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Sampling Bias in an International Internet Survey of Diversion Programs in the Criminal Justice System

Kathleen Hartford

Robert Carey

James Mendonca

Lawson Health Research Institute, London, Ontario

Despite advances in the storage and retrieval of information within health care systems, health researchers conducting surveys for evaluations still face technical barriers that may lead to sampling bias. The authors describe their experience in administering a Web-based, international survey to English-speaking countries. Identifying the sample was a multistage effort involving (a) searching for published e-mail addresses, (b) conducting Web searches for publicly funded agencies, and (c) performing literature searches, personal contacts, and extensive Internet searches for individuals. After pretesting, the survey was converted into an electronic format accessible by multiple Web browsers. Sampling bias arose from (a) system incompatibility, which did not allow potential respondents to open the survey, (b) varying institutional gate-keeping policies that "recognized" the unsolicited survey as spam, (c) culturally unique program terminology, which confused some respondents, and (d) incomplete sampling frames. Solutions are offered to the first three problems, and the authors note that sampling bias remains a crucial problem.

Keywords: *sampling bias; methodology; Internet surveys; mentally ill*

As numerous researchers have observed, the Internet promises to be a highly effective means by which to conduct health survey research (Ahern, 2005; Ritter, Lorig, Laurent, & Matthews, 2004; Solomon, 2001). Nevertheless, the medium remains "an area marked by great potential but also little experience" (Witte, Amoroso, & Howard, 2000, p. 180). This article describes our experience in using a Web-based survey to study diversion from the criminal justice system for persons with mental illness (PMI) in

English-speaking countries. Co-occurring disorders were excluded from this review by our mandate from our funding agency, the Ontario Ministry of Health and Long-Term Care. Diversion is a process by which alternatives to criminal sanctions are made available to PMI who have come into contact with the law for certain offenses. The objective is to secure appropriate therapeutic services without invoking the usual criminal justice control of trial and/or incarceration. Treating the disorder, it is hoped, reduces the likelihood of further offending, and the focus is on helping individuals to access community support and treatment. In general, diversion programs take one of three forms: (a) police prearrest or prebooking diversion, (b) court diversion and, (c) special courts, such as drug courts or mental health courts (MHCs). In our literature review, we found that most literature on this topic consisted of descriptive studies that failed to address important questions specified by our mandate, which required us to identify best practices in the field. Because part of our research already involved interviewing key local informants in the field of mental health diversion, we decided that it would be worthwhile to augment this effort by conducting an international survey of diversion programs in North America, Great Britain, Australia, and New Zealand (Hartford et al., 2005). It was anticipated that the Web-based survey would have few of the disadvantages of a traditional mail-based survey—no paper, no postage, no phone charges, or keyboard data entry. Furthermore, we did not foresee that selection bias would be problematic given that government-funded diversion respondents would have access to a computer. Neither did we expect that responses to our survey would reveal confidential information; respondents were promised anonymity in the final report. Despite these expectations, we found that sampling bias remains a major problem, especially when surveying publicly

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Table 1
Key Challenges in Conducting an International Survey via the Internet

Challenge	Solution
Respondents may have trouble accessing the questionnaire because of system incompatibility.	Ensure the survey is sent in multiple formats and can be downloaded from a project Web site.
Varying institutional policies regarding attachments or mass mailings.	Enroll researchers to distribute the survey.
Accurate sampling frames may be inaccessible or nonexistent.	Assemble research team in relevant countries to identify sample.
Program terminology may vary from site to site.	Involve researchers and stakeholders in questionnaire design.
Some Web sites fail to identify appropriate contact person.	Institutions should appoint a liaison person to facilitate research.

funded programs in an international context. Although potential respondents are now more computer literate and familiar with the Internet, the advent of spam has resulted in Web masters blocking both nonmembers and e-mails with keywords such as "survey." In addition, system incompatibility presents special problems for researchers conducting large-scale, international Internet surveys. This article identifies key challenges of conducting such a survey and recommends solutions.

Literature Review

The efficacy of Web-based surveys varies from study to study. Web-based, e-mail, and postal surveys report different response rates, ranging from 7% to 44% for Web surveys, 6% to 68% for e-mail surveys, and 15% to 77% for mail surveys, depending on the nature of the survey and the techniques used to augment the response rate (Dillman, 1999; Schonlau, Fricker, & Elliott, 2001, Solomon, 2001). Although Web-based surveys have traditionally resulted in lower response rates than mailed surveys, Raziano, Jayadevappa, Valenzuela, Weiner, and Lavizzo-Mourey (2001) compared the two methods directly. Using a sampling frame of 114 geriatric medical chiefs in the US constructed from public source documents, half were randomly selected to receive e-mail surveys, whereas the remaining received postal surveys. E-mail respondents were offered a choice of responses: e-mail, Web, or printing the survey and mailing it. Both groups

had three follow ups. Although the response rate was 58% for the e-mail group and 77% for the postal group, response times were quicker and the costs lower for the e-mail group. E-mail nonresponders were contacted by phone and reported lack of comfort with the technology. The authors noted that the electronic format minimizes data input. However, 12% of the e-mail group was not accessible, because the process of obtaining e-mail addresses can be labor intensive if electronic databases are not available.

Although methods to increase Web-based response rates have been identified (e.g., prenotification, simplistic design, and follow up) Solomon (2001) postulates that we may still lack knowledge on how to achieve high response rates. Indeed, only recently have sociodemographic differences in response rates and reliability issues been examined. Matz (1999) identified no significant differences between demographic characteristics, such as age and gender. In contrast, Ahern (2005) reports concern that bias is implicit because of the typical characteristics of Internet users—middle class, educated, and white collar. However, examining the reliability of Internet versus mailed questionnaires, Ritter et al. (2004) assembled a convenience sample of people with chronic disease who were computer literate. The sample was randomly assigned to an Internet or mailed survey of 16 self-reported, previously validated health assessment instruments. Response rates of 87.0% for Internet users and 83.1% for mail respondents were not significantly different.

Recent publications provide detail on the design, administration, and costs of Web-based surveys (Leece et al., 2004; Schleyer & Forrest, 2000). Advantages include low cost, ease of processing results and tabulating data, and greater flexibility in questionnaire design (Dillman, 1999). Reaching respondents across international borders is also cited as a benefit (Baernholdt & Clarke, 2006). Disadvantages include the nonrandom nature of the sample, unavailability of population lists, lack of computer literacy, browser compatibility problems, and confidentiality issues (Leece et al., 2004; Schleyer & Forrest, 2000). LaCoursiere (2003) argues that, without careful oversight, Internet research can magnify self-selection, thus compromising external validity. Conversely, Eysenbach and Wyatt (2002) noted that some groups may be concerned about privacy issues, a factor that can also lead to sampling bias. In addition, various means of distributing survey questionnaires can lead to different response rates. Leece et al. (2004) accessed an international orthopedic trauma database in 2002 and alternately assigned members to e-mail (mixed methods of PDF and paper copy) or postal survey. Response rates were significantly higher in the mail group than in the e-mail group (58% and 45% respectively, $p = .01$), in spite of concerted efforts and

accessing a group that was comfortable with the Internet. Even when e-mail addresses exist, as in the Braithwaite, Emery, de Lusignan, and Sutton (2003) survey of the password-protected U.K. General Medical Council's (GMC) site for general practitioners, 26% of e-mail surveys were rejected as incorrect or invalid addresses. Braithwaite et al. (2003) were also able to validate the representativeness of the sample vis-à-vis the GMC's demographics. Although Morris, Fenton, and Mercer (2004) had access to all e-mail addresses of the American Association of Colleges of Nursing and conducted three follow-up contacts, a 21% response rate was obtained to their Web-based survey of national trends in nursing education.

Method

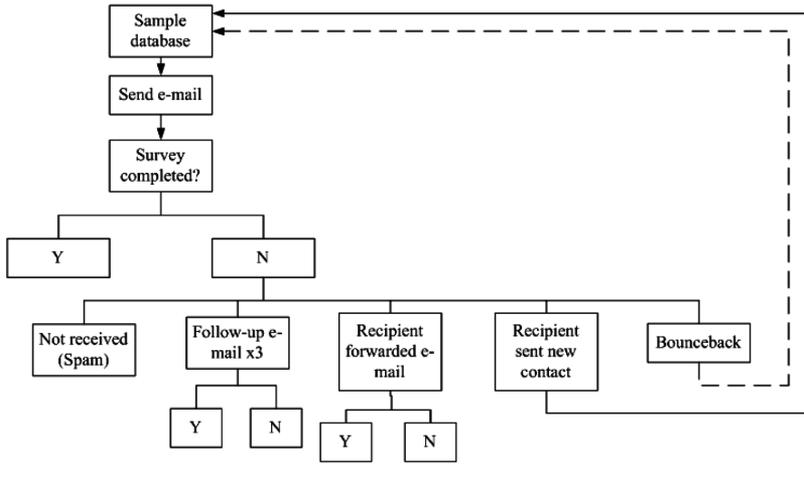
Upon obtaining ethical approval from the University of Western Ontario's Health Sciences Research Ethics Board, three survey questionnaires were developed: (a) a mental health court survey that consisted of 60 questions, (b) a court diversion survey with 41 questions, and (c) a police survey with 38 questions. Each survey included questions about demographic information, personnel and funding, referral to community agencies and interagency memoranda of agreements, program monitoring criteria, annual volume, current training, and future needs for training in mental health or legal issues. The survey was pretested with police and community mental health agencies providing diversion. It was also pretested with the research team and sent to the Ministry of Health and Long-Term Care liaison personnel for review. Comprehension, ease of administration, and time for completion were assessed. During the pretests, completion time ranged from 20 to 40 min.

After pretesting the survey, it was converted into an electronic format accessible by multiple Web browsers. Prospective respondents were directed to the Web site by means of e-mails that explained the nature of the survey and that contained a hypertext link to the Web site. In addition, PDF, Word, and WordPerfect documents were attached with the e-mail, providing respondents with a range of response options. The Web site itself introduced the survey with a cover letter explaining the reason for and nature of the survey and provided assurances of confidentiality. Because many of the questions asked for detailed responses, individuals were able to cut and paste existing documents into the survey, send them as an e-mail attachment, or fax them, ensuring maximum flexibility. Respondents were asked if they wanted to receive a copy of the final report, and an automatic thank you was sent upon completion.

Identifying the sample was a multistage effort. The first step involved searching for published, public e-mail addresses. The U.S. National Alliance for the Mentally Ill, and the Council of State Governments (2004), as well as the Council of State Governments (n.d.) documents provided an e-mail listing of 228 police, court diversion, and mental health courts. After consideration of the new federal privacy legislation, the Canadian Association of Chiefs of Police released their membership directory that contained 129 e-mail addresses. The second step involved Web searches of public agencies. Police e-mail addresses or fax numbers in Australia and New Zealand were located; generic U.K. police, court, and National Health Service (NHS) e-mail addresses were also identified. The third step involved examining literature, using personal contacts known to the authors, and linking these to extensive searches on the Internet. From steps two and three, e-mail addresses of 518 individuals from Canadian, U.K., Australian, and New Zealand police, court diversion, and mental health courts were identified. Thus, an initial convenience sample of 875 persons/organizations was assembled. E-mails inviting prospective respondents to participate in the survey, and directing them to the survey Web site, were sent in four waves between May 24, 2004 and July 7, 2004.

Because many of the e-mail addresses in the original convenience sample proved unusable or inaccurate, we refined our sample throughout the survey by using snowball sampling and by deleting unusable addresses from our database, a process illustrated in Figure 1. If our original e-mail inviting a prospective participant to participate in the survey did not yield a response, we sent up to three follow-up e-mails as reminders. In some cases, e-mail recipients forwarded new contacts to us, which we then added to the sample. In other cases, recipients took the initiative to forward e-mails to people in their organizations whom they thought more likely or appropriate to complete the survey. Contacts whose e-mail addresses resulted in "bounce backs" were deleted from the sample (illustrated by the broken line in Figure 1). After several months of revising our sample in this way, we arrived at 321 e-mail addresses we believed to be usable—that is, they were accurate addresses of people or associations involved in operative diversion programs. Nevertheless, because we have no way of distinguishing nonresponses from undelivered mail—some of our e-mail to addresses in the United Kingdom, for example, were treated as spam—it is therefore difficult for us to provide an accurate denominator to calculate the response rate. Thus, our final estimated response rate—47% (126/321)—is artificially high.

Figure 1
Iterative Survey Distribution Process



Results

Although the estimated response rate is typical for Web-based surveys, it might have been higher but (a) time did not permit the sending of a prior letter informing respondents that the survey was forthcoming as advised by Dillman (1999), (b) identifying accurate e-mail addresses through Web searches was problematic, (c) researchers who had previously conducted surveys in the United Kingdom and United States had either not retained the addresses or did not feel the addresses were current, and (d) the problems associated with spam and attachments containing viruses make it easy for respondents and corporate spam/virus filters to delete unexpected e-mail. In addition to e-mail arriving from an unexpected source, the inclusion of the word "survey" in the subject heading may be problematic and may be subject to exclusion by spam filters.

Because the agencies to which we distributed the survey were compiled from numerous secondary sources, some of which proved to be obsolete or inaccurate, we are unable to assert that the respondents represent the actual statistical population of all mental health diversion programs. Thus our

survey yields a “snapshot” of mental health diversion as it is commonly practiced, rather than a statistically generalizable data set.

In addition to providing basic descriptive information about diversion programs, such as how many PMI were diverted annually, the survey identified needs for improved cross-training in mental health and legal issues, more housing options for PMI, and the development of specific criteria to monitor the diversion process. Furthermore, although the literature recommended that diversion programs establish memoranda of understanding with community agencies in order to specify responsibility for services at different stages of the diversion process, we found that only a minority of respondents had done so.

Discussion

Increasingly, the Web is seen as a viable alternative to traditional survey media, particularly among respondent populations with uniform access to the Internet (Eysenbach & Wyatt, 2002). As such, the Internet can be an ideal means to conduct large-scale surveys among people who are affiliated with various institutions (e.g., government, universities, and health care facilities). As a survey medium, however, the Internet has inherent problems. In addition to the usual caveats regarding the reliability and validity of Web-based surveys (Dillman, 1999), we noted several practical problems that arose in our study. Insofar as these problems lead to sampling bias, they represent significant challenges for quantitative researchers who wish to construct rigorous samples for the purpose of statistical analysis. In accordance with this, we describe below the major challenges we encountered and offer possible solutions.

System Incompatibility

Despite the reputed convergence of information and communication technologies, such as Internet browsers, e-mail programs, and various other types of software (Mertler, 2002), we noted that some respondents experienced difficulty accessing the survey because of system incompatibility. Some respondents, for example, had browsers that were unable to open the survey Web site correctly. Others were unable to display the PDF version of the survey (likely because of the fact that they were using an older version of Adobe Acrobat). Obviously, it is difficult to specify the precise number of nonrespondents who fell into this category. Given that less than

1% of the completed surveys we received were in paper or Acrobat formats, it is safe to say that system incompatibility issues affected a distinct minority of respondents. Nevertheless, the potential sampling bias created by system incompatibility can be rectified easily by distributing the survey in a variety of formats and by giving respondents an opportunity to bypass the use of the Internet entirely when completing and returning the survey. In our case, we were careful to distribute the survey not only in Acrobat and Web formats; we also attached Microsoft Word and Corel WordPerfect versions of the survey to each e-mail sent to prospective respondents. Moreover, we clarified that respondents were free to print out and mail or fax the completed surveys to us.

Barriers Arising From Varying Institutional Policies

As noted, we encountered varying institutional policies regarding attachments or mass mailings, particularly in the United Kingdom; all U.K. NHS e-mails were rejected by spam filters, presumably because of the domain name and address associated with the original e-mail (i.e., lhsc.on.ca), or because of the subject line attached to the message (i.e., "survey"). As a solution, one member of the research team re-sent these 117 e-mails using a university e-mail address, a tactic that achieved some success. In retrospect, a better solution would be to enlist the cooperation of institutional gatekeepers in the countries where the surveys are to be distributed. In our case, such gatekeepers would consist of scholars or program administrators in each country. The use of program administrators would depend on each country and each type of program, that is police, courts, and mental health agencies having a single administrator. Mass e-mails would be less likely to be rejected if they were sent internally by such participants. Although identifying gatekeepers may require an investment of time, the ultimate viability of probability sampling for an international Internet survey may depend on it.

Sampling Frames

As is true of all international surveys (Dillman, 1999), the completeness, currency, and availability of the usual sampling frames (e.g., directories) may vary widely from country to country. This problem is especially germane to Web surveys in which the challenge is not only to identify appropriate respondents but to retrieve accurate and current e-mail addresses as well. In some jurisdictions (e.g., the United Kingdom), the e-mail addresses of useful respondents are difficult to access because they do not appear on

institutional Web sites, nor are they published in relevant print resources. Again, a possible solution is to enlist the help of local liaisons in each country who would probably be in a better position to retrieve current and accurate contact information for prospective survey participants.

Program Terminology

Another problem is related to program terminology. This is particularly relevant to research of an evaluative nature, because program terminology may vary widely and it is important to design the questionnaire so that it can be understood by all respondents. In our case, mental health criminal justice diversion programs vary not only within jurisdictions (e.g., police diversion has fundamentally different aims than court diversion) but also across jurisdictions, where police, court, and social services may be funded and structured in different ways. Terms such as felon, offender, court diversion, and court liaison, for example, either carry different meanings or are not used at all in some of the jurisdictions we studied. A comprehensive literature review and communication with key players in each jurisdiction may identify important commonalities and differences in program terminology. In our case, we were able to enlist several local experts in key jurisdictions (e.g., New Zealand and the United States) who reviewed the questionnaire and provided useful feedback. Another solution would be to enlist local experts and scholars as part of the investigative team, each of whom would be responsible for editing and phrasing questions so that they reflect the form and style of mental health criminal justice diversion in each country included in the survey. As is the case with enrolling gatekeepers, however, expanding the investigative team may increase the costs associated with the research. The time to conduct the research may also expand as issues regarding obtaining ethical approval in each country may also arise.

Conclusion

If the Web is to become a truly viable survey research tool, it must yield data that are representative of the population being studied. In our view, a key obstacle to the collection of such data is the difficulty involved in compiling accurate and timely sampling frames, without which the problem of sampling bias is unlikely to be solved. Ultimately, the solution to this problem is twofold. First, although publicly funded institutions around the

world have made wide use of the Internet, there still exists great variation in the transparency and accessibility of various Web sites. This presents a fundamental problem for researchers involved in large-scale, international projects, because it is frequently difficult to know whom to approach to enlist cooperation or permission to conduct research. Because publicly funded institutions should ideally be receptive to open inquiry, it would seem inappropriate to hinder the efforts of external researchers through opaque or inscrutable Web design. By this we mean that Web sites—for example, those associated with government and publicly funded agencies—clearly identify a liaison person who is able to facilitate communication between researchers and the appropriate members of the institution. Obviously, this would be of tremendous help to researchers who wish (a) to identify a survey population and (b) to compile a probability sample of that population. In the field of mental health diversion, for example, the pre-booking jail diversion program survey is currently being conducted by the US National GAINS Center is intended to develop a U.S. registry to identify and catalogue existing programs (<http://www.gainscenter.samhsa.gov/programs/default.asp>). Based on our experience it would be important that such as database include contact names to facilitate interaction with researchers.

Second, although Internet surveys are frequently hailed as being more convenient and less expensive than surveys delivered through other media, we argue that these advantages may, in fact, be deceptive. In particular, our experience has convinced us, that although more time consuming and expensive, it is crucial that international Internet surveys be designed and delivered through the auspices of an international team of researchers, an approach that yields several advantages. Given that researchers tend to be members of formal and informal scholarly networks, it is likely that each member of the international team would be better able to identify populations of interest in her or his particular locale than would an outsider. For example, such researchers would have ready access to print materials, such as directories of internal e-mail addresses that are not widely available in electronic format. This would have beneficial consequences in terms of developing accurate and current sampling frames. Moreover, researchers situated in particular locations of interest would be in a much better position to resolve issues associated with program nomenclature, system incompatibility, and the barriers arising from varying institutional policies. Resolving these issues would help to address key sources of sampling bias that limit the generalizability of Internet health surveys.

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