The Effectiveness and Costs of Special Data Collection Efforts in a Telephone Survey of Physicians

Sara Thran, Lorayn Olson, AMA, Richard Strouse, Mathematica Policy Research
Sara Thran, 535 North Dearborn, Chicago, Illinois 60610

The American Medical Association's Socioeconomic Monitoring System, an ongoing telephone survey program of physicians, collects data on characteristics of medical practice and health policy issues. Special efforts are undertaken to ensure as high a response rate as possible. These efforts include: sending a mail version of the questionnaire to physicians who prefer to respond in writing rather than by telephone; making numerous calls to nonrespondents; and mailing a letter to physicians who initially refused to complete an interview and then calling them in an effort to convert the case to a completed interview.

This study examines characteristics of respondents to the special efforts and determines whether the special efforts reduce bias in survey estimates. The costs of the special efforts in terms of item nonresponse and budget implications are considered. This is followed by a discussion of whether the costs and effectiveness of the three special data collection efforts justify their use.

Previous Research on Socioeconomic Surveys of Physicians

Physicians are generally regarded as a particularly difficult population to interview. They have demanding work schedules, are usually protected by receptionists or other "gatekeeper," and are frequently surveyed for both marketing and policy studies. Obtaining physician cooperation is particularly difficult for predominantly economic surveys. Providing detailed, factual information on practice characteristics is both difficult and, for many physicians, intrusive. A variety of methods have been used to increase response rates to economic surveys of physicians and to minimize bias. These include endorsements, a mix of mail, telephone and in-person data collection methods, monetary incentives, flexible call scheduling, special efforts to convert refusals and lengthy field periods.

The Physician Practice Costs and Income Survey (PPCIS), sponsored by the Health Care Financing Administration, and the Physicians' Practice Survey (PPS) for the National Medical Care Expenditure Study, sponsored by the National Center for Health Statistics, both obtained detailed information on the demographic and financial characteristics of physicians' practices using telephone interviewing methods. Both of these surveys obtained high response rates without the use of monetary incentives, but allowed for long field periods. The PPS consisted of a 15-minute telephone interview relating to the characteristics of the physician's setting, as well as some basic demographic data (Berk, 1984). The response rate after four months was only 49 percent, but was increased to 74 percent by extending the field period an additional four months. Berk found that the addition of late respondents (those who responded during the last four months) did not have a substantial effect

on most estimates of key demographic variables. Further, he found that regression estimates of income based on the full sample were very similar to those that would have been produced if the survey had been terminated after four months, when the response rate was 49 percent. He suggested that, in surveys like the PPS which focus on demographic variables and practice costs, relaxing the requirement of high response rates will result in considerable cost savings and will not necessarily produce biased estimates.

The PPCIS, which was conducted using computer assisted telephone interviewing from October, 1984 to June, 1985, obtained detailed information on financial management, physician participation in public programs and physician and patient characteristics during an interview that averaged from 30 to 45 minutes (Sprachman, 1985). The weighted response rate was 67.7 percent and the unweighted response rate was 69.0 percent. Efforts made to obtain a high response rate included: mailing letters to specialty societies and medical boards, as well as to physicians; conducting the interview in portions; using proxies for financial data; allowing self-administration of specified sections of the questionnaire; providing a toll-free number; and follow-up attempts to interview physicians who initially refused. The report on survey methodology did not include comparisons of early and late responders or those who were easy and more difficult to interview.

AMA's Socieoconomic Monitoring System

The American Medical Association's Socioeconomic Monitoring System (SMS) is a telephone survey of physicians which periodically collects information regarding medical practice characteristics (work patterns, fees, income, and expenses) and health policy issues related to patient care. Two SMS surveys are conducted each year, an annual core survey and an autumn survey. The annual core survey obtains data from approximately 4,000 physicians through a 25-minute interview. The autumn survey collects data on approximately 2,800 respondents through a 16-minute interview.

The sample for each survey is selected from the AMA Physician Masterfile. The Masterfile contains current and historical information on every physician in the United States. The eligible sample is limited to nonfederal physicians who have completed their residency, whose major professional activity is patient care, and who spend at least 20 hours per week in patient care activities. The survey uses a stratified random sample design with the strata defined by specialty and geographic region. Each survey includes reinterviews with physicians who were initially interviewed a year earlier, as well as interviews with physicians who are selected for the first time.

This study examines 4,336 physicians sampled for the first time in the 1986 core survey.

Following a mailing of advance letters, Mathematica Policy Research used a computer assisted telephone interviewing system to conduct the survey from April through July, 1986.

Various efforts were made to obtain a high response rate and to ensure that the responses of the participating physicians would be representative of the universe. In addition to scheduling interviews during a thirteen-hour interviewing period Monday through Saturday and providing a toll-free telephone number for return calls, the special efforts included:
1. sending a mail version of the questionnaire to physicians who preferred to respond in writing rather than by telephone;
2. making callbacks to nonresponders throughout the field period (sometimes more than 30); and
3. mailing a letter to physicians who initially refused to complete an interview and then calling them in an effort to convert the case to a completed interview.[1]

Effectiveness of Special Data Collection Efforts

To analyze the effectiveness of the three special data collection efforts, the following were examined:
o the effect on overall response rate of each of the special efforts;
o respondent characteristics by type of effort;
o probit analyses on response by each of the special efforts; and
o income regressions for respondents to each of the special efforts, respondents not requiring special effort, and all respondents.

The improvement in response rates due to the special data collection efforts was examined. Without using any special efforts, there were 1976 respondents (a response rate of 45.6%). The three special efforts increased the response rate to 60.1 percent. More cases are added by repeated callbacks than by mail or refusal conversion.

We also examined the demographic and practice characteristics of the eligible sample, cases completed by each of the special efforts, and all respondents. Sex and specialty distributions are significantly different among respondents to the three types of special efforts. Also, the respondents to special efforts differed significantly from "easy" cases with respect to sex, specialty, and census region.

Next, using multivariate analysis, we examined the relationship between respondent characteristics and the special data collection efforts. The purpose of this analysis was to determine whether the demographic and practice characteristics of respondents to each special effort differed from those of all other survey respondents. Thus respondents to each special effort are compared with cases completed without a special effort as well as cases completed with the other two special efforts. For survey respondents, a dichotomous dependent variable was defined to indicate whether or not each special effort was used. Probit analyses were performed to determine how respondents to special efforts differed from other respondents with respect to speciality, census region, sex, age, AMA member-ship status, annual net income from medical practice, hours worked per week, location, and reporting of income and hours.[2] We performed this analysis individually for each type of effort and then for all three special efforts combined. The results of the analyses are presented in Table 1.

Demographic and practice characteristics are not good predictors of completion by mail. Mail respondents are more likely to be from the West than the Northeast and less likely to be psychiatrists than general/family practitioners. The probability of response by refusal conversion is predicted by the demographic and practice characteristics as is the probability of response by many calls. The cases obtained by refusal conversion are more likely to be internists and less likely to be radiologists, psychiatrists, or anesthesiologists than general/family practitioners. In addition, they are more likely to be male, not to report income, to work fewer hours per week, and to report hours. Cases completed with more than 12 calls are less likely to be from the North Central than the Northeastern region, are female, young, have high incomes, and are more likely not to report their income.

The probit analyses show that response by any special effort is significantly related to: specialty, census region, age, income, and income not reported. Internists are more likely than general/family practitioners to complete the interview with a special effort, while radiologists, psychiatrists, anesthesiologists, and pathologists are less likely to complete the interview with a special effort. Physicians completing the survey with a special effort are less likely to be in the North Central region and are more likely to be in the Northeast. They are more likely to be young, to have high incomes, and at the same time, not to report income.

Table 2 presents income regressions for the cases completed without a special effort, each of the special efforts, any special effort, and all respondents. The most interesting comparison is between the regression coefficients for the easy cases and those completed with any special effort, since we want to know whether the special data collection efforts reduce bias in survey estimates. The coefficients for these two regression equations are not significantly different (F=1.33; d.f.=28, 1820) according to the Chow test. These findings are supported by a similar analysis (not presented here) for hours worked per week, in which the coefficients for the easy cases did not differ significantly from those for the cases requiring special efforts. This suggests that the special efforts have not reduced bias in the survey estimates.[3]

Costs of the Special Data Collection Efforts

The cost analysis presents data on marginal costs of the three special data collection efforts in terms of item nonresponse, labor time, and number of calls. Labor and related costs are estimated in terms of the additional number of calls required by each effort. Item nonresponse is an additional cost analyzed here.

a. Cost of Additional Calls (No Other Special Efforts)

Access to most physicians is controlled by receptionists or other gatekeepers who screen their calls. Consequently, the probability of completing an interview is low on the initial call, and it increases after a firm appointment is made.

The probability of completing an interview with eligible physicians for each call was examined. On the first call, 3.5 percent of the physicians completed the interview. The percent who responded increased to 7.1 percent on the second call, averaged between eight and nine percent from the third through the eighth call, and decreased to approximately five to six percent on subsequent calls. These data indicate that, while the probability of completing the interview peaks on the eighth call, it decreases only slightly for subsequent calls. While the marginal productivity of the additional rounds of calls decreases only slightly, the additional calls affect the average cost per case, especially when the number of required calls is very high.

b. Cost of Refusal Conversions

The call records of physicians who refuse to be interviewed (or whose receptionists refuse for them) were reviewed by supervisors to determine whether additional efforts would be made. Refusal conversions were attempted for subgroups for whom response rates were below average (e.g., medical and surgical specialties and AMA nonmembers) and other cases in which the supervisor thought additional contact might be productive (e.g., refusals obtained by relatively inexperienced interviewers).

Refusal conversions were attempted for 42 percent of the physicians who initially refused. The average number of calls made per eligible physician in the refusal conversion sample, 8.5, was identical to the number made for the remainder of the sample surveyed by telephone (Table 3). However, only 38 percent of the physicians selected for the refusal conversion sample were interviewed in contrast to 69 percent for the remainder of the physicians surveyed by telephone. Consequently, the ratio of total calls to completed interviews was much higher for the refusal conversion sample (22.1) than for the telephone sample (12.2). Unfortunately, we do not know the number of calls made to physicians selected for refusal conversion efforts before follow-up calls were attempted. If we assume that half of the calls made to the refusal conversion sample occurred before the initial refusal and add these calls to the remainder of the telephone sample, the ratio of total calls to completed interviews increases from 12.2 to 13.1. This still represents an additional cost of approximately nine calls per interview for initial refusals selected for refusal conversion efforts. Conducting refusal conversions also requires additional supervisory labor to review the call records, additional letters to physicians encouraging them to respond, and a small bonus for interviewers who convert initial refusals.

c. Cost of Mail Questionnaires

Physicians who would not complete a telephone interview but offered to complete a mail questionnaire were mailed a questionnaire tailored to their specialty. Some physicians, who may not have made a decision about participating, may have wished to review the questionnaire before deciding whether to respond. Other physicians who requested questionnaires may never have intended to return them. Each week, interviewers called the offices of physicians who had not returned questionnaires to remind them to do so. At that time, the interviewer also offered to obtain the data by telephone if the physician preferred. For the 1986 Core Survey, only 23 percent of those requesting mail questionnaires returned them (Table 3).

The interviewers made an average of 6.5 reminder calls per eligible physician. Because the rate of return was only 23 percent, an average of 27 reminder calls was made per completed interview. Even after factoring in the savings in labor and telephone costs due to the substitution of a mail questionnaire for an interview, the added labor cost for this effort was substantial. Additional non-labor costs included questionnaire printing and postage.

Because the probability of completing an interview by telephone does not decrease appreciably with the number of calls, it is desirable to continue contacting physicians who have not refused to complete the interview or requested other special efforts. However, the additional costs for refusal conversions and reminder calls to physicians who request mail questionnaires may not be justified—especially if these additional cases do not reduce bias in key study variables.

d. Item Nonresponse

Item nonresponse is higher for the special effort cases than for those not requiring special effort (Table 4). The item nonresponse rate for annual income was 22.0 percent for easy cases, 24.8 percent for cases completed by mail, 35.9 percent for cases completed with more than 12 calls, and 45.6 percent for refusal conversions. Similar patterns existed for hours worked per week and total patient visits per week, with nonresponse being lowest for the "easy" cases and highest for the refusal conversion cases.

Discussion

These findings provide the opportunity to evaluate the worth of each of the three special data collection efforts. While the data on the costs and effectiveness of each of the special data collection efforts are not precise uniform measures, we can still compare the cost and effectiveness of the three efforts to determine whether they are worthwhile.

The univariate analysis suggests that the mail questionnaire is particularly useful in eliciting responses from some of the difficult cases who are male, who are in general/family practice or internal medicine, or who live in the West. Refusal conversions are especially effective for physicians who are male, who specialties in internal medicine, or who live in the West. Numerous calls are effective for physicians who live in the Northeast; or who specialize in internal medicine, surgery, or

obstetrics/gynecology. The probit analyses confirmed that different types of difficult-to-reach physicians respond to different types of special efforts. We also examined the effectiveness of the special efforts in reducing bias in the income estimate. It was shown that the three special efforts did not reduce bias.

In evaluating whether or not the three efforts are indeed crucial, it is necessary to balance the benefits of the three efforts with their associated costs. There are four types of costs to be considered--labor; other direct costs such as telephone, printing, and postage; data quality; and the potential for interviewer persistence to be perceived as harassment.

In calculating labor and other direct costs, we examined the marginal costs of the special effort cases. In terms of number of calls and other costs (additional supervisory labor, additional letters, and interviewer bonuses for refusal conversions, and questionnaire printing, postage, and labor for mail questionnaires), the cost per completed case was highest for mail questionnaire cases, followed by refusal conversions.

One way to evaluate quality of survey data is the examination of the percentage of missing values on some variables. In the SMS survey, key outcome and predictor variables include income from medical practice, number of hours worked, and number of patient visits. The cases requiring special effort had much higher item nonresponse for these three variables, especially income. Likewise, the probit analyses show that the reporting of income was a strong predictor of whether or not an individual responded to a special effort.

The final cost is the potential for interviewer persistence in making the special efforts to be viewed by physicians as harassment. While this type of cost is important in all good research endeavors, it is probably of more concern to an organization such as the American Medical Association. Since the AMA is dependent on membership support, it strives to make every AMA contact with a physician a positive one. This cost is very difficult to gauge. Our only information about it comes from letters physicians send the AMA regarding the survey. Each year, the AMA receives only several letters from physicians expressing dissatisfaction with the SMS interview process. While of course this is a very rough measure, it suggests that this cost is not substantial.

Thus, it was shown that each of the three special efforts contributes to the overall response rate. No one effort, by itself, yields an acceptable response rate. Furthermore, different physicians respond to each of the data collection methods. The special efforts do not appear to reduce bias in survey estimates.

Considering the costs of each of these three efforts, should all three be continued? It was demonstrated that, per completed case, mail questionnaires were the most costly special effort, followed by refusal conversions. The effectiveness of refusal conversions in reaching respondents who otherwise would be missed justifies the continuation of refusal conversion efforts. Only a small number of completed cases

were added as a result of the mail questionnaires and the cost per completed case is high. Probit analyses also showed that response to a mail questionnaire was not closely associated with demographic and practice characteristics. One explanation of the higher cost associated with mail questionnaires is that a request for a mail questionnaire could be one way for a sample physician or the gatekeeper to reply to an interviewer's request for participation in the survey without completing the interview. More research is needed in order to make a decision regarding continuation of the mail questionnaire. In order to conduct the study in a cost-effective manner, reminder calls to physicians sent mail questionnaires will be discontinued.

The reduction in data quality as a cost of obtaining participation from reluctant respondents was discussed. If in analyses where the income variable is used, the data on each case missing income data are lost, is it worthwhile to achieve a higher response rate? If income is indeed the key variable in the survey, it may be wise to evaluate whether or not collection of data from these respondents is justified. On the other hand, income is reported for 63.5 percent of the special effort cases.

Summary
The benefits and costs of three special data collection efforts (mail questionnaires, refusal conversions, and numerous calls) used by the AMA's Socioeconomic Monitoring System were evaluated. The three special efforts increased the response rate from 45.6 to 60.1 percent. More cases were added by repeated callbacks than by mail or refusal conversion. The physicians who responded to a special effort were more likely to be internists than general/family practitioners, while radiologists, psychiatrists, anesthesiologists, and pathologists were less likely to complete the interview with a special effort. Physicians completing the survey with a special effort were less likely to be in the North Central region and more likely to be in the Northeast. They were more likely to be young, to have high incomes, and, at the same time, not to report income. The responses to two key survey items, income and hours worked per week, were compared for the easy cases and those completed with special efforts. The regression coefficients for the easy cases did not differ significantly from those for the cases completed with special efforts. This suggests that the special efforts have not reduced bias in the survey estimates. The special efforts are costly, mail questionnaires being the most expensive and refusal conversions second.

Nearly 40 percent of the SMS sample failed to respond at all and we do not know whether the exclusion of nonrespondents biases sample estimates. In the next year, we plan to examine this problem directly by making additional efforts to interview a representative subset of the SMS nonrespondents. These additional efforts will include extending the field period (allowing more time for refusal conversions and added calls) and possibly monetary incentives. Confidence in the sample estimates will be increased if they are unaffected by the addition of a

significant portion of the remaining nonrespond-
ents

FOOTNOTES

[1]Cases completed using a mail questionnaire and
one of the other special efforts are treated as
mail respondents only, cases completed as a
refusal conversion and repeated callbacks are
treated as refusal conversions only.
[2]Thran, et al (1986) examine the relationship
of survey response and item response in detail.
In this analysis, if income (or hours) was miss-
ing it was set to 0 and the income (or hours)
not reported dummy variable was set to 1. This
allowed inclusion of more cases.
[3]Replication of this analysis using log income,
log hours, and log weeks yielded very similar
results.
[4]The number of calls is used here for lack of
a better alternative. It is not a uniform
measure--while one call might be the interview
call involving 25 minutes of interviewer labor
and telephone charges, another call might not
be answered so that there is no telephone
expense and only minimal interviewer labor.
It is difficult to obtain more precise cost
information. Rather than leave the question
of cost effectiveness unexamined, we are using
these data to make some cost estimates.

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TABLE 1. Probit of Response by Special Efforts by Respondents

	Mail	Refusal Conversion	More Than 12 Calls	Any Special Effort
Constant	-1.60	-1.06	-1.14	-.49
Internal Medicine	.11	.31*	.15	.28**
Surgery	-.15	-.10	.22	.05
Pediatrics	-.21	-.28	-.04	-.20
Obstetrics/Gynecology	-.24	-.09	.20	.02
Radiology	-.30	-.65**	-.33	-.57***
Psychiatry	-.59*	-.49*	-.14	-.46**
Anesthesiology	.04	-.64*	-.31	-.40**
Pathology	-.14	-.40	-.29	-.39*
Other Specialty	-.42	-.37	.20	-.14
North Central	-.01	-.02	-.25**	-.19*
South	.11	-.06	-.15	-.10
West	.27*	.19	-.19	.05
Female	-.09	-.48**	.23*	-.01
Age	.002	-.002	-.008**	-.006*
AMA Membership	.10	-.15	.05	.01
Annual Income (in Thousands of Dollars)	-.0005	.0010	.0015**	.0012**
Income Not Reported	-.08	.65***	.49***	.59***
Hours Worked per Week	-.002	-.008**	.003	-.001
Hours Not Reported	-.10	-.51*	.22	-.07
Small Metropolitan	.06	.09	-.12	-.03
Nonmetropolitan	-.03	-.06	-.10	-.10
Log-Likelihood	-501.6	-659.9	-976.5	-1441.4
x^2 (21 d.f.)	28.14	120.09***	87.75***	153.75***

*p<.05 NOTE: The reference categories are general/family practitioners,
**p<.01 large metropolitan areas, and the Northeast. The coding for cate-
***p<.001 gorical variables is 0=no, 1=yes.

TABLE 2. Regression of Annual Net Income (in Thousands of Dollars) for Easy-To-Complete Cases, Cases Requiring Special Efforts, and All Cases

	Easy	Mail	Refusal Conversion	More Than 12 Calls	Any Special Effort	All Respondents
Intercept	-357.8	-1104.5	-4428.7	-1537.3	-1275.1	-352.8
Internal Medicine	10.8	12.5	-8.3	18.2	3.3	9.6
Surgery	50.4***	9.1	88.0**	52.1**	54.1***	51.4***
Pediatrics	-7.5	-36.8	-22.6	3.1	-11.2	-8.5
Obstetrics/Gynecology	30.3***	14.0	28.5	35.1	25.9	28.9***
Radiology	51.3***	100.5**	149.1	75.2*	86.5***	53.6***
Psychiatry	10.6	-15.8	-7.6	32.5	14.9	10.7
Anesthesiology	40.7***	40.5	101.9	126.1***	83.7***	45.2***
Pathology	45.1***	2.2	-21.3	0.3	-10.0	37.5***
Other Specialty	21.6**	106.2**	17.2	27.0	40.4*	24.3***
North Central	3.9	-20.7	60.9*	22.9	22.0*	6.9
South	8.3	7.2	30.7	26.1	20.3*	9.7*
West	-4.1	-13.6	10.9	21.0	5.0	-1.9
Small Metropolitan	.5	-2.5	-4.5	-8.0	-7.5	-1.1
Nonmetropolitan	-11.4*	-19.7	-48.3	8.8	-8.0	-11.3**
Years of Experience	-2.2***	-2.0	-4.3	-2.4	-2.9**	-2.4***
Ln (Years of Experience)	31.4***	44.8	61.5*	46.0**	47.2***	35.8***
Self-Employed	27.5***	21.0	-20.8	25.0	13.5	25.7***
Group Practice	12.8***	42.2**	-1.6	14.9	14.9*	13.1***
Weeks Worked per Year	16.3***	44.5	173.0	64.6	51.3	15.3***
Hours Worked per Week	1.3***	-.4	1.7	.1	.7	1.2**
Weeks Squared	-.2***	-.5	-1.7	-.7	-.5	-.2***
Hours Squared	-.006*	.003	-.008	.002	-.002	-.006*
Female	-14.1*	-11.0	-26.6	-29.0	-26.6*	-16.0**
Board Certified	14.8***	37.5*	23.1	17.0	24.2**	16.2***
AMA Membership	9.5**	9.4	37.0	1.5	15.5*	10.8***
FMG	-.3	-13.4	-15.6	6.8	8.8	0.0
Hospital-Based	5.4	-1.0	-21.6	3.9	-12.3	2.2
R²	.28	.36	.24	.27	.27	.28
F	22.39***	2.85***	2.11**	3.79***	6.28***	27.56***
N	1,487	88	96	200	386	1,874

*p<.05 **p<.01 ***p<.001

NOTE: The reference categories are general/family practitioners, large metropolitan areas, and the Northeast. The coding for categorical variables is 0=no, 1=yes.

TABLE 3. Average Number of Calls Per Eligible Physician and Completed Interview By Level of Effort

	Mail Questionnaire Sample: Reminder Calls	Telephone Sample: Refusal Conversion Attempted	Telephone Sample: No Refusal Conversion Attempted	All Completed Cases
Total Calls	3,442	4,027	28,146	35,615
Number of Eligible Physicians	530	474	3,314	4,318
Number of Completed Interviews	125	183	2,299	2,607
Average Number of Calls Per Eligible Physician	6.5	8.5	8.5	8.2
Average Number of Calls Per Completed Interview	27.5	22.1	12.2	13.7

TABLE 4. Percent of Item Nonresponse for Easy and Special Effort Cases

	Easy	Mail	More Than 12 Calls	Refusal Conversion	Any Special Effort
Annual Net Income	22.0%	24.8%	35.9%	45.6%	36.5%
Hours Worked Per Week	4.5	4.8	5.3	5.5	5.2
Number of Patient Visits Per Week	6.6	11.6	9.3	17.6	12.2