

Dropout in longitudinal studies: Strategies to limit the problem

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Abstract:

Different types of nonresponse threaten the validity of longitudinal studies; First the initial nonresponse during the recruitment in the base-line survey; Second, successive dropout at each time point. In this entry specific attention is given to dropout and strategies to limit the problem. Dropout in longitudinal surveys has three separate sources: failure to locate research participants, failure to contact research participants, and failure to achieve cooperation. Effective measures are described to reduce nonresponse. To limit nonresponse a total design approach is advocated with specific attention to each source. That is to limit both noncontact (i.e., failure to locate and subsequent failure to contact a located research participant), and noncooperation.

In longitudinal studies research units (e.g., households, individual persons, establishments) are measured repeatedly over time. Usually a limited number of separate measurement occasions or waves is used. The minimum number of waves is two, as in the classical pretest-posttest designs, that are well known in intervention studies and experiments. But, longitudinal studies can have any number of measurement occasions (waves) in time. If the number of occasions is very large this is called a time series. In a time series a small number of research units is followed through time and measured on many different occasions on a few variables only. Examples of time series can be found in psychological studies, educational research, econometrics, and medicine. In social research and official statistics a common form of longitudinal study is the panel survey. In a panel a well-defined set of participants is surveyed repeatedly. In contrast to time series, panel surveys use a large number of research units and a large number of variables, while the number of timepoints is limited. Examples are budget surveys, election studies, socio-economic panels and general household panels. In the following sections, most examples will come from panel surveys and survey methodology. However, the principles discussed also apply to other types of longitudinal studies and other disciplines.

The validity of *any* longitudinal study can be threatened by dropout. If the dropout is *selective*, if the missing data are not missing randomly, than the results may be biased. For instance, if in a panel of elderly, the eldest members and those in ill-health drop out

more often, or if in a clinical trial for premature infants the lightest infants are more likely to stay in the intervention group, while the more healthy heavier babies drop out over time. When one knows who the dropouts are and why the dropout occurs, one can statistically adjust for dropout. But this is far from simple and the more one knows about the missing data, the better one can adjust. So, the first step in good adjustment is to prevent dropout as much as possible, and collect as many data as possible of people who may eventually drop out. But even if the dropout is not selective, even if people are missing completely at random, this may still cause problems in the analysis. The smaller number of cases will result in less statistical power and increased variance. Furthermore, in subgroup comparisons dropout may lead to a very small number of persons in a particular subgroup. Again the best strategy is to limit the problem by avoiding dropout as far as possible.

Nonresponse in longitudinal studies can occur at different points in time. First of all, not everyone who is invited to participate in a longitudinal study will do so. This is called initial nonresponse. Especially when the response burden is heavy, initial nonresponse at recruitment may be high. Initial nonresponse threatens the representativeness of the entire longitudinal study. Therefore, at the beginning of each longitudinal study one should first of all try to reduce the initial nonresponse as much as possible, and secondly collect as much data as possible on the nonrespondents to be used in statistical adjustment (e.g., weighting). Initial nonresponse is beyond the scope of this entry, but has been a topic of great interest for survey methodologist and in the past decade much empirical knowledge on nonrespondents and reduction of nonresponse has been collected [1].

After the initial recruitment, when research participants have agreed to cooperate in the longitudinal study, nonresponse can occur at every time point or wave. This is called dropout. Dropout or wave nonresponse occurs when a participant in the study does not produce a completed questionnaire or interview at a specific time point, or fails to appear at a scheduled appointment in an experiment. If after a certain time point research participants stop to respond to all subsequent questionnaires or interviews, this is called attrition or panel mortality.

Finally, besides dropout, there is another source of nonresponse that may threaten the validity of longitudinal data and should be taken into account: item nonresponse. When item nonresponse occurs a unit (e.g., research participant, respondent) provides data, but for some reason data on particular questions or measurements are not available for analysis. Item nonresponse is beyond the scope of this entry, for an introductory overview on prevention and treatment of item nonresponse, see De Leeuw, Hox, and Huisman [2].

Starting at the initial recruitment, the researcher has to take steps to reduce future nonresponse. This needs careful planning and a total design approach. As research participants will be contacted over time, it is extremely important that the study has a well-defined image and is easily recognized and remembered at the next wave. A salient title, a recognizable logo and graphical design are strong tools to create a positive study identity, and should be consistently used on all survey materials. For instance, the same

logo and graphical style can be used on questionnaires, interviewer identity cards, information material, newsletters, and thank-you cards. When incentives are used, one should try to tie these in with the study. A good example comes from a large German study on exposure to printed media. The logo and mascot of this study is a little duckling Paula. In German, the word 'Ente' or duck has the same meaning as the French word 'canard': a false (newspaper) report. Duckling Paula appears on postcards for the panel members, as soft toy for the children, as ornament for the Christmas tree, printed on aprons, t-shirts etc, and has become a collector's item.

Dropout in longitudinal studies originates from three sources: Failure to locate the research unit, failure to contact the response unit, and failure to obtain cooperation from the response unit [3].

Thus the first task is limiting problems in *locating* research participants. At the recruitment phase or during the base-line study the sample is fresh and address information is up-to-date. As time goes by, people move and address, phone, and e-mail information may no longer be valid. It is of the utmost importance, that from the start at each consecutive time-point, special locating information is collected. Besides the full name, also the maiden name should be recorded to facilitate follow-up after divorce. It is advisable to collect full addresses and phone numbers of at least three good friends or relatives as 'network contacts'. Depending on the study, names and addresses of parents, school-administration, or employers may be asked too. One should always provide 'change-of address-cards' and if the budget allows, print on this card a message conveying that if one sends in a change of address, the researchers will send a small 'welcome in your new home-gift' (e.g., a flower token, a DIY-shop token, a monetary incentive). It goes without saying that the change-of-address cards are pre-addressed to the study administration and that no postage is needed.

When the waves of follow-up times are close together, there is opportunity to keep locating-information up-to-date. If this is not the case, for instance in an annual or bi-annual study, it pays to incorporate between wave locating efforts. For instance sending a Christmas card with a spare 'change-of-address card', birthday cards for panel-members, and sending a newsletter with a request for address update. Additional strategies are to keep in touch and follow-up at known life events (e.g. pregnancy, illness, completion of education). This is not only motivating for respondents; it also limits loss of contact as change-of-address cards can be attached. Any mailing that is returned as undeliverable should be tracked immediately. Again, the better the contact ties in with the goal and topic of the study, the better it works. Examples are mother's day cards in a longitudinal study of infants, and individual feedback and growth curves in health studies. A total design approach should be adopted with material identifiable by house style, mascot and logo, so that it is clear that the mail (e.g., child's birthday card) is coming from the study. Also ask regularly for an update, or additional network addresses. This is extremely important for groups that are mobile, such as young adults.

If the data are collected by means of face-to-face or telephone interviews, the interviewers should be clearly instructed in procedures for locating respondents, both during training and in a special tracking manual. Difficult cases may be allocated to specialized 'trackers'. Maintaining interviewer and tracker morale, through training,

feedback, and bonuses helps to attain a high response. If other data collection procedures are used (e.g., mail or internet survey, experimental, or clinical measurements), staff members should be trained in tracking procedures. Trackers have to be trained in use of resources (e.g. phone books, telephone information services), and in the approach of listed contacts. These contacts are often the only means to successfully locate the research participant, and establishing rapport and maintaining the conversation with contacts are essential.

The second task is limiting the problems in *contacting* research participants. The first contact in a longitudinal study takes effort to achieve, just like establishing contact in a cross-sectional, one-time survey. Interviewers have to make numerous calls at different times, leave cards after a visit, leave messages on answering machines, or contact neighbours to extract information on the best time to reach the intended household. However, after the initial recruitment or base-line wave, contacting research participants is far less of a problem. Information collected at the initial contact can be fed to interviewers and used to tailor later contact attempts, provided, of course, that good locating information is also available. In health studies and experimental research, participants often have to travel to a special site, such as a hospital, a mobile van, or an office. Contacts to schedule appointments should preferably be made by phone, using trained staff. If contact is being made through the mail, a phone number should always be available to allow research participants to change an inconvenient appointment, and trained staff members should immediately follow-up on 'no-shows.'

The third task is limiting dropout through lost willingness to cooperate. There is an extensive literature on increasing the cooperation in cross-sectional surveys. Central in this is reducing the cost for the respondent, while increasing the reward, motivating respondents and interviewers, and personalizing and tailoring the approach to the respondent [4, 5, 1]. These principles can be applied both during recruitment and at subsequent time points. When interviewers are used, it is crucial that interviewers are kept motivated and feel valued and committed. This can be done through refresher training, informal interviewer meetings, and interviewer incentives. Interviewers can and should be trained in special techniques to persuade and motivate respondents, and learn to develop a good relationship [1]. It is not strictly necessary to have the same interviewers revisit the same respondents at all time points, but it is necessary to feed interviewers information about previous contacts. Also, personalizing and adapting the wording of the questions by incorporating answers from previous measurements (dependent interviewing) has a positive effect on cooperation.

In general, prior experiences and especially 'respondent enjoyment' is related to cooperation at subsequent waves [3]. A short and well-designed questionnaire helps to reduce response burden. Researchers should realize this and not try to get as much as possible out of the research participants at the first waves. In general, make the experience as nice as possible and provide positive feedback at each contact.

Many survey design features that limit *locating* problems, such as sending birthday and holiday cards and newsletters, also serve to nurture a good relationship with respondents and keep them motivated. In addition to these intrinsic incentives explicit incentives also work well in retaining cooperation, and do not appear to have a negative

effect on data quality [1]. Again the better the incentives fit the respondent and the survey, the better the motivational power (e.g., free downloadable software in a student-internet panel, air miles in travel studies, cute t-shirt and toys in infant studies). When research participants have to travel to a special site a strong incentive is a special transportation service, such as a shuttle bus or car. Of course, all real transportation costs of participants should be reimbursed. In general, everything that can be done to make participation in a study as easy and comfortable as possible should be done. For example, provide for child-care during an on-site health study of teenage mothers.

Finally, a failure to cooperate at a specific time point does not necessarily imply a complete dropout from the study. A respondent may drop out temporarily because of time pressure or lifetime changes (e.g., change of job, birth of child, death of spouse). If a special attempt is made, the respondent may not be lost for the next waves.

In addition to the general measures described above, each longitudinal study can and should use data from earlier time points to design for nonresponse prevention. Analysis of nonrespondents (persons unable to locate again and refusals) provides profiles for groups at risk. Extra effort then may be put into research participants with similar profiles who are still in the study (e.g. offer an extra incentive, try to get additional network information). In addition these nonresponse analyses provide data for better statistical adjustment.

With special techniques it is possible to reduce dropout in longitudinal studies considerably, but it can never be prevented completely. Therefore adjustment procedures will be necessary during analysis. Knowing why dropout occurs makes it possible to choose the correct statistical adjustment procedure. Research participants may drop out of longitudinal studies for various reasons, but of one thing one may be assured: they do not drop out completely at random. If the reasons for dropout are not related to the topic of the study, responses are missing at random and relatively simple weighting or imputation procedures can be adequately employed. But if the reasons for dropout *are* related to the topic, responses are *not* missing at random and a special model for the dropout must be included in the analysis to prevent bias. In longitudinal studies, usually auxiliary data are available from earlier time-points, but one can only guess at the reasons why people drop out. It is advisable to ask for these reasons directly in a special short exit-interview. The data from this exit interview, together with auxiliary data collected at earlier time points, can then be used to statistically model the dropout and avoid biased results.

References

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Further reading:

D. Kasprzyk, G.J. Duncan, G. Kalton, & M.P. Singh (1989). *Panel surveys*. New York: Wiley

On the Internet:

The website of the *Journal of Official Statistics* <http://www.jos.nu> contains many interesting articles on survey methodology, including longitudinal studies and panel surveys.

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