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# Complementing Random-Digit-Dial Telephone Surveys with Other Approaches to Collecting Sensitive Data

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**Abstract:** Surveys of sensitive topics, such as the Injury Control and Risk Surveys (ICARIS) or the Behavioral Risk Factors Surveillance System (BRFSS), are often conducted by telephone using random-digit-dial (RDD) sampling methods. Although this method of data collection is relatively quick and inexpensive, it suffers from growing coverage problems and falling response rates. In this paper, several alternative methods of data collection are reviewed, including audio computer-assisted interviews as part of personal visit surveys, mail surveys, web surveys, and interactive voice response surveys. Their strengths and weaknesses are presented regarding coverage, nonresponse, and measurement issues, and compared with RDD telephone surveys. The feasibility of several mixed mode designs is discussed; none of them stands out as clearly the right choice for surveys on sensitive issues, which implies increased need for methodologic research.

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## Introduction

The National Center for Injury Prevention and Control of the Centers for Disease Control and Prevention routinely conducts surveys on topics related to injury prevention and control. These surveys are typically conducted by telephone using random-digit-dial (RDD) sampling methods. Key examples include the Sexual Violence and Intimate Partner Violence modules in the Behavioral Risk Factor Surveillance System (BRFSS), the National Violence against Women Survey, and the Injury Control and Risk Surveys. An important characteristic of all of these surveys—one that they share with many other federal surveys—is that they ask sensitive questions about people's behavior and experiences.

Telephone surveys have been an attractive alternative to face-to-face surveys for decades. The principal reasons have been savings in costs and time, with relatively high levels of coverage of the general population. In addition, there is some evidence that reducing the physical presence of the interviewer may increase reporting of sensitive behaviors. However, telephone surveys have come under increasing threat in the past few years in terms of both coverage and nonresponse. In this paper, the issues relating to telephone surveys

and the possible alternatives for accurately measuring sensitive topics among probability samples of the general public are reviewed, beginning with a brief review of the prevailing threats to inference from telephone surveys. Selected alternative modes of data collection are then reviewed, followed by a discussion of their strengths and weaknesses relative to RDD telephone surveys.

## Problems with Random-Digit-Dial Surveys Coverage Issues

Telephone coverage of households in the United States has remained relatively steady in the range of about 95% for several decades now, and the coverage properties of telephone surveys are well established.<sup>1</sup> As of the first half of 2005, Blumberg et al.<sup>2</sup> estimated that 91.6% of adults in the United States live in households with landline telephone service. This leaves 6.7% of the adults who live in households with wireless service only and 1.7% without any service at all. However, while the under-coverage of the poor, those in rural areas, and those with less access to health care has been shown to have limited impact on the estimates on a wide variety of topics, the fact that certain at-risk groups are disproportionately excluded from telephone surveys may bias estimates regarding domestic violence and injury, especially for certain subgroups.

The problem of noncoverage in telephone surveys is again receiving attention from survey researchers, primarily because of the trend away from fixed landline phones to mobile or cellular phones. The United States

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is in the midst of an upheaval in the structure of telephone service, following similar changes in Europe and Asia in the last decade.<sup>2-6</sup> While the current situation does not appear too problematic, it seems inevitable that the trend toward mobile phones will force survey researchers to re-think their approach to telephone surveys.

Cell phone users without landlines are especially challenging to estimates gained through RDD surveys, because RDD samples exclude cell phone numbers. Various sources converge at the estimate that about 6% of U.S. households can be reached only by cell phones.<sup>2,5,7</sup> Compared with adults living in landline households, adults living in cell phone-only households are more often younger (almost 20% of the group aged 15 to 24 years lives in cell phone-only households), Hispanic, not married, and renters.<sup>5</sup> In addition to demographic differences, the cell phone-only people may be different in some health-related behaviors. For example, data from the National Health Interview Survey show that cell phone-only adults consume more alcoholic drinks and are more likely to smoke and to be uninsured than adults who live in households with a landline.<sup>2</sup> This can induce bias in prevalence estimates of these behaviors obtained through RDD surveys. A recent experiment conducted by the Joint Program in Survey Methodology<sup>8</sup> has shown that although cell phone numbers can be included in RDD samples, there are three drawbacks: response rates are lower (e.g., 22.1% vs 34.0% for a 10-minute questionnaire via cell phone and landline telephone, respectively), incentives are needed to compensate for the cost to the respondent, and respondents are more likely to be involved in other activities while completing the survey.

### Nonresponse Issues

The paper by Johnson et al.<sup>9</sup> deals with nonresponse in RDD surveys in greater depth, but we briefly review a few key issues here. First, it is generally accepted that telephone response rates are declining, and the pace of decline may have accelerated in recent years.<sup>10,11</sup> Many blame the rise of telemarketing for this trend, although evidence of this link is hard to come by. The introduction of the Federal Communications Commission (FCC)'s National Do-Not-Call Registry may help, but we have not yet seen any evidence of a slowing or reversal in the decline in telephone response rates, and the registry may have come too late. People have already changed their answering behavior and adopted a variety of tools to screen unwanted telephone calls.<sup>12</sup> The decline in telephone response rates may also be related to emerging trends in time away from home, competing demands, and a host of other factors outside the control of survey researchers.<sup>13</sup>

Second, there may not be a direct relationship between response rates and nonresponse bias. For example, Keeter et al.<sup>14</sup> compared a standard RDD design with a relatively low response rate to a more rigorous design with a higher response rate and found few differences on a variety of attitude measures. Curtin et al.<sup>10</sup> assessed the impact of excluding initial refusals and harder-to-reach respondents from samples obtained in the Survey of Consumer Attitudes from 1979 to 1996 and found only minimal effects on survey estimates. However, surveys with both high and low response rates may suffer from substantial nonresponse bias, as recently demonstrated by Groves.<sup>15</sup>

### Measurement Issues

Several comparisons of telephone surveys with face-to-face surveys have generally concluded that the two yield similar results for nonsensitive items.<sup>16-18</sup> However, telephone interviews appear to be less effective than personal interviewing in eliciting sensitive information, and the data typically show a higher social desirability bias for data collected by telephone.<sup>17,19-21</sup> While some studies find the opposite effect,<sup>22,23</sup> the de Leeuw and van der Zouwen study<sup>17</sup> is particularly telling since it is a meta-analysis based on a large number of mode comparisons.

To an increasing degree, both face-to-face and telephone surveys use self-administration rather than an interviewer for sensitive items. In the case of face-to-face interviewing, audio computer-administered self-interviewing (ACASI) is used. In telephone surveys, the corresponding technology is called telephone ACASI or interactive voice response (IVR). Both methods are discussed in more detail below.

### Alternatives to Telephone Surveys

#### Audio Computer-Assisted Self-Interviewing

Of all the methods of data collection currently available to survey researchers, the combination of ACASI, face-to-face contact with the household by an interviewer, and area probability sampling may be the closest thing to a "gold standard" for measuring sensitive topics.

**Coverage and nonresponse issues.** Area probability sampling may not yield complete coverage of the population. For instance, it necessarily misses the homeless, typically misses some fraction of dwelling units, and omits some people within partially enumerated households. In high-quality surveys, such as the Current Population Survey, the coverage is probably close to 95% of the population,<sup>24</sup> far exceeding that of any other method. For example, 10% or more of all households are typically omitted from telephone surveys (because 8.4% of the households have no landline service,<sup>2</sup> and about 4% are in "zero banks" [groups of

100 consecutive possible numbers, none of which is a residential listing]).<sup>25</sup>

Surveys in which interviewers contact the household in person also typically have higher response rates than those in which the household is contacted by telephone interviewer or is mailed a questionnaire.<sup>26,27</sup> Despite recent declines in response rates, several federal surveys that are done face-to-face still have response rates of about 90%.<sup>28</sup> Thus, face-to-face recruitment of members of an area probability sample is likely to minimize both coverage and nonresponse errors compared to telephone, mail, or web surveys.

**Measurement issues.** The ACASI approach also has very desirable measurement properties as well. An interviewer is present to establish the legitimacy and importance of the survey and to instruct the respondent in the use of the laptop computer that administers the questions. The questions are presented both visually onscreen and aurally via earphones so that even respondents with low levels of literacy can take part.<sup>29</sup> ACASI combines the power, flexibility, and standardization of automation with the privacy of self-administration. At least five experiments have compared ACASI with some other method of self-administration (such as a paper self-administered questionnaires), and all indicate that ACASI is at least as good as the alternative methods for eliciting reports about sensitive information.<sup>29-33</sup> For example, Lessler et al.<sup>31</sup> reported higher levels of reporting of illicit drug use with ACASI than with a self-administered paper questionnaire.

Because of these desirable properties, several national surveys that collect sensitive information have switched to ACASI in conjunction with area probability samples; these include the National Survey of Drug Use and Health and the National Survey of Family Growth. However, one major drawback to this methodology is the expense involved. Currently, face-to-face interviews with national area probability samples can run as high as \$1000 per completed case, depending on the length of the interview, the need for initial screening to identify members of rare populations, the target response rate, and other factors. Clearly, for many studies these costs will be prohibitive.

Surveys on domestic violence raise particular issues in that it is important to keep other family members, especially the potential abuser, from learning the topic of the survey. Aquilino et al.<sup>34</sup> showed that computer assisted self-administration reduced the impact of the presence of other people, apparently because the answer "disappeared" in the computer, rather than leaving a paper trail. However, it is not clear which modes provide the greatest confidentiality, because other family members can open a mail survey, look over the shoulder in an ACASI or web survey, or listen in on a telephone interview.

## Mail Surveys

Mail surveys have some advantages over other methods of data collection. They are considerably cheaper, have relatively stable response rates, and may improve reporting of sensitive issues. On the other hand, there is little control over who completes the questionnaire, whether the instructions are being followed, and whether the questions are understood as intended.

**Coverage and nonresponse issues.** Mail surveys usually require a list of addresses to which the questionnaires can be sent. Such lists may exist for limited populations, such as the employees of an organization or subscribers to a certain service, but they are not available for most nationally targeted surveys. Nevertheless, once a satisfactory frame is available, it is relatively easy to select good quality samples. The inherently lower cost of mail surveys (e.g., half or less than half of the cost of a completed telephone interview<sup>35</sup>) allows for more geographically dispersed and larger samples than in comparable interviewer-administered surveys.

Although mail surveys are often perceived as suffering from low response rates, some studies suggest that response rates of 60% may be possible in mail surveys.<sup>26,27,35-37</sup> Furthermore, the response rates to mail surveys have remained relatively stable during the period of significant decline in response rates for telephone and face-to-face surveys.<sup>27</sup> However, nonrespondents to mail surveys may be different from the respondents in some important ways, such as in gender, education, or cognitive abilities.<sup>38</sup>

A further challenge for mail surveys is lack of control over selecting the target respondent among all persons who can be reached at a given address. While in face-to-face and telephone surveys interviewers can implement various respondent selection procedures, in mail surveys one has to rely on the good judgment and conscientiousness of survey recipients. Even with specific written instructions about the appropriate selection procedure, there is no guarantee that this procedure will actually be followed.<sup>39,40</sup>

**Measurement issues.** Because they are self-administered, mail surveys have some important advantages over interviewer-assisted modes. Most notably, many studies have shown an overwhelming effect of self-administration on levels of reporting sensitive behaviors.<sup>41</sup> For example, Schober et al.<sup>42</sup> showed that paper self-administered questionnaires sharply increased the reported rate of illicit drug use compared to interviewer administration. A major disadvantage of mail surveys is that the researcher has little control over the response process. For example, there is no way to know whether the respondents are reading the questions and instructions thoroughly, whether they understand the question in the intended way, or whether they look up records when asked to do so.

## The Internet

Web surveys have several advantages over other survey modes. The most prominent ones are lower costs and higher speed of data collection, elimination of geographic limitations, ease of use of audio and video elements, and automated features that can improve data quality. On the other hand, web surveys are threatened by serious coverage and sampling difficulties and generally have relatively high nonresponse rates.<sup>43</sup>

**Coverage and nonresponse issues.** Internet surveys of the general population are prone to serious coverage biases, since a significant portion of the population still does not have access to the Internet, and there are large differences between those with access and those without. According to Nielsen/Net Ratings, only 75% of the U.S. population had access to the Internet from home in 2004,<sup>44</sup> and less than 50% used the Internet at least once in the last month.<sup>44</sup> Furthermore, people without access to the Internet are significantly different from those who do have access, with the former more likely to be older, less educated, poorer, black or Hispanic, and unemployed.<sup>44-47</sup>

Nonresponse can arise in different phases of an Internet survey. Some of the e-mail invitations never reach some sample members, some who received the e-mail never read it, of those who start the online survey some give up immediately and some later, and often only a relatively small portion of the sample completes the questionnaire (e.g., only 35% of the sample described by Lozar Manfreda et al.<sup>48</sup> and Vehovar et al.<sup>49</sup>). An advantage of online surveys is that respondents' behavior can be well documented even when they break off before the end of the survey.<sup>50</sup>

Overall, response rates in web surveys vary widely and depend on factors such as the type of population, the sampling procedure, and whether incentives are offered. In his review of web surveys, Schonlau<sup>51</sup> reported response rates that ranged from less than 1% in a convenience sample of web users contacted by web site advertising to 75% in a U.S. Census Bureau establishment survey. For list samples, web surveys usually get lower response rates than mail surveys,<sup>43,51</sup> although there are some exceptions.<sup>52-54</sup>

As in mail surveys, a researcher cannot be sure who completes the web survey. In pre-recruited web survey panels, participants usually complete a screening questionnaire and provide a personal e-mail address through which they can be invited to surveys. While there is no guarantee that the invitees will not forward the survey to others, in practice this appears to be of negligible concern.

**Measurement issues.** Like all computer-assisted surveys, web surveys allow for complex routing and skips, automated edits and checks, randomizations, and feed-

back and assistance to the respondents. These automated routines can improve the quality of data,<sup>55,56</sup> although some require that a respondent's browser can run active content such as JavaScript. Web surveys also enable easy implementation of various visual elements, such as pictures, symbols, and animation. While this can make a web questionnaire more interesting to the respondents and improve their comprehension of the questions, the added visual elements can also change the measurement properties of questions.<sup>57,58</sup>

Like mail surveys, web surveys are inherently self-administered. That can enhance reporting of sensitive behaviors, although it also reduces the researcher's control over how respondents understand and answer the questions. The absence of interviewers may reduce social desirability bias in web surveys, in accord with comparable findings from computer-assisted self-interviewing (CASI) and computer-assisted personal interviewing (CAPI) questionnaires,<sup>59</sup> but these gains have yet to be clearly demonstrated. Some studies suggest that computerization itself may have similar effects to self-administration.<sup>60-63</sup>

## Interactive Voice Response

The telephone counterpart to ACASI is known variously as interactive voice response, touchtone data entry, or telephone ACASI. We will refer to this mode of data collection as IVR, the most widely used term. Regardless of the label, the method involves an automated telephone interview, in which the computer plays a recording of the questions and the respondents indicate their answers by pressing one of the number keys on their telephone hand-set or, increasingly, by saying the number corresponding to their answer aloud. Tourangeau et al.<sup>64</sup> provide a review of most of the studies examining this method of data collection. Relative to computer-assisted telephone interviewing (CATI), IVR should produce some cost savings from reduced interviewer time, but we know of no studies that estimate these savings.

**Coverage and nonresponse issues.** Since the members of an IVR sample are usually recruited via RDD sampling, the coverage problems for an IVR are typically the same as those for telephone surveys generally—that is, more than 10% of all households are likely to be excluded because they lack a landline telephone or their telephone number falls into a bank that is excluded from the frame.

In a typical IVR study, the respondents are initially contacted by a telephone interviewer, who collects some demographic information and switches the respondent to the IVR system. The response rates to the initial portion of the interview are similar to those of other RDD surveys; in addition, however, respondents may drop out during the switch to IVR or part way through the IVR portion of the interview.<sup>64</sup> These

dropout rates are often substantial (e.g., 24% in Cooley et al.,<sup>65</sup> and 18% in Gribble et al.<sup>66</sup>). Tourangeau et al.<sup>64</sup> found that asking a few innocuous questions before the switch can significantly reduce the dropout rate.

**Measurement issues.** Advocates of IVR point to its positive impact on reports about sensitive behaviors. For example, Turner et al.<sup>67</sup> report that respondents are more likely to admit risky sexual behaviors in an IVR interview than in a conventional CATI. Gribble et al.<sup>66</sup> found that the IVR respondents were more likely to report illicit drug use than CATI respondents. Tourangeau et al.,<sup>64</sup> show reduced positivity bias in customer satisfaction surveys done via IVR compared to the same questions administered in CATI interviews. More generally, IVR seems to bring some of the gains from self-administration into telephone interviews, although it is not yet clear whether the gains from IVR are as large as those from other forms of self-administration.

### Mixed-mode Designs

Many survey researchers see mixed-mode designs as a promising means to offset the rising costs of survey data collection and to counter declining response rates and coverage. Mixed-mode designs come in many different flavors, but three are relevant to surveys of sensitive topics: dual-frame designs, single-frame designs, and panel designs. Each of these approaches is reviewed briefly in turn.

### Dual-Frame Designs

The idea behind this approach is to use more than one frame to compensate for the coverage weaknesses of a single frame. Such designs may be attractive for repeated cross-sectional surveys, where relatively infrequent surveys conducted using more costly and higher-quality methods (e.g., face-to-face or telephone) are supplemented with more frequent measurement using another mode (e.g., Internet, mail). The data from the high-quality surveys are then used to calibrate the estimates from the lower-quality surveys with larger sample sizes to produce trends that can be projected to the larger population. Perhaps the most typical dual frame design combines a large-scale RDD survey with smaller face-to-face surveys targeted at those areas with low telephone coverage.<sup>68</sup> This approach is used on the National Survey of America's Families.<sup>69</sup> It is also possible to use a second frame to increase efficiency in finding members of a specific subgroup. For example, Census data could be used to identify areas with a high percentage of minority residents (e.g., Hispanics), and an address list could be used to sample from those areas.

### Single-Frame Designs with Mode Option

This approach has been used in several surveys in which the main mode of data collection is mail. Two of the more prominent examples are the Decennial Census<sup>70</sup> and the American Community Survey (ACS).<sup>71</sup> In each case, the mailed questionnaire contains an invitation to complete the survey over the Internet. The goal is to reduce the costs of data collection, but relatively few ACS or Census respondents availed themselves of the opportunity to provide the data via the web. This method is based on the assumption that measurement error is invariant across modes for the basic demographic items that these surveys collect. This assumption is less likely to hold in the case of surveys on sensitive topics.

In a variant of this approach, Link and Mokdad<sup>40</sup> explored the feasibility of the web and mail as options for the BRFSS. In two separate experiments conducted in four states, a subset of an RDD sample that could be matched to addresses was invited, by mail, to complete a web or mail survey. Telephone follow-up was used for nonrespondents. Link and Mokdad<sup>40</sup> found that overall response rates were increased using this strategy, relative to the telephone-only approach, but they found significant demographic differences in those who completed the survey using the different modes.<sup>40</sup> For example, mail respondents were significantly older than those who responded on the web, and both of the self-administered groups were older than the telephone respondents. They also found significant differences between web and telephone modes in responses to several questions on health conditions and risk behaviors. For example, even after controlling for differences in demographic characteristics, web respondents were consistently more likely than both mail and telephone respondents to report that they had five or more drinks on at least one occasion within the last 30 days.<sup>72</sup>

### Panel Designs

There are also many ways to mix modes in the context of panel studies. We focus here on the recruitment of respondents via the telephone, with follow-up via mail or Internet. This approach does not solve the coverage or nonresponse concerns about the telephone mode, but uses the pool of telephone respondents as a frame for later surveys.

In a recent example, Fricker et al.<sup>73</sup> conducted a short telephone screener using RDD sampling methods. Those who reported Internet access were randomly assigned to a web survey or a telephone interview. The response rate for the screener was 42.5%. Of those assigned to the web mode, 51.6% completed the online survey, compared with 98.1% of those assigned to the telephone interview, which immediately followed the screener. Two similar studies<sup>74,75</sup> had even lower

overall response rates. In another example of this approach, called the Knowledge Networks panel, members are recruited through RDD surveys and then provided with Internet access in exchange for participation in online surveys.<sup>76,77</sup>

To summarize, while mixed-mode designs are an attractive option for certain types of studies (particularly for panel surveys and list-based samples), they are not a panacea for the problems that ail RDD surveys of the general population. In particular, the use of web data collection as part of a mixed-mode strategy becomes an attractive option for survey researchers under several conditions: (1) enough members of the sample are both willing and able to respond via the web to justify the investment in this mode; (2) the data quality differences across the modes are negligible, permitting the merging of data from different sources; and (3) the introduction of the alternative mode offers some tangible benefit such as increased overall response rates, greater timeliness, or reduced costs.

## Conclusion

Traditionally, survey researchers have relied on three main methods of data collection—telephone interviews with members of RDD samples, face-to-face interviews with members of area probability samples, and mail questionnaires sent to members of list samples. We discussed these three methods (with ACASI used in place of the traditional face-to-face interviews), plus two relatively recent additions to the list—IVR interviews and web surveys. Finally, we also briefly discussed briefly mixed mode surveys that combine two or more of these options.

Each of these methods of data collection has its pros and cons, but no method stands out as clearly the right choice for surveys on sensitive issues. As societal trends make people increasingly harder to reach and more difficult to persuade to take part in surveys,<sup>78</sup> research organizations will likely need considerable investments in methodologic research just to maintain the current levels of coverage and response rates. We believe such investments are well worth the cost if surveys are to continue to yield accurate information for important policy decisions.

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