

## Telephone, Internet, and Paper Data Collection Modes for the Census 2000 Short Form

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This study examined the hypothesis that the response rate in the U.S. Census 2000 could be increased by explicitly offering respondents an alternative to using the paper form. A random sample of 10,494 households received special Census 2000 mailings. Half of these households were offered the alternative of responding via the web, while the other half were offered a telephone alternative. The offer of these alternative response modes boosted response rates by more than two percentage points over households that were not offered a response mode alternative. Half the mailings included an insert that held a telephone calling card incentive, which was activated if the household chose to use the web or telephone alternative. The insert holding the calling card greatly increased responding via the alternate response modes, but this increase was more than offset by decreased responding via the paper form. The implications of the results for future decennial censuses are discussed.

*Key words:* Response mode; response rate; incentive.

### 1. Introduction

In Census 2000, five-sixths of all American households received a short form asking basic questions such as the number of residents and the name, age, sex, race, and Hispanic origin of each. The remaining one-sixth of all households received a long form, asking many additional questions. Although all households were legally required to provide the data requested on the forms, 33 percent of all households did not (<http://www.census.gov/dmd/www/rates.html>), requiring the U.S. Census Bureau to send field enumerators to collect the data. Because these enumerators entailed substantial expense, any procedures that decreased the proportion of nonresponding households could potentially result in meaningful cost savings (General Accounting Office 2001).

The Census 2000 forms specifically mentioned only one method for respondents to provide their data – filling out and mailing back the form. However, households that received the short form had two additional methods available to them: they could fill out an electronic census form on the U.S. Census Bureau's web site, or call the Census Bureau's toll-free help line and provide their census data by telephone.

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The U.S. Census Bureau decided not to publicize either of these alternatives widely. The U.S. Census Bureau had never before collected decennial data on a web questionnaire, and recognized that prominent, high-traffic government web sites may encounter problems with system security, integrity, and load capacity (Whitworth 2001). The U.S. Census Bureau's toll-free call center was staffed to provide assistance, not to handle a large number of respondents calling to report their data. Because of the lack of publicity, neither of these response modes was widely used in Census 2000. Some people learned of the web option from news reports or from one of President Clinton's Saturday radio addresses, while some people learned of the telephone option from the toll-free help line operators. However, relatively few people were aware of these response mode alternatives.

This article describes an experiment to examine the hypothesis that the response rate in Census 2000 could have been increased by explicitly offering respondents the alternatives of providing their data using the telephone or the Internet instead of the paper form. Another way of stating this hypothesis is: some people who were unwilling or unable to respond to the Census 2000 paper form would have been willing and able to respond by telephone or the Internet if those alternatives were publicized.

The Technology Acceptance Model (TAM), first proposed by Davis (1989), provides a context for this hypothesis. The TAM is widely cited in the organizational and management literature to explain why people select one technology rather than another to complete a task (e.g., Szajna 1996; Teo, Lim, and Lai 1999). Briefly stated, the TAM posits that people select a technology through a combination of two factors. First, they select the technology that they regard as the most likely to let them complete the task successfully (i.e., the technology with the greatest perceived usefulness). This factor is called "extrinsic motivation" because it pertains to what the technology can accomplish. Second, people select the technology that they find most appealing and least burdensome (i.e., the technology with the greatest perceived novelty, acceptance by others, or ease of use). This factor is called "intrinsic motivation" because it pertains to the qualities of the technology itself.

Some respondents might believe that the telephone or the web would be more useful than the paper form for reporting census data; that is, the respondents might be "extrinsically motivated" to use these alternative response modes. Some persons may be willing to provide their data but have visual difficulties or limited literacy skills that prevent them from filling out the paper form. The results of the National Adult Literacy Survey suggested that the reading proficiency of about 30 million English-speaking Americans was at the lowest defined level. About one-fifth of this group had trouble reading because of visual problems (Kirsch, Jungeblut, Jenkins, and Kolstad 1993). However, respondents do not need literacy skills to report their data over the telephone; they need only call and speak to an interviewer. Also, many visually impaired people can complete a web questionnaire using assistive web browsers or screen magnification software. Therefore, some people with visual problems or limited literacy skills might provide their census data only if they could use telephone or web-based alternatives to the paper form.

Also, some people might prefer (that is, be "intrinsically motivated" to select) a telephone or web data collection method, regardless of whether they thought that these media were actually more useful than the paper forms for collecting census data. Ramos,

Sedivi, and Sweet (1998) wrote that some respondents were drawn to computer-based surveys because of the surveys' novelty and technological timeliness. That idea is consistent with studies suggesting that people tended to participate in surveys which they perceived to offer an unusual opportunity (Groves, Cialdini, and Couper 1992; Groves and Couper 1998). Although those studies focused on the content of surveys, not response modes, they suggested that respondents who viewed telephone or web data collection as out of the ordinary or cutting-edge might prefer those response modes to a paper-and-pencil form.

However, evidence also exists to suggest that offering respondents alternate response modes would not boost response rates. Dillman, West, and Clark (1994) mailed a survey similar to the short form in the 1990 Census to households throughout the United States and found no increase in the response rate when they added the option of responding by calling a toll-free telephone number. Griffin, Fischer and Morgan (2001) found that the total response rate in the American Community Survey actually fell when they added an Internet response option.

In the present study, randomly selected households throughout the United States received Census 2000 short forms with instructions that explicitly offered the option of responding via the Internet or by calling a toll-free number. Half of these households received special encouragement for using these alternate response modes, in the form of a colorful insert that both urged them to use the alternative response mode and held a telephone calling card which was activated after the household used the alternative response mode.

Incentives are known to increase response rates, especially when the incentives are given to potential respondents who have not yet decided to provide their data (Singer 2002). Social exchange theory explains this effect by emphasizing that incentives serve as symbolic expressions of the researcher's gratitude, creating a relationship that fosters the respondents' cooperation. Incentives can also work as an exchange of tangible benefit, meaning that respondents may perceive incentives as payment for their service in taking the survey. In that case, respondents may weigh the value of an incentive against the effort required for the survey. This economic effect of small incentives is much weaker than their social effect, according to social exchange theory.

The goal of this experiment was to assess the effect of explicitly offering telephone and web-based response mode alternatives upon response rates in Census 2000, with and without special encouragement to use the alternatives. The findings of the experiment potentially could help in the planning for future decennial census data collection efforts.

## **2. Method**

### *2.1. Households*

A total of 30,133 households were randomly selected for this study from the Decennial Master Address File (DMAF) for Census 2000. All of these households were from the 94.3 million households in "mailout/mailback" areas, where the U.S. Census Bureau collected data by mail. Households were not included if they were among the 21.6 million located in areas where the U.S. Census Bureau used other enumeration methods, such as

“update/leave” areas where the forms were hand delivered by census personnel. All of the selected households were scheduled to receive the short form. Group homes and institutions, and households in Puerto Rico or other territories, were not included in the sample.

The DMAF was known to contain errors in which some households were listed more than once. Because of this duplication, a small number of households in this study may have received more than one mailing from the U.S. Census Bureau. The experimental design could not control for such duplication.

### 2.2. *Experimental design*

Of the households selected for this study, 10,494 were randomly dispersed among four panels in a 2 by 2, fully factorial design. The first factor, response mode, had two levels: Internet and call-in computer-assisted telephone interview (CATI). (The original design of the experiment included a third mode, Interactive Voice Response with Automatic Speech Recognition. This mode was eventually excluded because a mailing delay for some of these households made the results impossible to interpret.) The second factor, encouragement, had two levels: encouragement and no encouragement.

All four panels had the option of mailing in their census data on the usual paper forms. Two panels were given the option of calling a toll-free number, where an interviewer administered the short form using CATI. The other two panels were given the option of responding on a web questionnaire. Two panels received special encouragement for using the alternative mode, in the form of an insert holding a telephone calling card incentive, while the other two panels received no special encouragement.

The number of households assigned to each of the four panels in this design is shown in Table 1.

### 2.3. *Control group*

The remaining 19,639 households that were selected for this study constituted a control group, which was offered neither the option of responding using an alternative mode nor an insert and incentive. The control group served as a panel against which the four experimental panels could be compared.

### 2.4. *Stratification*

Each household selected for this study was classified as being from one of two strata: a low coverage area (LCA) or high coverage area (HCA). The LCA contained census tracts with high concentrations of non-White residents and renters, two groups associated with low

*Table 1. Number of households assigned to each of the four panels*

	CATI	Internet
No encouragement	2,621	2,627
Encouragement	2,622	2,624

response rates. In Census 2000 mailout/mailback areas, 19.3 percent of all households were in the LCA; the HCA consisted of the remaining households. In this study, households were proportionately sampled, with about 19.3 percent of the households in each panel and the control group from the LCA stratum.

### 2.5. Mailings

The U.S. Census Bureau mailed a Census 2000 short form and a cover letter to each household in the four experimental panels around March 13, 2000, the same time that census forms were mailed to all households in the nation. The cover letter explained that the household could provide census data in either of two ways. The household could mail in the data in the usual manner using the enclosed paper form. The cover letters to the two CATI panels explained that the household could choose instead to call a toll-free number to provide data over the telephone. The cover letters to the two Internet panels explained that the household could alternatively provide data on a web questionnaire, and provided the survey's Uniform Resource Locator address (URL).

The mailings to the two panels in the encouragement condition contained the paper census form, a cover letter, and a colorful insert printed on heavy stock paper. A calling card could be peeled off of the insert. The cover letter and insert explained that if the household provided its census data using the alternative response mode, the calling card would be activated, giving it value worth 30 minutes of domestic calls. The card would not be activated if the household responded using the paper form or failed to respond at all. The mailings to the two panels in the no-encouragement condition contained only the paper census form and a cover letter, with no calling card or insert.

The paper census forms sent to the households in all four panels provided a toll-free "Operator Assistance" (OA) number to call with questions about Census 2000 generally and about the incentive and alternative response modes. This number was different from the toll-free number that appeared on the forms received by households that were not in this study.

The mailings to the control group were identical to the standard Census 2000 mail package. They contained no insert, incentive, or reference to alternative response methods.

### 2.6. CATI and Internet surveys

The CATI data collection system was programmed in Blaise™. The questions on the CATI survey were almost identical to the questions on the paper-and-pencil Census 2000 form. One major difference was that the paper form identified "Person 1" as the homeowner or leaseholder in the household while in the CATI survey "Person 1" was the person who called, whether or not that person was the homeowner or leaseholder.

The entire web questionnaire appeared on a single web page. The respondent scrolled down the page, answering exactly the same questions that appeared on the paper census form.

### 2.7. Leakage across response mode conditions

Some leakage could occur across the response mode conditions. If a respondent called OA and asked to provide census data, the OA operator transferred the call to a CATI operator who collected the data. Even respondents who were in the control group or the Internet

condition could have provided their data via CATI in this manner. Also, several news organizations, the President, and other public officials disclosed the URL of the Internet-based census form. Consequently, households that were assigned to the CATI condition or control group could have provided their data via the web questionnaire.

### *2.8. Response rates and weighting*

Response rates were calculated three ways. “Overall response rates” considered all modes of responding: paper forms, Internet, and CATI. “Assigned mode response rates” considered only the alternative response mode of the respondent’s panel. “Mail-only response rates” considered only the mailed-in paper forms. In all three response rate calculations, households were considered nonrespondents if they failed to respond at all, or if they provided data that were too incomplete to meet the criteria of the U.S. Census Bureau for a “sufficiently complete response” in Census 2000. Households whose mailings were returned undeliverable as addressed (UAA) by the U.S. Postal Service were dropped from the analyses. These households constituted 9.71 percent of the original sample.

This method for calculating response rates corresponded to the standard definition “RR5” of the American Association for Public Opinion Research (2000). It differed from the method used by the U.S. Census Bureau to calculate the initial response rate in Census 2000, in that it excluded mailings returned UAA. As a result, the response rates obtained in this study were generally higher than those reported by the U.S. Census Bureau. In addition, this study’s response rates were higher because the sample excluded group homes and institutions, households in areas other than mailout/mailback areas, households that received the long form, and households in Puerto Rico and other territories.

The calculation of assigned mode response rates took into account the leakage across the response mode conditions. Households that were assigned to a CATI panel and that provided data to a CATI operator were always counted as “assigned mode” respondents, even if they reported their data by calling OA and being transferred to a CATI operator, rather than by calling the CATI number directly. However, the one household in the CATI condition that provided its data on the web questionnaire was not considered an “assigned mode” respondent. Similarly, 15 households were in the Internet condition but provided data to CATI operators after having called OA; these households were not counted as “assigned mode” respondents either.

All estimates were weighted by the inverse of the probability of selection. The weights were not adjusted for nonresponse, because the response rates themselves were dependent variables. Significance tests were computed with a jackknife balanced replication procedure using WesVar™ Version 4.

## **3. Results**

### *3.1. Response rates*

Table 2 shows the overall, mail only, and assigned mode response rates of the CATI and Internet panels, and both panels combined, in the encouragement and no encouragement conditions. It also shows the overall response rate of the control group.

Table 2. Response rates

Response rate	No encouragement			Encouragement			Control group
	CATI	Internet	CATI, Internet combined	CATI	Internet	CATI, Internet combined	
Overall	73.50	73.90	73.70	71.81	71.50	71.65	71.44
Mail only	72.00	69.62	70.81	54.13	55.84	54.96	NA
Assigned mode	1.45	3.98	2.71	17.68	15.37	16.52	NA

Note: Entries are percentages. The assigned mode and mail only response rates do not sum to the overall response rate for every panel because of leakage (e.g., households in an Internet panel responding via CATI). The mailings to the control group did not offer any alternative response mode. Therefore, the mail only and assigned mode response rates were not applicable (NA) to the control group.

### 3.2. Effect of the alternative response mode upon the overall response rates

Chi-square analyses were performed to assess the effect of offering an alternative response mode option in the cover letter of the Census 2000 mailing, without any insert or calling card incentive. The comparisons involved three groups: the control group, which was offered no alternative response mode, the CATI-no encouragement panel, and the Internet-no encouragement panel.

Table 2 shows that the overall response rates of both the CATI-no encouragement panel and the Internet-no encouragement panel were larger than the control group's overall response rate (chi-square = 5.38,  $p < .025$  and 6.33,  $p < .02$ , respectively). Thus, the offer of either response mode option was associated with an increase in the overall response rate. This increase was 2.06 percentage points when the CATI alternative was offered and 2.46 percentage points when the Internet alternative was offered.

### 3.3. Effect of the insert and incentive upon the assigned mode response rate

Table 2 shows that the insert and incentive were associated with a 16.23 percentage point increase (17.68 minus 1.45) in the assigned mode response rate when CATI was offered as an alternative response mode (chi-square = 417.94,  $p < .001$ ), and an 11.39 percentage point increase in the assigned mode response rate when the Internet was offered as an alternative response mode (chi-square = 205.26,  $p < .001$ ). For both alternative response modes combined, the insert and incentive were associated with an increase in the assigned mode response rate of 13.81 percentage points (chi-square = 575.07,  $p < .001$ ).

### 3.4. Effect of the insert and incentive upon the overall and mail-only response rates

Table 2 shows that even though the insert and incentive were associated with this 13.81 percentage point increase in the assigned mode response rate, that increase was offset by a larger, 15.85 percentage point reduction (70.81 minus 54.96) in the mail-only response rate (chi-square = 275.56,  $p < .001$ ). As a net result, the combined overall response rate of the two panels that received an insert and incentive was 2.05 percentage points lower (73.70 minus 71.65) than that of the two panels that received no insert or incentive

(chi-square = 4.32,  $p < .05$ ). Thus, when the mailings contained an insert and calling card, the offer of an alternative response mode was no longer associated with an increased overall response rate relative to the control group.

### *3.5. Comparisons between the response rates of the Internet and CATI panels*

No statistically significant difference was found between the overall response rates of the Internet–no encouragement panel and the CATI–no encouragement panel (chi-square = 0.10, n.s.). When the insert and incentive were included in the mailing, the overall response rates of the Internet panel and the CATI panel still did not differ significantly (chi-square = 0.05, n.s.).

When no insert and incentive were offered, the assigned mode response rate of the Internet panel was higher than that of the CATI panel (chi-square = 23.94,  $p < .001$ ). When the insert and incentive were offered, however, the assigned mode response rate of CATI panel was higher than that of the Internet panel (chi-square = 6.13,  $p < .02$ ).

### *3.6. Effect of the coverage area*

Logistic regression analyses were carried out to test for any interaction effects among the coverage area strata and the encouragement and response mode factors. The results revealed that the overall, mail-only, and assigned mode response rates were significantly larger in the HCA than in the LCA. However, no significant interactions were detected between the coverage area strata and either the encouragement or response mode factor.

### *3.7. Calling card usage*

The calling card company was asked to report on total usage of the cards six months after the data collection period. Data from the company revealed that 33.9 percent of all the cards activated in this study were never used, 38.4 percent were partially used, and 27.7 percent were completely used up.

### *3.8. Demographic characteristics of the respondents*

Table 3 shows the respondents' unweighted demographic data, as reported on the mail, Internet, and CATI questionnaires. The table shows the number of respondents who used each response mode, regardless of their panel assignment. The table also shows the mean household size, and the demographic characteristics reported for Person 1. The data for Person 1 in the households that responded by CATI are not comparable to the data for Person 1 in the other households. As mentioned earlier, Person 1 in the CATI survey was whoever provided the data while in the mail and Internet surveys it was the homeowner or leaseholder.

The data in Table 3 suggest that the homeowners or leaseholders in households that responded on the Internet tended to be younger than those in households that responded by mail. They also were more likely to be male, White, not Hispanic, and not Black. Because the data in Table 3 were merged across all four experimental panels, these comparisons must be interpreted with caution.



Table 3. Demographic characteristics of the respondents, divided according to the response mode that they used to provide their census data

	Response mode used		
	Mail	Internet	CATI
<i>N</i>	5,950	463	471
Household size	2.54 (1.40)	2.65 (1.36)	2.65 (1.54)
Person 1			
Age	51.4 (17.2)	43.9 (13.1)	46.9 (15.6)
Male	.63	.75	.60
Hispanic	.12	.06	.06
White	.80	.90	.80
Black	.11	.03	.11

Note: Entries for household size and age are means with standard deviations in parentheses. Entries for male, Hispanic, White, and Black are proportions describing the responses to demographic questions about Person 1.

## 4. Discussion

### 4.1. Alternative response modes

The results suggest that some people who are unable or unwilling to provide their decennial census data on the paper census forms would respond using an alternative response mode. That is, explicitly offering an Internet or call-in CATI option in the decennial census could increase the proportion of households who respond to the initial mailing. In the present study, that increase was small, only a little over two percentage points above the response rate achieved when no alternative response modes were offered.

The results seem to conflict with those of Dillman, West, and Clark (1994), who observed no response rate increase when they added a telephone response mode alternative to their paper survey. However, their study differed from the present study in that theirs was a field test, while the present study was conducted during Census 2000. In the field test, households that were not interested in responding may have ignored both the paper form and the telephone option. The results also seem to conflict with those of Griffin, Fischer and Morgan (2001), who observed a reduction in response rate when they added an Internet response mode alternative. However, in their study, response rates were well under 50 percent. By contrast, Census 2000 was accompanied by substantial publicity, all households were obligated to provide their data, and the response rate was relatively high. The respondents in the present study may have been more likely to use their preferred response mode, even when they were not especially motivated to provide their census data.

### 4.2. Special encouragement

The special encouragement, in the form of an insert holding a calling card, was associated with a very large increase in the use of the alternative response modes. This result is not surprising. Households in the no-encouragement condition would not have even known about the alternative response modes unless they read the cover letter. The inserts holding the calling cards in the mailings to the households in the encouragement condition,

however, prominently conveyed a sense that the alternative modes were important and desirable.

The special encouragement was more effective in increasing the response rate when the CATI alternative was offered than when the Internet alternative was offered. Perhaps this effect reflects the fact that telephones are more universally and easily available than are computers with Internet access.

Even though the special encouragement brought about a 13.81 percentage point increase in the assigned mode response rate for the CATI and Internet panels combined, this increase was offset by a larger, 15.85 percentage point decrease in the mail-only response rate. The net result was a 2.05 percentage point decrease in the overall response rate.

Social exchange theory (Singer 2002) may offer a partial explanation for this effect of the insert holding the calling card increasing the assigned mode response rate greatly but decreasing the mail-only response rate even more. This special encouragement was designed to motivate the households to respond via the alternative mode, not via the paper form. As a result, many respondents who would be willing to send in the paper form switched to the alternative mode. However, the special encouragement might have also had the unintended effect of making the alternative response mode too attractive. Because of the special encouragement, some people who wanted to use the paper forms may have concluded that the U.S. Census Bureau preferred that they use the alternative response mode instead. These people may have hesitated and put the census mailing aside, while they decided which response mode to use. A portion of these people, who ordinarily would have responded, may have never returned to their mailing.

Also, some proportion of the respondents may have glanced at the insert and incorrectly concluded that the survey was only for people who were willing and able to respond by telephone or the Internet. Some of these people may have been unwilling to use these media, or may have lacked telephones or Internet access, and concluded that they should not respond at all.

#### *4.3. Coverage area*

As expected, response rates were higher for households in the HCA than for LCA households. However, the logistic regression analyses failed to reveal any significant interactions between the coverage area strata and the encouragement or response mode factors. This result is surprising, because the Internet may have been less universally available and the incentive may have been perceived as more valuable in the LCA than in the HCA (National Telecommunications and Information Administration 2000). Future research might revisit this issue with a larger number of households. Greater statistical power might help in investigating the differential effect of incentives and alternative response modes in high and low coverage areas.

#### *4.4. Internet usage*

The results may suggest that a household was more likely to use the Internet when the homeowner or leaseholder was younger, male, White, not Hispanic, and not Black. These results mirror the fact that a “digital divide” still exists in the United States and much work remains to close it (National Telecommunications and Information Administration 2000).

#### 4.5. *Calling card incentives*

The results show that over a third of the activated calling cards went completely unused. This is consistent with the results of a study by Mitchell, Lamothe-Galette, and Potter (2003), who compared various incentives, all worth \$10, in a mixed-mode survey of low-income households. In that study, only 30 percent of the people who received telephone calling cards ever used them. Point-of-sale cards and checks were much more widely used. Of course, there was no way to determine the number of respondents in the present study who chose not to use the calling card in order to save it for emergencies. The results nonetheless suggest that telephone calling cards are not highly valued universally.

### 5. **Conclusions**

#### 5.1. *Alternative response modes*

Should alternative response modes be explicitly offered in future decennial censuses? In the present study, offering the web or CATI options, with no insert or calling card, boosted the response rate by 2.46 and 2.06 percentage points respectively over the control group. These results suggest that offering alternative response modes might reduce the costs of sending enumerators into the field to collect data from households that failed to respond to future decennial Census mailings. However, these potential savings must be weighed against the costs of offering such alternative response modes.

A well-advertised web questionnaire response mode, requiring no telephone interviewers, may have the potential to increase the response rate cost-effectively. Even a relatively modest increase in the response rate—such as those observed in the present study—might reduce the need for nonresponse follow-up by enumerators in the field enough to justify the costs of establishing and maintaining a web questionnaire. This conjecture, of course, assumes that one can generalize from the present study to future decennial censuses.

CATI and web-based data collection methods also have advantages over paper forms beyond potentially increasing the response rate. With both CATI and web-based data collection, the computer can be programmed to enhance quality assurance, by enforcing the branching logic and guarding against implausible or missing responses. Both methods avoid the costs and potential errors associated with transcribing data from paper. Both eliminate the cost of postage for returning the paper form.

As 2010 approaches, the likely costs and benefits of offering alternative response modes will become more clear. Other Census 2000 evaluation studies (e.g., Guarino 2001) and further U.S. Census Bureau research will inform decisions regarding the feasibility of explicitly offering alternative response modes in the 2010 Census and beyond.

#### 5.2. *Special encouragement*

Should households be offered an insert with an incentive for using an alternative response mode in the decennial census? The results of this study do not suggest that such special encouragement would increase the proportion of households who provide their census data; the results actually suggest the contrary. The cost of the incentives therefore could not be justified.

### 5.3. *Implications for other mail surveys*

The decennial census is an important data collection effort, with far-reaching implications for domestic policy and spending. However, the Census short form is a unique instrument. Further research is needed to determine whether the results in this experiment apply also to the long form, which is more burdensome, and to other Federal surveys, which are often voluntary and more complex (Couper, Singer, and Kulka 1998; Singer, Mathiowetz, and Couper 1993). Further research can study differences among demographic groups, and examine the effect of offering response mode alternatives together rather than singly, with several different levels of encouragement for using the alternative response modes. Such controlled experimentation can identify the most cost-effective strategies for boosting response rates in many Federal data collection efforts.

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