% responding by mail. They also explored additional strategies that investigated the use of financial incentives. However, they did not explore having a Web+mail approach without an instruction card or financial incentive. We investigate this approach in our paper.

Multiple Mailings

When a mixed-mode survey implementation plan utilizes sequential-option mailings, the optimum number of contacts must be determined while considering that some selected households will not have the opportunity to respond when only a Web option is offered. The impact of four mailings has been studied with a mixed-mode approach (Messer and Dillman 2011). In our experiments we explored whether an additional mailing to the Web+mail mode would benefit response rates.

MIXED-MODE SURVEYS VERSUS SINGLE MODE SURVEYS 13

Using a Colored Cover

There is conflicting evidence over whether the use of color in a questionnaire improves response rates. Fox, Crask, and Kim (1988) found an increased response rate, while Greer, Chuchinprakarn, and Seshadri (2000) did not show any effect on response rates. We experimented with the effect of a color front cover, hypothesizing that a more attractive cover page would increase response rates.

Preletter and Cover Letter Content

Dillman et al. (2014) suggested that for surveys contracted to another organization, a preletter introducing the contracting organization provides an exchange of trust to the contracting agency. The experiments discussed in this paper involve studies conducted by the Oregon State University Survey Research Center (OSU-SRC) for the Oregon Department of Transportation (ODOT). Using this principle, we tested whether a preletter originating from the sponsoring agency and using the ODOT letterhead versus a preletter originating from and using the letterhead of the OSU-SRC would improve the response rate.

In addition, Dillman et al. (2014) also pointed to the importance of the content of the invitation cover letter that asks respondents to complete the questionnaire. The purpose of the cover letter is to explain the objectives of the study but also to explain the benefits obtained by completing the questionnaire. Given that costs can be reduced by completing the survey online, we hypothesized in another experiment that cover letters emphasizing the cost savings achieved by completing the survey online rather than by mail would achieve more on-line responses than cover letters without such information.

Envelope Size

In this age of junk mail, many households might discard mailed survey packets without opening them. Dillman et al. (2014) suggested ways to distinguish survey mailings from junk mail. To examine the impact of envelope size on response rate, we conducted an experiment to explore the use of different sizes of mailing- and return-envelopes on response rates.

Summary

In the following sections we report on a series of experiments that we conducted in surveys administered over multiple years (2006, 2008, 2010, 2012, and 2014) to identify data collection methods that improved unit response rates. We compare survey response rates based on (i) telephone, mail and Web+mail modes in the 2006

and 2008 studies and (ii) mail and Web+mail modes in all five studies. Additionally, within each survey we examined a range of survey delivery options to quantify effects on response rates, and experimented with methods to increase the proportion of online responses in mixed-mode survey approaches. Specifically, we examined: 1) using a preletter originating from the sponsor or contracting organization; 2) including additional instructions to access the Web version of a questionnaire; 3) using four vs. five contacts for a Web+mail mode survey; 4) offering an option or choice to complete a survey by mail or Web; 5) changing the cover letter to emphasize the cost savings that would result from completing the survey online; 6) using a color front cover on a questionnaire; and 7) using different sizes of envelopes. We also compare the demographics of respondents in each mode to those of the general population to identify changes in respondent demographics over time and to examine if any of the tested methods has an impact on the demographics.

Our discussion in this paper focused on unit response rates. Lesser et al. (2011) previously discussed item nonresponse error associated with different modes using a subset of these data.

METHODS

The OSU-SRC conducted surveys for ODOT during the years 2006, 2008, 2010, 2012, and 2014. The questionnaires used each year were nearly identical, and each asked random samples of Oregon households their opinions on the quality of transportation services within the state. Table 1 summarizes each of the treatment groups, sample sizes, as well as contact dates and corresponding descriptions for each of the five study years.

Before 2006, this survey was conducted for ODOT by telephone only. The 2006 study added two treatment groups, a Mail-only treatment group and a Web+mail treatment. The Web+mail used a sequential approach, first offering the Web as an option to complete the questionnaire and then offering the printed version of the questionnaire to the nonrespondents. Thus we investigated differences between offering mail as a single survey response mode and offering the Web followed by mail as sequential survey response modes. In addition, we explored whether the response rate was influenced by a preletter originating from the sponsoring agency (ODOT) as compared with the influence of a preletter originating from the OSU-SRC. We wished to determine whether a letter from ODOT would convey additional trust resulting in higher response rates. This comparison was done for subsets of both the mail-only and Web+mail groups. After the 2006 study all preletters used ODOT letterhead.

TABLE 1. TREATMENT GROUPS AND CONTACT INFORMATION¹

TREATMENT GROUP (SAMPLE SIZE)	1 ST CONTACT	2 ND CONTACT	3 RD CONTACT	4 TH CONTACT	5 TH CONTACT
2006	10/04	10/10	10/18	11/02	
		Letter &	Reminder	Letter &	
Mail-only, ODOT pre-letter (670).....	Pre-letter	Questionnaire	Postcard	Questionnaire	
		Letter &	Reminder	Letter &	
Mail-only, SRC pre-letter (665).....	Pre-letter	Questionnaire	Postcard	Questionnaire	
			URL Reminder	Letter &	
Web+mail, ODOT pre-letter (835).....	Pre-letter	URL Letter only	Postcard	Questionnaire	
			URL Reminder	Letter &	
Web+mail, SRC pre-letter (835).....	Pre-letter	URL Letter only	Postcard	Questionnaire	
Telephone.....	6,445 telephone numbers used. Up to 15 call attempts made.				
2008	9/04	9/09	9/17	9/25-10/2	
		Letter &	Reminder	Letter &	
Mail-only (1,000).....	Pre-letter	Questionnaire	Postcard	Questionnaire	
		URL Letter with	URL Reminder	Letter &	
Web+mail, insert (1,000).....	Pre-letter	Insert only	Postcard	Questionnaire	
			URL Reminder	Letter &	
Web+mail, no insert (1,000).....	Pre-letter	URL Letter only	Postcard	Questionnaire	
Telephone.....	6,310 telephone numbers used. Up to 15 call attempts made.				
2010²	3/25	3/30	4/07	4/14-4/21	4/29
		Letter &	Reminder	Letter &	
Mail-only (1,095).....	Pre-letter	Questionnaire	Postcard	Questionnaire	
			URL Reminder	Letter &	Letter &
Web+mail, cost savings not in letter (1,095)	Pre-letter	URL Letter only	Postcard	Questionnaire	Questionnaire

TABLE 1. TREATMENT GROUPS AND CONTACT INFORMATION (CONTINUED)¹

TREATMENT GROUP (SAMPLE SIZE)	1 ST CONTACT	2 ND CONTACT	3 RD CONTACT	4 TH CONTACT	5 TH CONTACT
Web+mail, cost savings in letter (1,095)	Pre-letter	URL Letter only	Postcard URL Reminder	Letter & Questionnaire URL Letter &	Letter & Questionnaire
Option, cost savings not in letter (1,095)	Pre-letter	Questionnaire URL Letter &	Postcard Reminder	Questionnaire URL Letter &	
Option, cost savings in letter (1,095)	Pre-letter	Questionnaire	Postcard	Questionnaire	
2012	5/17	5/22	5/29	6/7-6/14	6/28-7/5
		Letter &	Reminder	Letter &	Letter &
Mail-only, color (1,369)	Pre-letter	Questionnaire	Postcard	Questionnaire	Questionnaire
		Letter &	Reminder	Letter &	Letter &
Mail-only, black & white (1,369)	Pre-letter	Questionnaire	Postcard	Questionnaire	Questionnaire
			URL Reminder	URL Letter &	URL Letter &
Web+mail, color (1,369)	Pre-letter	URL Letter only	Postcard	Questionnaire	Questionnaire
			URL Reminder	URL Letter &	URL Letter &
Web+mail, black & white (1,368)	Pre-letter	URL Letter only	Postcard	Questionnaire	Questionnaire
2014	5/29	6/03	6/10	6/24	7/14
		Letter &	Reminder	Letter &	
Mail-only, large envelope (1,369)	Pre-letter	Questionnaire	Postcard	Questionnaire	
		Letter &	Reminder	Letter &	
Mail-only, small envelope (1,370)	Pre-letter	Questionnaire	Postcard	Questionnaire	
			URL Reminder	URL Letter &	URL Letter &
Web+mail, large envelope (1,368)	Pre-letter	URL Letter only	Postcard	Questionnaire	Questionnaire
			URL Reminder	URL Letter &	URL Letter &
Web+mail, small envelope (1,368)	Pre-letter	URL Letter only	Postcard	Questionnaire	Questionnaire

NOTE: ¹With each paper questionnaire, a prepaid return envelope was included. ²The experiment explored the use of a statement in the first cover letter for both the Web+mail and Option groups stating that the state saved money if a respondent completed the survey online.

MIXED-MODE SURVEYS VERSUS SINGLE MODE SURVEYS 17

In 2008, the study included four treatment groups (telephone, mail-only, Web+mail, and a modified Web+mail treatment group). Several potential respondents had contacted the OSU-SRC in 2006 with questions about how to locate the questionnaire on the Web. To investigate whether additional information would increase the proportion of respondents completing the survey online, we added a modified treatment group that tested the effects of providing an information card containing additional instructions on how to find and complete the Web version of the questionnaire. This card was included in the first mailing of the questionnaire.

In 2010, the telephone mode was eliminated along with the additional information card used for the Web+mail treatment group. The 2010 study consisted of three treatment groups: Mail-only, Web+mail, and an Option (or Choice) group and two subgroups. The Option group allowed respondents the option, at each contact, of completing the questionnaire by Web or mail. For the subgroups, two versions of the cover letter were used in the Web+mail and Option modes. The only differences in the letters were two sentences stating that the use of the Internet saved the state money, and encouraging recipients to respond quickly: "If people respond by using the Internet, the state saves money in these difficult economic times and obtains results quickly. It would be particularly helpful if you could respond in the next 10 days." A fifth contact, including a paper copy of the question for the Web+mail treatment groups, was added to determine the impact of an additional mailing for this mode, since individuals in this group without Internet access could not respond to the first mailing. Colored versions of the front cover were introduced this year in the expectation of obtaining improved response rates.

The 2012 study consisted of four treatment groups, which tested the effects of offering mail and Web+mail as response modes. Based on the results of the 2010 study that used a colored version of the front cover, we tested the effects of using this cover. Black-and-white and colored versions of the front cover were tested for subgroups in both the mail and Web+mail modes. Five contacts were implemented for each treatment group to test the effects of this additional contact.

The 2014 study consisted of four treatment groups. The treatment groups were designed to measure the effects of offering mail and Web+mail, but also to test the effect of different envelope sizes on response rates. When paper questionnaires and recruitment materials were mailed to respondents in the 'small envelope' group, a 9" x 12" flat envelope was used for the outgoing delivery and a smaller 6" x 9" business reply envelope was included for paper questionnaire responses. The 'large envelope' group, which employed the envelope size used in previous years, received

a packet using a larger outgoing envelope of 9 ½" x 12 5/8" and a 9" x 12" business reply envelope for returns. All envelopes were white. There were four contacts for the mail group while the Web+mail treatment groups had a fifth contact for reasons explained earlier.

In all studies across all years, the paper version of the questionnaire consisted of twelve pages including a cover page. The number of questions varied from 95 to 127 over the five years. The Web and telephone versions of the questionnaire contained the same questions as the corresponding year's paper version of the questionnaire. We attempted to have the layout and appearance identical between the Web and mail versions. Cover letters between the mail and Web+mail were identical except for the mention of the survey URL, the instructions on where to type the URL in the respondent's browser bar, and a personal access code. Although the Web version of the questionnaire was accessible throughout the duration of the study, it was mentioned only in the first cover letter in 2006-2010. In 2012 and 2014, all cover letters for the Web+mail group included the URL and access code information and informed the individual that the online version was still open.

A stratified random sampling design was implemented to facilitate comparisons among geographic regions of the state delineated by ODOT. Nonresponse adjustments were included in the analysis to account for the different response rates across regions, as well as to bring the sample demographics more in line with the population demographics. The telephone samples were obtained using the random digit dialing (RDD) sampling frame, which uses both listed and unlisted numbers. Fifteen call attempts were made. The Oregon household addresses for mail-only and Web+mail surveys were obtained using address-based sampling (ABS) from the USPS-DSF. Sample sizes for each treatment group are shown in Table 1. Each household was assigned a unique access code to ensure that no more than one questionnaire was completed per household. Comparisons of response rates were made using chi-square tests (SAS Software). *P*-values are provided and interpreted as discussed in Ramsey and Schafer (2013). To examine the change in respondent demographics across the years relative to the State, population data for all demographics except employment were obtained for each year using the U.S. Census Bureau's American Community Survey. The employment data were obtained from the State of Oregon Employment Department and National Bureau of Economic Research. The survey data were summarized based on respondent demographics from four contacts. This was done to provide a more consistent comparison for all years discussed in this analysis. In addition, the demographics for the Web respondents from the Web+mail group were also examined.

MIXED-MODE SURVEYS VERSUS SINGLE MODE SURVEYS 19

RESULTS

Several experiments were conducted between 2006 and 2014 to determine whether changes to the contact procedures would affect response rates. Response rates are summarized for 2008–2014 in Table 2 using AAPOR RR4. To reduce the impact of the changes in survey implementation tested, the results shown in this table include response rates for the experimental groups that had the most consistent methods of delivery used over the years. This included presenting only the experimental groups using the ODOT preletter group for 2006, since the SRC letterhead was not used in further studies. The table displays response rates based on four contacts for each year, and since large envelopes were used each year, results for only the large envelopes are shown for 2014.

TABLE 2. UNIT RESPONSE RATES BY MODE ASSUMING FOUR CONTACTS FOR BOTH MAIL-ONLY AND WEB+MAIL MODE.¹

YEAR	RESPONSE RATE (%) ²			PERCENT RESPONDING BY WEB ³
	TELEPHONE	MAIL-ONLY	WEB+MAIL	
2006	30.3	31.2	22.3	29.2
2008	31.9	33.0	26.5	30.0
2010	—	37.9	27.4	30.5
2012	—	30.5	23.1	50.3
2014	—	25.4	19.6	45.6

NOTES:¹Response rates between 2008-2010 are presented for subgroups that were most similar to the 2006 methods. For example, the summary here included: response rates based on four contacts; the group using the ODOT letterhead in 2006; the Web+mail mode but not the Option Mode; and the group not receiving the information card. The percentages can be compared with their comparison group in the tables that follow. Note that some methods changed from year to year, being conclusive about whether changes over time were results of new design features or an indication of changing interest in particular modes is not possible. ²There is convincing evidence of a difference in the response rates across modes in each year ($p < 0.006$). When data from 2006 and 2008 are analyzed excluding telephone responses, there is also convincing evidence of a difference in response rates between Mail vs. Web+mail in both years ($p < 0.001$). ³Percent responding by web is calculated for the Web+mail groups by dividing the total number of web responses by the total number of web and paper responses combined.

Significant differences in response rates across modes were found within each year. Response rates using a printed copy of the questionnaire sent by the US mail were the highest of all modes for each year. Due to the cost of the telephone mode and concern about the frame coverage, this mode of data collection was dropped

after 2008. Response rates for mail and Web+mail increased until 2010; since then both have decreased. However, there has been an increase in the percent of respondents responding by Web since 2006. Note that the follow-up cover letters in 2012 and 2014 reminded respondents that they could go to the Web and included another reminder of their access code. This was not done in the reminder letters in the previous years and could have accounted for the increase of Web responses in 2012. Because methods changed from year to year, particularly for the mixed mode approaches, being conclusive about whether changes over time were results of new design features or an indication of changing interest in particular modes is not possible. Although the response rates for Web+mail were lower than either the telephone or mail modes, the potential for cost savings when data are collected by Web served as motivation for testing additional approaches in 2008-2014.

2006

In 2006, an experiment examined whether a preletter originating from the OSU-SRC Center or the Sponsoring agency (i.e., ODOT) would generate higher response rates in both the mail and Web+mail modes (Table 3). Both preletters explained the objectives of the upcoming survey, however, the letter from ODOT had one additional statement introducing the OSU-SRC as the organization conducting the survey for their agency, thus giving the respondent a sense of their trust in the legitimacy of the OSU-SRC.

TABLE 3. RESULTS OF 2006 PRELETTER STUDY.

MODE	RESPONSE RATE (%) ¹	% RESPONDING BY WEB
Mail:		n/a
ODOT preletter	31.2	-
OSU-SRC preletter	27.2	-
Web+mail:		
ODOT preletter	22.3	29.2
OSU-SRC preletter	18.4	27.3

NOTES:¹Test effect of preletter: •There is no evidence of a difference in response rates between the two preletter groups for the Mail mode ($p = 0.124$). •There is suggestive evidence of a difference in response rates between the two preletter groups for the Web+mail mode ($p = 0.059$). •There is evidence of a difference in response rates between the two preletter groups when modes are combined ($p = 0.016$).

In both experimental modes, the response rate for the respondents using the ODOT preletter was higher than the response rate for the OSU-SRC preletter group. Whether there was a difference in the response rate between the ODOT and OSU-SRC preletters was tested for the Mail-only contact group, the Web+mail

MIXED-MODE SURVEYS VERSUS SINGLE MODE SURVEYS 21

group, and for both modes combined. When both modes were combined, there was evidence of a difference in response rates ($p = 0.016$). Given that there was no additional cost for using either type of preletter, the preletter from ODOT was adopted in further studies.


2008

The 2008 study examined whether or not additional instructions would result in a larger percentage of online responses to the survey. An information card (insert) was included with the cover letter explaining where the website address should be typed into the browser and giving other instructions to gain access to the Web survey (Figure 1; Table 4).

How to find and Complete the Web Version of the Oregon Transportation Needs and Issues Survey


Step 1:
Go to your Web browser (for example: Internet Explorer, Mozilla, etc.) and enter the survey Web site address. The Web site address is:
<http://www.stat.oregonstate.edu/odotsurvey/>

(Be sure not to type the address into the Google space by mistake!)

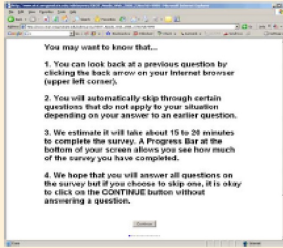


Step 2:
Now that you are at the Welcome page of the survey, please type in your 4-digit PAC number. Your PAC number can be found in the letter you received with this flyer.


Click the **Log In** button to begin the survey



Step 3:
This page explains a few things about the survey. When you are done reading it, please click the Continue button.



Step 4:
Here is an example of a survey question. When you complete a question or page of questions on the survey and click CONTINUE, the next question will automatically appear on your screen.



Any questions? If so, please email our Web Master at src@science.oregonstate.edu or call us at 541-737-1993.

22 MIXED-MODE SURVEYS VERSUS SINGLE-MODE SURVEYS

FIGURE 1. EXAMPLE OF INSTRUCTION CARD PROVIDED TO SAMPLE IN 2008.

TABLE 4. RESULTS OF 2008 EXAMINATION OF THE EFFECT OF PROVIDING ADDITIONAL WEB INSTRUCTIONS.

MODE	RESPONSE RATE (%) ¹	% RESPONDING BY WEB ²
Web+mail		
No insert	26.5	30.0
Insert	21.0	35.4

NOTES: Test of effect of insert difference: ¹ There is evidence of a difference in the response rates between the group receiving an information card and the group not receiving an information card ($p = 0.005$). ² There is no evidence of a difference in percent responding by Web between the group receiving an information card and the group not receiving an information card ($p = 0.22$).

The response rate to the mailing packets sent without the information card was more than five percentage points higher than the response rate with the insert ($p = 0.005$). This may be an example of a situation where some individuals felt that the information card was providing too much information and thus provided a disincentive to respond. The number of responses submitted by the Web increased by five percentage points when the insert was used, which was what we expected. Although this increase was not statistically significant ($p = 0.22$), mentioning the practical importance of the increase is important. Since p -values are sample size dependent, the small sample size in this test was not enough to detect a significant difference although the estimates suggest that there was an influence of the insert. However, in view of the added cost of the insert, and its negative impact on response rates, the inset was dropped in further years.

2010

Additional methods that we hypothesized would improve the percent of responses obtained by the Web, were tested in 2010 (Table 5). First, the impact of changing the content of the cover letter used to recruit respondents to complete the questionnaire was examined. Second, we introduced an Option group that gave individuals the option of completing the questionnaire by Web or by mail at each contact. The Web+mail group was compared with the Option group. In addition, a fifth mailing was added for the Web+mail group to determine the added benefit of an additional contact.

A series of statistical analyses were computed for these data. First, the effect of differing cover letter content on response rates was examined. There was no evidence of any change in response rates due to the wording change in the cover letter for either the Option or Web+mail modes ($p > 0.10$).

24 MIXED-MODE SURVEYS VERSUS SINGLE MODE SURVEYS

TABLE 5. RESULTS OF THE 2010 STUDY COMPARING WEB+MAIL VS. OPTION MODES.

MODE	FOUR MAILINGS		FIVE MAILINGS	
	RESPONSE RATE (%) ¹	% RESPONDING BY WEB ²	RESPONSE RATE (%) ¹	% RESPONDING BY WEB ²
Web+mail				
Cost savings not in letter	27.4	30.5	34.2	24.9
Cost savings in letter	26.8	39.9	36.0	30.7
Option			n/a	n/a
Cost savings not in letter	35.1	11.3		
Cost savings in letter	32.4	22.9		

NOTES:¹Test effect of cover letter: •There is no evidence of a difference in the response rates between the two cover letter groups for the Web+mail mode using four mailing ($p = 0.63$) or five mailings ($p = 0.50$). •There is no evidence of a difference in the response rates between the two cover letter groups for the Option mode using four mailing ($p = 0.21$).
²Test effect of moving respondents to Web: •There is moderate evidence of a difference in percent responding by Web for the Web+mail mode using four mailing ($p = 0.012$) and suggestive evidence when using five mailings ($p = 0.08$). •There is convincing evidence of a difference in percent responding by Web for the Option mode using four mailing ($p < 0.001$).

Next, the percent of respondents completing the questionnaire by Web was compared across the two types of cover letters. There was an increase in the percent of responses submitted by the Web for the Web+mail mode using four mailings ($p = 0.012$) and some evidence of an increase in the percent of responses submitted by the Web for the Web+mail mode when using five mailings ($p = 0.08$). The percent responding by Web dropped as more respondents chose to complete paper surveys because of this fifth contact that included another copy of the printed questionnaire. There was convincing evidence of a difference in the proportion of responses submitted by the Web for the Option mode using four mailings ($p < 0.001$).

Response rates were compared across modes. Since the Option group only received up to four contacts, the response rate was compared between the Option and Web+mail mode assuming four mailings. The response rate was approximately six percentage points higher ($p < 0.001$) for the Option group using four contacts. Another mailing was added to the Web+mail group to examine the cost effectiveness of implementing an additional mailing. Since the overall response rates between cover letters were not significantly different when either four or five mailings were used, data from both cover letter groups were combined to test the effect of the fifth mailing, revealing that the use of a fifth mailing resulted in a

substantial increase in the response rate ($p < 0.001$). This suggested that the fifth mailing provided was valuable in encouraging recipients to respond to the survey.

2012

Table 6 shows the response rate results for both the mail and the Web+mail modes based on four and five mailings. In addition, the impact of a color front cover for the questionnaire was examined.

TABLE 6. RESULTS OF THE 2012 STUDY EXAMINING A COLOR COVER ON THE QUESTIONNAIRE AND TWO SURVEY DELIVERY MODES.

MODE	FOUR MAILINGS		FIVE MAILINGS	
	RESPONSE RATE (%)	% RESPONDING BY WEB ²	RESPONSE RATE (%) ¹	% RESPONDING BY WEB ²
Mail		n/a		
Black/White	30.5	-	34.3	-
Color	30.0	-	34.0	-
Web+mail				
Black/White	23.1	50.3	28.4	43.0
Color	20.4	46.0	25.4	40.3

NOTES:¹Test effect of color: •Assuming 5 mailings, there is no evidence in response rates between the use of a color cover for the Mail mode ($p = 0.66$), but suggestive evidence that color is associated with response rates for the Web+mail mode ($p = 0.09$). ²Test effect of moving respondents to the Web: •There is no evidence of a difference in percent responding by Web for the Web+mail mode using 4 mailing ($p = 0.30$) and when using five mailings ($p = 0.47$).

With five mailings there was no evidence that the color front cover was associated with increased response rates for the mail mode ($p = 0.66$) but there was suggestive evidence that color decreased response rates for the Web+mail mode ($p = 0.09$). There was an increase in the percent of responses by Web across groups compared with previous years (Table 2). This effect may be due to repeating the access code in subsequent cover letters for the Web+mail group, but could also be because more respondents were accessing the Web. Although the fifth mailing increased response rates for the Web+mail group, most of these additional responses were obtained by mail, as indicated in the drop in the percent responding by Web. This could be attributed to the availability of the printed questionnaire included in the mailing packet. When using the color cover there was no evidence of a difference in the percent of responses submitted by the Web for the Web+mail mode using four mailings ($p = 0.30$) or when using five mailings ($p = 0.47$).

26 MIXED-MODE SURVEYS VERSUS SINGLE MODE SURVEYS

2014

The effects on response rates for different outgoing and return envelope sizes were compared in this study. Table 7 shows the response rate results for both the mail and the Web+mail modes based on four and five mailings and includes results from the analysis of the impact of envelope size.

TABLE 7. RESULTS OF THE 2014 STUDY EXAMINING ENVELOPE SIZE AND TWO SURVEY DELIVERY MODES.

MODE	FOUR MAILINGS		FIVE MAILINGS	
	RESPONSE RATE (%) ¹	% RESPONDING BY WEB ²	RESPONSE RATE (%) ¹	% RESPONDING BY WEB ²
Mail		n/a	n/a	n/a
Small	23.1			
Large	25.4			
Web+mail				
Small	19.0	50.6	22.7	47.1
Large	19.6	45.6	24.3	39.9

NOTES:¹Test effect of envelope size: •There is no evidence that envelope size is associated with response rates for the Mail mode ($p = 0.28$) and for the Web+mail mode when using five mailings ($p = 0.42$). ²Test effect of moving respondents to Web: •There is no evidence of a difference in percent responding by Web for the Web+mail mode when using 4 mailing ($p = 0.26$), but there is suggestive evidence of a difference in percent responding by Web for the Web+mail mode when using five mailings ($p = 0.07$).

When a larger envelope was used, there was a slight increase in response rates for all mailings and both modes; however, the increase was not statistically significant for the mail mode ($p = 0.28$) and Web+mail mode ($p = 0.42$; five mailings). There was no evidence of a significant difference in the number of responses submitted by the Web for the Web+mail mode using four mailings ($p = 0.26$), but there was some evidence of a difference in the number of responses submitted by the Web for the Web+mail mode when using five mailings ($p = 0.07$). The larger size of the envelope may have appeared more important to some respondents and thus encouraged responses using the mail, which is indicated by fewer respondents responding by Web for those receiving the larger envelope.

Demographics

The demographics of the respondents based on responses from four contacts were compared with the general population estimates obtained from the American Community Survey for each year of the study. The telephone, mail, Web+mail, and the Web respondents in the Web+mail group were examined. Demographics based

on the respondents to the four contacts were used to provide some similarity across years. Consistent differences between the demographics of the respondents and the general population existed across all the years of our studies (Figure 2). This variability existed no matter what methods were used to improve response rates across the years.

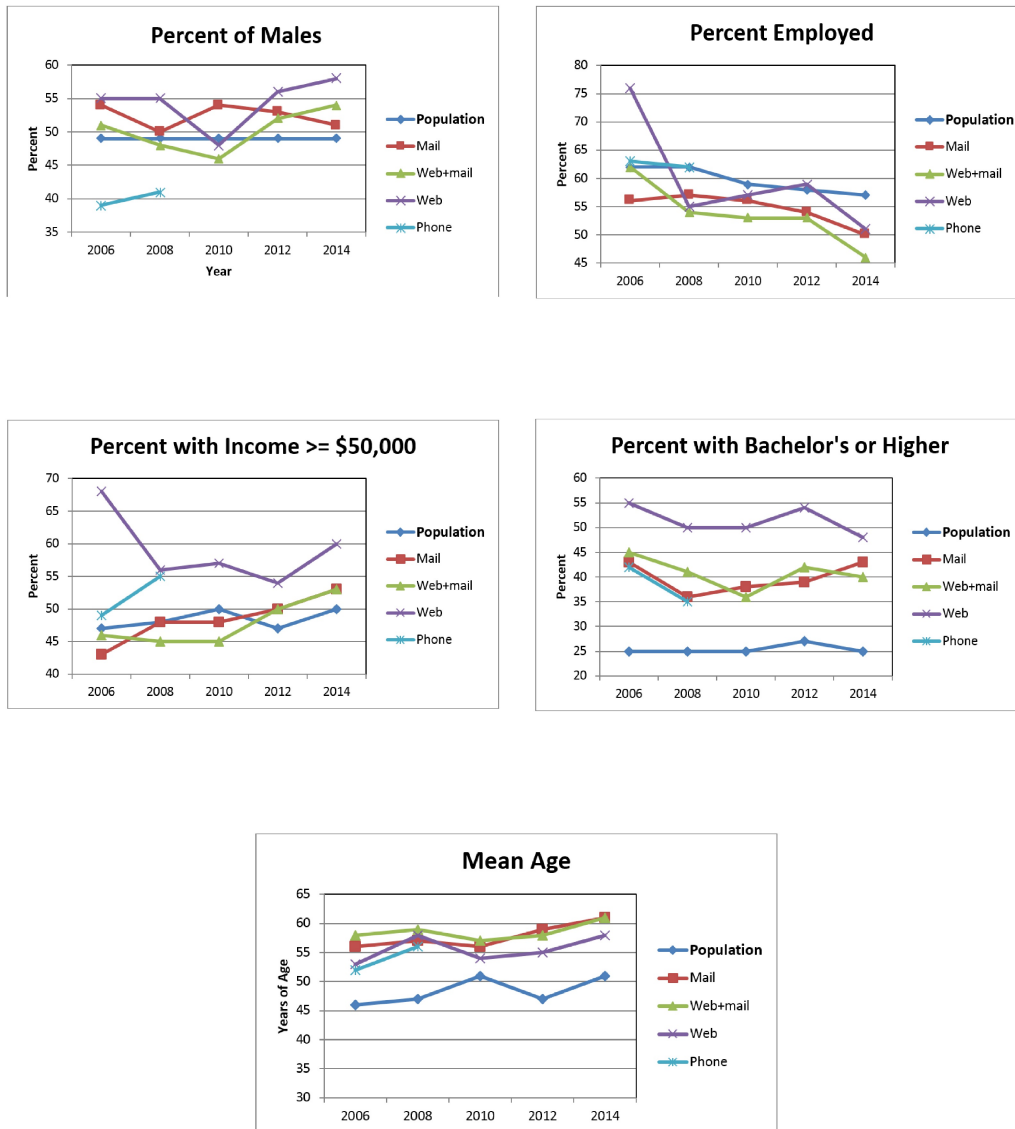


FIGURE 2. TRENDS IN DEMOGRAPHIC CHANGES IN PERCENT OF MALES, PERCENT EMPLOYED, PERCENT WITH INCOME GREATER OR EQUAL TO \$50,000, PERCENT WITH A BACHELOR'S DEGREE OR HIGHER, AND AVERAGE AGE OF RESPONDENTS TO DIFFERENT MODES COMPARED TO POPULATION DEMOGRAPHICS.

28 MIXED-MODE SURVEYS VERSUS SINGLE MODE SURVEYS

The largest difference between the respondent and the population demographics was consistently found for the percent of individuals with a Bachelor's Degree or higher, which was the variable used in this study to compare the education level of respondents. Respondents for all modes were more educated than the general population, and respondents using the Web had, and continue to have, the highest percent with a Bachelor's Degree or higher. Age, gender, percent employed, and percent with income \geq \$50,000 were the other demographic variables investigated. For all modes, the respondents were older than the general population. For gender, in the two years that telephones were used as a survey mode, the telephone sample had the largest degree of discrepancy from the general population. More females responded to the telephone questionnaire as compared with males. More male respondents were using the Web as compared with male respondents using mail for most years of the study. The percent of respondents employed were similar across modes. There was a higher percent of respondents with incomes greater than \$50,000 responding using the Web than using the mail mode throughout the study period. The largest difference over time was attributed to the employment of the Web respondents who more closely resembled the other modes after 2006. After 2006, the demographic characteristics did not appear to change dramatically from year to year. The measures we examined do not appear to have changed the demographic characteristics of the respondents.

DISCUSSION

The experiments discussed in this paper were aimed at investigating methods to increase overall survey response rates and to increase the percent of responses obtained using the Web. We also examined how the demographics of the respondents varied among the modes examined in these experiments. We first discuss the changes in response rates over time and changes in the percent of responses obtained using the Web, and then discuss the changes in demographics.

Affect on Response Rates

To have the most consistent comparison over the years to examine changes in response rates, the rates were based on the experimental groups that were as similar as possible over the five years. Therefore, changes over time may be the results of both the design features that we changed slightly over the years and an indication of changing interest in particular modes. However, noting that within each year the mail-only group consistently had the highest response rates compared with the alternatives using the Web is important.

Between 2006 and 2010 the percent of responses submitted on the Web increased slightly, but the most substantial increase occurred in 2012 when providing guidance about accessing the Web was repeated in subsequent contacts. The 2010 study showed that providing an additional sentence about the benefits of completing the online survey had an impact on encouraging respondents to complete the survey by Web, as shown in Table 5. As more responses to a mixed-mode survey are obtained by Web, the cost savings of this approach potentially increase. Lesser et al. (2013) illustrated that the cost effectiveness of using the Web depends on the sample size, overall response rate, percent completing the questionnaire by Web, data entry costs, postage/printing costs, and programming cost. All these features should be considered, along with the population under study, in determining the optimal mode and number of contacts when collecting survey data.

A fifth mailing was introduced in 2010 and produced an increase in response rate between 6-9 percentage points in the Web+mail group, depending on the type of cover letter used. In 2012-2014, the fifth mailing generated an increase of 4-5 percentage points in the response rate. Based on the increase in response rate shown in our studies for a fifth mailing, this additional contact should be considered when developing a survey design to assess whether the increased response rate benefits of an extra mailing warrant the added costs of implementing a fifth mailing.

Several small changes to the administration of the survey provided further improvements in response rate. A preletter using the sponsoring agency letterhead and envelopes improved response rates as compared to using the OSU-SRC letterhead. The observed four percentage point increase in response rates in both the mail and Web+mail mode did not add any additional cost to the survey. We speculate that the agency's letterhead was perceived to be more relevant and, hence, legitimating which helped to establish the importance and trust with respondents (Dillman et al. 2014).

Adding information about completing the survey online resulted in a five percentage point increase in Web responses; however, the information card decreased response rate from the group receiving this added information. Another general population study also conducted in 2008 (Lesser et al. 2011) showed an eight percentage point increase in Web responses when the information card was added about accessing the Web. Similar to the 2008 study discussed in this paper, this additional study also showed a five percentage point decrease in response rate for the group receiving the insert as compared to not receiving the information card. The information card was perceived as a positive influence to respond by Web for some recipients. However, simultaneously, other recipients were not influenced

30 MIXED-MODE SURVEYS VERSUS SINGLE MODE SURVEYS

by this and in fact had a negative influence in responding to the survey. The added information is an example of an attribute discussed by Groves et al. (2000) having both positive and negative impact, depending on the perceived salience and importance of the attribute that this was viewed by the recipient. The additional materials in the mailing package may have led to information overload or increased perceptions about task difficulty and may be responsible for the lower overall response rates. Messer and Dillman (2011) incorporated two experiments to examine the use of an insert when including a \$5 incentive. They reported that the insert did not increase the proportion of Web respondents or significantly increase Web or overall response rates. This may be because the financial incentive had already positively influenced trust and successfully increased response rates.

In 2010, the cover letters were slightly modified to determine whether additional information on the advantages of using the Web would encourage more responses by this mode. By adding this statement on cost savings we achieved a substantial increase in the number of responses obtained online for both the Web+mail and Option groups.

Assuming both Web+mail and Option modes used four contacts, the response rate for the Option mode was much higher than for the Web+mail mode. Since the Option group had the printed version of the questionnaire in all mailing packets, completing the printed version could have been more convenient for respondents as compared with moving to the online version. Although giving individuals the option of completing the survey using Web or mail showed higher overall response rates compared with the Web+mail group, the percent responding by Web was much lower for the Option group as compared with the Web+mail group. Millar and Dillman (2011) did not show such large differences in response rates between the Option and Web+mail, but they studied students who are assumed highly Web-literate and more likely to respond by Web as compared with members in the general population. The impact on the overall response rate, the percent responding by Web, and the population under study, should be considered when developing either a sequential Web+mail or an Option mode of delivery. As an example, in a study examining the costs of Web+mail versus an Option mode, Lesser et al. (2013) showed that the Option mode was not as cost-effective as the Web+mail mode across a range of sample sizes. The Option mode not only includes the questionnaire printing cost for each contact, but also the labor costs to program the questionnaire as compared with the Web+mail mode.

Demographic Comparisons

The demographics of the respondents, as compared with the general population, varied across each mode. Not surprisingly, more respondents completing the surveys by Web had higher incomes and had an education level of a Bachelor's Degree or higher. As the penetration of the Web into more households continues and extends to all demographic groups, we expect the demographics in surveys with delivery modes that include the Web (e.g., the Web+mail mode) to become more similar to the general population demographics. However, this will clearly depend on whether survey methodologists can attract individuals to respond to the online questionnaire. For our studies, the demographics of the respondents across the mail and Web+mail modes appear quite similar for all years. This is not surprising since many respondents to the Web+mail group responded by mail.

SUMMARY

Our research found declining response rates to a survey repeated over an eight-year period, but indicated promising trends in the proportion of respondents completing the survey by the Web. Our findings appear consistent with the general theory of social exchange and leverage saliency theory, in that respondents in our experiments react positively to options that offer rewards, such as the benefits to the state when a questionnaire was completed online and the trust induced by the endorsement of the sponsoring agency in a preletter. A sequential mixed-mode approach was more effective in obtaining responses by Web as compared with an Option approach.

As Dillman et al. (2014) concluded, the mixed-mode approach for conducting surveys can provide lower costs, improve timeliness of response, improve response rates and reduce error (e.g., attributed to coverage, nonresponse and measurement). Future surveys of the general population will undoubtedly offer respondents the option of using the Web given the attractiveness of the cost savings, but, because of the lack of a frame for Web users, a mixed-mode approach using the USPS-DSF is likely to persist. Nevertheless, we have shown that using improved procedures for the mail mode generated higher response rates over all years of these studies, so using mail surveys should not be discounted particularly for populations with less prevalent Web access.

This research has identified various methods that can improve Web+mail response rates and increase the percentage of Web responses to a Web+mail survey mode. However, continued research is necessary to further investigate how to encourage more individuals to complete surveys online. Such research must include studies of how to improve online completion of surveys using smartphones and

32 MIXED-MODE SURVEYS VERSUS SINGLE MODE SURVEYS

tablets, which are increasingly becoming the preferred online technology in both developed and developing countries.

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