RESEARCH FOR THE 1993 NSF SURVEYS OF SCIENTISTS AND ENGINEERS

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Introduction:

The National Science Foundation (NSF) has developed a system of data about scientists and engineers (S&E) called SESTAT. This data system is developed from NSF-sponsored and other surveys and includes such information as employment status, educational attainment, demographic and other characteristics of US scientists and engineers.

Much of the SESTAT data is collected through three NSF sponsored demographic surveys: the Survey of Doctorate Recipients (SDR) conducted by the National Research Council; the National Survey of Recent College Graduates (NSRCG), conducted by Westat; and the National Survey of College Graduates (NSCG) conducted by the Census Bureau. These surveys use separate sampling frames, including NRC's Doctorate Records File, the decennial census, and compiled lists of recent S&E bachelors' and masters' degree graduates of colleges and universities. The use of several frames allows the surveys to take advantage of the strengths of each of each available frame. The NSF surveys use instruments and procedures that are very similar so that the combined estimates (which are multiplicity adjusted) are more compatible. The combined target population for the three surveys is US residents holding a bachelor's degree or higher, who are either trained as or working as a scientist or engineer.

In 1993, when SESTAT began development, the demographic surveys were extensively redesigned-- in survey concepts, sample design, survey instruments, procedures and weighting/estimation techniques. This work is discussed in a series of paper presented in 1992 at the annual ASA conference in Boston. While this early work covered many topics, most emphasis was placed on a review of the survey content, the instrument design, and methods for improving response. The response rate focused improvements included personalization, reminder post-cards, national change of address (NCOA) updating, use of priority mail, etc. 1/ Also for the 1993 surveys, sample reductions and reallocations, and enhancement of survey resources were made.

For the early redesign work done in 1991-92, the most readily available measures of improvement are response rates. The table below shows the survey response rates before and after the implementation of the redesign techniques:

Overall Survey Response Rates

	1980s	1993
SDR	65	86
NSRCG	72	84
NSCG	70	79

Note: Weighted response rates are shown, where available. The cumulative (longitudinal) response rate for the NSCG for the 1980s was 37%. SDR rates shown are cumulative.

In the 1992 ASA session, discussant Daniel Kasprzyk argued that there should be future budget provision made to allow for continued SESTAT research and evaluation. "The program will have invested wisely if some funds are allocated to a continuing research and evaluation program" he noted. Also mentioned were the need for understanding non-response (and its special importance to longitudinal surveys) and the need for an ongoing quality monitoring program. These thoughts foreshadowed the next phase of the SESTAT research and evaluation program.

For the 1993 surveys, a broad coordinated program of research and evaluation was set up. The overall goals and features of the program are:

* to provide a broad spectrum of research that is balanced across statistical and cognitive aspects of survey methodology;

* to define research projects according to their contribution to: (a) information to the data users (quality profile) and/or (b) identifying and resolving questionnaire or procedural problems;

* to take advantage of the range of skills and interests of the SESTAT organizations and similarity of the survey instruments; and

* to design a research and evaluation program with a "long view". Staging the research projects and areas to be complementary over time as well as across organizations.

Reasons for the SESTAT research and evaluation program are several. In the 1970s and 1980s, the surveys were criticized for lack of coordination and long standing and growing data quality problems.2/ In response, it was decided that a small portion of the survey budgets would be used for ongoing research and quality analysis projects. In this way, accumulating problems are less likely to remain undetected. Another important reason for the program is the scale of the 1990s SESTAT redesign. Most of the survey instruments and procedures were modified or replaced entirely in the redesign. Although an extensive pretest was done prior to the 1993 surveys, the extent of the redesign argued for a strong and varied research and evaluation program.

Balancing the Research Projects:

To evaluate the redesign work in the larger context of the full-scale 1993 surveys themselves, a broad spectrum of complementary research was performed. Similarity in the populations covered and the questionnaires used in the SESTAT surveys allow research findings from one survey to be extended to others in the system.

In choosing the mix of SESTAT research projects several things were considered. The first consideration was the potential gain in quality profile information and/or survey instrument/procedures information. From the quality profile viewpoint, special consideration was given to research projects that could provide variable specific information. Quantitative information was preferred, but qualitative information which is also useful to data analysts was also obtained as well. Part of features of the research and evaluation project designs was an attempt to organize the research so that results could be mapped to specific variables (instrument questions). The SESTAT system would then convey the variable specific research findings to the data analyst in a manner that was most readily accessable, and thus more useful.

A second consideration was pairing different projects to balance measurement (metric) and resolution capabilities. Often evaluation techniques that have good measurement aspects (e.g. reinterview measurement of respondent variance) are less useful in identifying the *reasons* for the problems. Thus hampering resolution. Complementary research, such as cognitive debriefing or focus groups, can be done to supply the missing information on the mechanism that causes the problem (e.g. respondent recall).

Of course practical considerations of funding, human resource constraints, and timing were also important. Since the research and evaluation program was to be long-term, some projects were delayed until the 1995 round so that they could take advantage of the 1993 results.

An outline of the research and evaluation (R&E) projects for the SESTAT system are shown below:

R&E projects conducted prior to the 1993 data collection:

* focus groups and cognitive interviews

* large pretest of NSCG--alternative questionnaire lengths and incentives

* Cati testing of alternative methods for occupational data collection

R&E projects conducted concurrent with the 1993 data collection:

* study of use of priority mail for follow-ups

* reinterview study of mail/Cati respondents

* mode effects study of mail/Cati responses

* studies of Cati interviewer variance

* behavioral coding of Cati interview/respondent interactions

* response and non-response studies and methods of mitigating bias

* debriefings of interviewers and coders

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* analysis of response patterns to write-in questions

Future and Continuing R&E projects:

* reinterview study of Cati responses

* comparison of generalized variance functions and other methods for providing data users with approximations of standard errors

* studies of variance and bias in special coding work

* study of recall attributes for degree information

* alternative methods for weighting adjustments: post-stratification with regression weights, propensity modeling with logistic regression

* study of auto-coding verbatim occupational responses in Cati

* time series analysis of questionnaire changes

Applying Research Results:

One of the two primary goals of the program was to improve future survey instruments. Leading to the 1995 surveys, a series of working group meetings was held, including both researchers and survey instrument designers. The purpose was to discuss and compare the 1993 research results and the implications on future survey instruments. The meetings were useful in developing a relatively complete picture of a given instrument problem. The involvement in the working group of those intimately familiar with the research allowed better judgements to be made, particularly when interpretation and "interpolation" of the research data were needed--which was often.

Early in the process, it was planned that interim research results would be available to meet the 1995 survey instrument development cycle. This meant that findings could be incorporated from all projects -- even those that naturally fell late in the 1993 survey cycle.

The task of the working group meetings was too explore the nature of the problems identified. Discussion of possible solutions did occur, but in most cases, the decision on specific instrument changes to be made were differed. This allowed instrument designers time to explore alternatives while not slowing the progress of the working group meeting.

Conclusion:

The NSF SESTAT data system has benefitted from an ongoing program of research and evaluation. This program will continue with projects linked by statistical and cognitive methods; across survey organizations; and across the survey cycles.

Endnotes:

1/ Much of this work followed mail survey principles developed by Dr. Donald Dillman of Washington State University.

2/ In the late 1980s, NSF funded a general review of the S&E survey program. See *Surveying the Nation's Scientists and Engineers,* National Academy Press, 1989.

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