

ESTIMATING THE PERCENTAGE OF WORKFORCE HEALTH PROGRAMS IN ONTARIO FROM RESULTS OF A MAIL SURVEY AT DIFFERENT FOLLOW-UP STAGES

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Abstract: Selection bias due to nonrespondents is a common concern in mail surveys. The authors developed a procedure to estimate characteristics of nonrespondents based on when subjects respond, using data from a survey of personnel managers from large Ontario companies. The study was designed to assess the nature and extent of employee assistance programs (EAPs) and health promotion initiatives. Results indicated that personnel managers who responded quickly were significantly more likely to have an EAP than those who responded later. Estimates of the proportion of nonrespondents with EAPs were made by extrapolation, based on when people responded. The estimated proportion of nonresponders with EAPs was nearly identical to the actual proportion as determined by follow-up telephone interviews. Analyses also showed that companies with EAPs were significantly more likely to have health promotion programs. Extrapolation procedures were therefore used to estimate the proportion of companies with these other health promotion initiatives.

Résumé: Le biais de sélection attribuable aux non-répondants est un problème commun aux enquêtes postales. La procédure établie par l'auteur, à partir des réponses de l'enquête, vise l'évaluation des caractéristiques des non-répondants basée sur les résultats d'une étude menée auprès des chefs de personnel de grandes entreprises ontariennes. L'étude a été conçue pour évaluer la nature et l'étendue des programmes d'aide aux employés (P.A.E.) et des initiatives de promotion de la santé. Selon les résultats, les chefs de personnel qui répondent aussitôt sont plus susceptibles d'avoir un P.A.E. que ceux qui répondent en retard. Les évaluations de la proportion des non-répondants ayant un P.A.E. ont été faites par extrapolation à partir des réponses

de l'enquête. L'évaluation de la proportion des non-répondants ayant des P.A.E. était presque identique à la proportion effective déterminée suite au suivi d'entretiens téléphoniques. Des analyses ont aussi montré que les entreprises ayant des P.A.E. sont bien plus susceptibles d'avoir des programmes de promotion de la santé. La procédure d'extrapolation a donc été employée pour évaluer la proportion d'entreprises ayant ces autres initiatives de promotion de santé.

■ The issue of response bias due to systematic differences between responders and those selected to participate in a study has been explored by several authors. In terms of sociodemographic characteristics, respondents to surveys are more likely to be female and married (Bull, Pederson, Ashley, & Lefcoe, 1988; Sudman, 1985). In terms of other key variables, the degree of selection bias depends on the variable of interest and the population being sampled. To reduce the possibility of selection bias, a follow-up procedure as described elsewhere (see Bishop, 1990; Goodfellow, Kiernan, Ahern, & Smyer, 1988; Sudman, 1985) should be implemented to ensure a high response rate.

An area that has received less attention is the relationship between key variables and the time at which people respond. Typically, researchers have examined whether significant differences exist between early and late responders in terms of sociodemographic characteristics and key variables (Berk et al., 1984; Bull et al., 1988; Goudy, 1978; Hammitt & McDonald, 1982; Jobber, 1984; Koenig, Martin, & Seiler, 1977; Wellman, Hawk, Roggenbuck, & Buhyoff, 1980). Conclusions from these studies as a group suggest that few significant differences exist; however, the failure to detect significant differences may be attributable to two factors.

First, in some studies the actual percentage differences in terms of response rates between follow-up groups were very small, meaning that very large samples sizes were required to detect statistically significant differences. A study by Koenig et al. (1977) illustrates this point. Three discrete samples utilizing different follow-up procedures were drawn from the general population. No follow-ups were used for the first sample (response rate = 33.1%), a postcard was mailed for the second sample (response rate = 35.3%), and a new questionnaire was mailed to all early nonrespondents for the last sample (response rate = 47.8%). The fact that the data from all samples were statistically equivalent in terms of sociodemographic characteristics might be attributable to the small percentage differences among groups.

A second reason that few differences between early and late responders were found may be the homogeneous populations from which some

samples were drawn. For example, studies were based on samples of physicians (Berk et al., 1984), Virginia owners of prime riverfront land (Wellman et al., 1980), and white-water rafters (Hammitt & McDonald, 1982). The failure to find differences between groups in samples such as these may be due to very low within-group variations in the population from which the samples were drawn. For example, there are likely few differences among physicians in terms of income.

Response differences may be more likely to emerge in studies where the subject matter is of more interest to a given subgroup of individuals within the sample. For example, Goyder (1987) found that those most active in computing were more likely to respond to a survey on computing and work life. Conclusions from other studies indicate that early responders are more likely to be interested in the questionnaire topic (Donald, 1960; Phillipello, Berg, & Webb, 1958; Wellman et al., 1980). Jobber (1984), however, found that a lower proportion of marketing executives from companies with marketing information systems responded to an initial questionnaire about marketing systems (71%) compared to the follow-up (86%; $p < .05$). Jobber suggested that the results may be due to the fact that those with marketing systems were asked to answer additional questions whereas those without systems were not.

Although many studies have shown a relationship between response time and outcome variables of more interest to a subgroup, no studies were found where a formula was developed for estimating unbiased population parameters based on when people respond. It is useful to know whether selection bias exists; however, estimation of unbiased population parameters is the ultimate goal of survey research.

OBJECTIVES

In this article, we estimate the characteristics of nonrespondents to a mail survey, based on when respondents returned their questionnaire. This technique could be useful in some situations for enhancing the accuracy of estimates of population parameters. The specific objectives are as follows:

1. To assess the accuracy of an estimate of a population parameter (i.e., the percentage of companies with EAPs) using extrapolation, based on when people return their questionnaires
2. To use a known population parameter (i.e., the percentage of companies with EAPs) for estimating population parameters for other variables (i.e., whether companies have health promotion programs)

BACKGROUND

The approach was developed from a study in which data was collected by self-administered questionnaires from a 10% representative sample of 927 personnel managers of Ontario worksites with 50 or more employees. The primary purpose of the study was to determine the proportion of companies that have employee assistance programs (EAPs) and other health promotion programs. EAPs are company programs that encourage individuals to receive treatment for personal problems. Companies with an EAP were asked to answer additional questions about their characteristics. In order to ensure a high response rate, follow-up letters and follow-up phone calls were initiated with nonresponders. Phone calls were also used to document whether or not organizations had EAPs; therefore, a 100% response rate (i.e., unbiased estimates) was generated for this item.

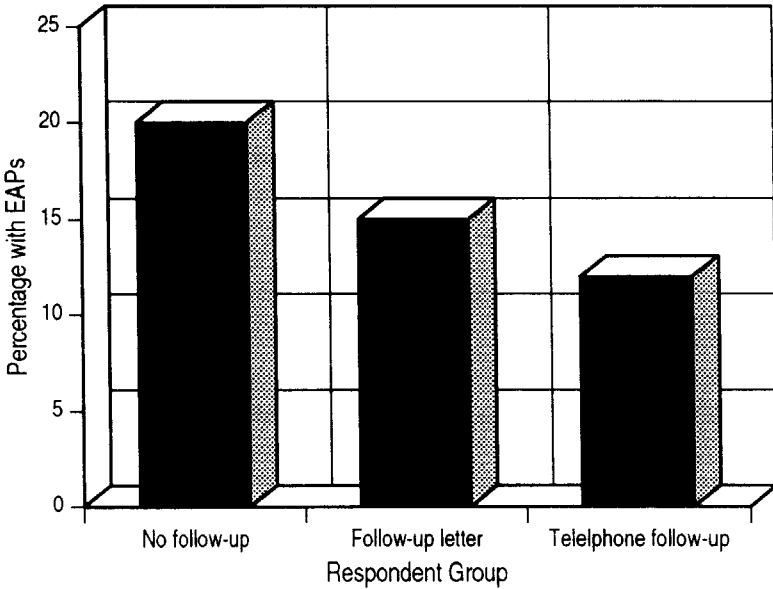
METHOD AND RESULTS

A breakdown of the proportion of organizations with EAPs at three points in the data collection process is provided in Figure 1. The percentage of worksites with EAPs was determined at three stages: (1) no follow-up, (2) after a follow-up letter, and (3) after a final telephone call back. Worksites that had an EAP were much more likely to send back the questionnaire quickly ($p < .01$, from a chi-square analysis). It seems probable that personnel managers from worksites with EAPs took more interest in the questionnaire and, accordingly, responded quickly. Those individuals from worksites without EAPs appeared more likely to be persuaded to complete the questionnaire through the follow-up procedures. The importance of these follow-up procedures cannot be overemphasized. Without any of the follow-up procedures, about 20.3% of worksites would have been estimated to have EAPs, based on this initial sample. In the full sample only 16.1% actually had EAPs, a substantial discrepancy. A more accurate estimate from the initial sample could be achieved by taking the timing of responses into account.

Assuming that the final telephone follow-ups were not conducted, the percentage of companies with EAPs could have been estimated using extrapolation as follows:

$$\frac{Y_3 - Y_2}{N_3 - N_2} = \frac{Y_2 - Y_1}{N_2 - N_1}$$

Figure 1
Percentage With EAPs at Different Follow-up Stages



N = 927

Solve for Y_3 where

- Y_1 = proportion of respondents with the program after no follow-up
- Y_2 = proportion of respondents with the program after follow-up letter
- Y_3 = unknown proportion of nonrespondents with program
- N_1 = number in sample with no follow-up
- N_2 = number in sample after follow-up letter
- N_3 = total sample, including nonrespondents

$$\frac{Y_3 - Y_2}{N_3 - N_2} = \frac{Y_2 - Y_1}{N_2 - N_1}$$

$$\therefore \frac{Y_3 - .147}{927 - 724} = \frac{.147 - .203}{724 - 345}$$

$$Y_3 = .117$$

Since there were 203 people in the nonrespondent category, 23.7 (i.e., $.117 \times 203$) companies from this group would be estimated to have EAPs. In fact, 23 companies had EAPs. The estimated proportion is well within the 95% confidence limits of the actual proportion.

Because the primary purpose of the study was to obtain an estimate of the percentage of worksites with EAPs, information for this variable was collected from all people in the survey. However, for questions about health promotion programs there were nonrespondents, because collection of this information was too time consuming over the phone. A major question that arose was whether information on the relationship between the likelihood of having an EAP and respondent group could be used for developing estimates of population parameters for other variables where information was available for participants only.

In order to address this question, we first examined whether there were relationships between having an EAP and each of the other types of programs. We suspected there would be a relationship because more progressive organizations would be more likely to have each of these programs. In every analysis, using a chi-square test, a significant (i.e., $p < .01$) relationship was found—that is, worksites with EAPs were significantly more likely to have other types of health promotion programs. Because there were strong relationships, it could be reasoned that nonrespondents were less likely than respondents to have these other programs.

The next question examined was whether people who returned the questionnaire quickly were more likely to have these health promotion programs than respondents who completed the questionnaire after follow-up procedures. Table 1 lists the 11 health promotion programs, with the percentages of worksites having each of these programs at the first two follow-up stages. As can be seen from the table, for 8 of 11 programs the percentage of worksites with each program dropped between the two follow-up stages. The declines, however, were generally not as large as found for EAPs. Based on these findings, it seemed reasonable to expect that trends for the health promotion variables from the two follow-up stages could be extrapolated to the nonrespondents.

Table 1
Percentage of Worksites With Various Health Promotion Programs

Health Promotion Program	Returned With No Follow-up (N= 333)	After Follow-up Letter (N= 326)	Average for Respondents (N= 659)	Estimate of Nonrespondents (Extrapolated)	Final Estimate
Fitness	14.7	13.5	14.1	12.85	13.7
Weight Reduction	9.6	10.4	10.0	X	10.0
Smoke Cessation	25.5	22.4	24.0	20.7	23.0
Stress Management	16.2	11.3	13.8	8.9	12.4
Day Care	3.0	5.5	4.2	X	4.2
Healthy Life Info	27.0	23.9	25.5	22.2	25.0
Blood Pressure	12.6	9.8	11.2	8.2	10.3
Nutrition Clinics	13.2	11.0	12.1	9.9	11.4
Info on Alcohol	20.7	20.6	20.6	20.2	20.5
Info on Drugs	21.9	19.3	20.6	X	20.6
Info on AIDS	23.1	23.6	23.4	X	23.4

The extrapolation technique was then applied to the proportion of nonrespondents with various health promotion programs. The procedure was used only for programs with decreasing trends, as the aforementioned analyses showed that increasing trends were likely attributable to chance. For health promotion programs with increasing trends, the proportions found for the respondents were taken as the final estimate (i.e., no adjustments were used).

This estimation procedure should be used only with larger sample sizes, as random error is associated with each follow-up stage. Another important factor is the size of the proportions. Zar (1974) suggests that estimates of proportions are only good when neither np or $n(1-p)$ are less than 5 where n = sample size and p = sample proportion.

DISCUSSION

Data from this study and other studies in the literature have shown that there is frequently a relationship between the time at which people respond to a questionnaire and key variables. This relationship is likely accentuated when a subgroup of the sample is more interested in the subject of a questionnaire. When making estimates of population parameters, it is important to establish both empirical and theoretical reasons for a link between follow-up stages and the key variable of interest. For this study, it was expected that personnel managers from worksites with EAPs would show more interest in a questionnaire about EAPs and therefore would be more likely to respond quickly. The data confirmed that this relationship existed. Furthermore, it was empirically established that worksites with EAPs were significantly more likely to have each of the health promotion programs. Therefore, linear extrapolation of the nonrespondents for estimating proportions of health promotion programs seemed appropriate. The approach might be worthwhile for other studies where similar conditions exist.

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