PATTERNS AND EFFECTS OF NONRESPONSE AND LATE RESPONSE ON A SURVEY OF 1983-84 MEDICAL SCHOOL GRADUATES

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BACKGROUND:

The challenges and potential high costs of conducting surveys with physicians has raised questions about the relationship of response rates, response bias, and survey costs. The central issue is under what conditions are the costs related to raising the response rate by a few percentage points justified. This paper examines the patterns and effects of nonresponse and late response whereby extra costs were required to raise response rates for a survey of recent medical school graduates. Response rates at various points in the collection are analyzed by characteristics of physicians, some of which are taken from the American Medical Association (AMA) masterfile and while some were collected as part of the survey itself. Potential response bias was also estimated for conditions where the survey would have been ended earlier with a lower response rate.

This analysis is based on a survey of a stratified sample of 1983-84 medical school graduates selected from the AMA masterfile which was conducted to provide data about career choices particularly as they related to sustained practice in primary care or service to underserved populations. The survey consisted of two mailings and telephone follow-up to nonrespondents. The unadjusted response rate for the survey was 74 percent; when adjusted for the estimated eligibility rate of nonrespondents, it was 77 percent. For this analysis, the sample includes allopathic physicians practicing in family or general practice, general internal medicine, and general pediatrics.

Some literature on this topic suggests that follow-up efforts may not be necessary when the physician sample is homogeneous such as when physicians are all of one specialty (Sobal, et al. 1990). A review of other studies finds that physician respondents and nonrespondents were not different in the majority demographic characteristics, but were different on other characteristics (Sobal and Ferentz, 1992; Goodman and Jenson, 1981; Berk and Meyers, 1980; and Harkins, 1981). Some studies have reported substantial differences in response rates while others have not (Gough and Hall, 1977; Harkins, 1981; Berk, 1985; Goodman and Jenson, 1981; and Loft, 1981). Berk (1985) in doing an analysis of early, middle, and late responders to the Physician Practice Survey (NMES), found estimates of early responders to be similar to those of late responders but warned of the need to have enough cases to conduct meaningful analysis. Guadagnoli and Cunningham (1992) found that nonresponse bias on a cancer attitude questionnaire was still present after increasing the response rate from 35 to 58 percent. They stress the importance of increasing response of all types of physicians at all points in the collection.

RESULTS OF THIS STUDY

Respondents and Nonrespondents

The respondents and nonrespondents to the survey were compared using selected information available on the AMA Masterfile. The variables used as a basis of this comparison included the location of practice; primary care specialty; major professional activity; and AMA membership status (Table 1). We found statistically significant differences ($p < .05$) between responders and nonresponders on primary care specialty and AMA membership. Compared to respondents, nonrespondents included a greater proportion of internists and a smaller proportion of the other specialities included in the survey. Similarly, current members of the AMA were more likely to respond to the survey than nonmembers or those whose membership was delinquent.

There was evidence during the telephone follow-up that a component of sample was adamantly opposed to responding to an AMA-sponsored survey. Conversely, there was also evidence that early and enthusiastic responders to the survey were positively affected by the AMA endorsement. These observations are consistent with AMA members being more likely that others to respond them to the survey.

Early, Middle, and Late Responders

Responders to the survey of medical school graduates, 1983 to 1984, can be classified as early, middle, or late responders based on when they returned

their questionnaire and by what mode. An early responder responded to the first mailing; a middle responder to the second mailing; and a late responder to the telephone follow-up to those not responding to the mailed surveys. If differences are found, this may indicate that response bias was reduced by the follow-ups.

Table 2 indicates some potentially important differences between the early, middle, and late responders. One of the differences is specialty. Those reporting a current specialty of internal medicine were less likely to respond to the first mailing than those reporting family practice/general medicine or general pediatrics as the current specialty. Those reporting internal medicine required greater telephone follow-up than the other two groups to reach the final completion rates. This finding is consistent with the greater percentage of nonresponders having the internal medicine specialty (see above).

Race appears to be another important factor: a greater proportion of physicians with more black patients (a traditionally underserved group) responded late while those with more white patients responded early; similarly, more white physicians responded early, while few black physicians responded early. There was no significant difference by gender of physician.

Those less likely to respond early also include: those with strong clerkship or volunteer experience with the underserved, those with experience in a federally funded shortage area, those who planned to serve underserved in the next five years. Conversely, those who planned to remain in primary care over the next five years were more likely to response early. There are no other significant differences of note.

EFFECTS ON RESPONSE ACCURACY

This section examines whether the previous significant findings indicate an appreciable impact on response accuracy. Increasing response rates can have two beneficial impacts on response accuracy: a larger sample size reduces sampling error for most estimates; and to the extent that nonresponders and responders differ, bias will be reduced by increasing the proportion of the total population that responds.

The impact on sampling error of increased sample size generally depends on two factors: the size of the sample and the proportionate increase in sample size attributed to increasing the response rate. In the current survey, follow-up had a substantial impact: the second mailing increased the sample size by about 35 percent; and the telephone follow-up increased the final sample by 71 percent, over the size of the initial sample. This increase would reduce standard errors (or 95 percent confidence intervals) by 16 and 31 percent, respectively. For the full sample, the two follow-up efforts would reduce the 95 percent confidence interval for a midrange percentage from ±3.0 to ±2.3 percentage points. The impact would be greater for analyses of subgroups such as racial groups, men and women or individual specialties since the sample sizes for these groups are smaller.

This issue of bias is more difficult to address, because we must make stronger assumptions. The sample bias of a variable can be defined as the difference between the sample estimate and the "true" or population value of that variable. This implies that to measure bias, we need an external source against which to validate sample estimates. We have two variables that we can validate externally (specialty listed on the sample frame, and AMA membership), and these can only be validated against the sample frame. For other variables, we must make the assumption that an estimate based on data with fewer nonresponses is less biased than one from a data set that has a larger degree of nonresponse. We believe this assumption to be reasonable. In this report, we will use the term apparent bias, by which we mean the difference between a sample estimate and the estimate from the sample frame, or between an estimate from part of the sample (e.g., responders to the first mailing) and the estimate from the entire responding sample.

The pattern is that of apparent bias being reduced by increasing the proportion of the sample responding. The apparent bias is much larger for some variables than for others. For example, estimates of specialty appear to be affected by a large bias and to be more severely biased when non-response is greater. The first mailing would substantially underestimate (by 8.2 percentage points), the proportion of the study population that are internists and overestimate the proportion in family practice (by 4.9 percentage points). While the estimate from the entire sample (after telephone follow-up) is still biased, the apparent bias has been substantially reduced. This pattern is also seen for currently reported specialty, with internal medicine being apparently underestimated and other specialties overestimated

There is apparent bias in most other categories of data. Exceptions are percent of physicians reporting they spend more than 80 percent of their time in outpatient settings (no apparent bias), and the mean percentage of physician's patients who are Hispanic (no apparent bias after the second mailing). Also, contrary to the expected pattern, the apparent bias increases slightly between first and second mailing for four estimates: percent of physicians reporting spending 40-79 percent of their time

in outpatient settings, percent of physicians who report that they are Native Americans or Alaskan Natives, percent planning to serve the underserved in 5 years and percent very satisfied with choice of specialty.

Detailed tables for this section are available upon request.

A measure analogous to the standard error is the root mean error (RME), which incorporates bias as well as sampling error. The standard errors and the percent of RME due to (apparent) bias are examined in a table which is available upon request. In some cases the percentage RME due to bias is very large (a percentage over 50 indicates that the bias is larger than the standard error). If our estimates of bias are correct, relying on sampling error alone as a measure of the accuracy of sample estimates could lead to erroneous conclusions.

DISCUSSION

In the comparison of respondents and nonrespondents to this survey the two significant differences were AMA membership status and specialty. Those with active AMA membership were more likely to respond to the survey. This is supported by written (mail) and oral (telephone) comments by respondents which indicated that members who were also early enthusiastic responders were positively affected by the AMA participation and endorsement of the survey while late responders were more negatively affected. This finding suggests that a different kind of appeal and advance letter then endorsement of the AMA may need to be used with those groups identified as late or nonresponders.

Similarly, a greater percentage of nonresponders and late responders were practicing general internal medicine than were practicing in family medicine, general practice, or general pediatrics. One can only speculate as to why this may be the case. For example, are those in general internal medicine busier, surveyed more often, or do they consider themselves as more of a separate specialty less associated with primary care?

The sample of physicians is homogeneous by experience of physician since all were 1983-84 graduates. It is also homogeneous in that all specialties are considered to be primary care specialties. However, without additional follow-up efforts, those in general internal medicine would have been underrepresented.

When early, middle, and late patterns of response are analyzed several patterns of particular importance emerge. Both white doctors and doctors with a substantial percentage of white patients, responded early (to the first mailing). Both black doctors and doctors with a substantial percentage of black patients tend to respond late requiring telephone follow-up. This racial difference has relevance to the topics of importance to the survey. Black physicians proved to be a more difficult group to survey and, yet, were an important subgroup to include in this survey concerned with career decisions related to primary care and service to underserved populations. Similarly, a greater percentage of those physicians planning to provide service to underserved populations required telephone follow-up to complete the questionnaire. A greater percentage of physicians working in a federally funded shortage area or incurring a higher medical school debt also required more telephone follow-up to complete.

Therefore, the analysis of response patterns for this physician survey suggests that a greater degree of effort to complete is required for those physicians who fall into categories at the peripheries of the "mainstream" practice characteristics.

Finally, the analysis on response accuracy indicated that the telephone follow-up did reduce the sampling error and, the apparent bias of the estimates was also reduced by increasing the proportion of the sample responding.

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TABLE 1

COMPARISON OF RESPONDENTS AND NONRESPONDENTS SELECTED ON AMA MASTERFILE VARIABLES
(* Significant at $p < .05$)

Variable	Respondent N = 1841	Nonrespondent N = 689
Location of Practice		
Nonmetro < 9,999	1.1	.9
Nonmetro 10-24,999	4.0	2.8
Nonmetro 25-49,999	5.5	4.8
Nonmetro > 50,000	6.7	6.8
MSAS 50-49,999	19.2	21.3
MSAS 500-999,999	16.6	19.5
MSAS 1-499,999	38.7	35.3
MSAS > 500,000	8.3	8.7
Specialty on Frame *		
Family practice	33.3	33.0
General practice	13.7	11.4
Internal medicine	36.2	41.9
Pediatrics	16.9	13.7
Major Professional Activity		
Full-time hospital physician	7.9	6.4
President > 1st year	2.9	3.4
Medical teaching	1.5	1.6
Office-based patient care	87.8	88.7
AMA Membership Status*		
Member	28.6	22.0
Nonmember	32.8	31.4
Delinquent in paying dues	38.6	46.6

TABLE 2

COMPARISON OF EARLY, MIDDLE, AND LATE RESPONDERS
(* Statistically Significant $p < .05$)

Questionnaire Variable	Respondent Status: Early (1st Mailing) N = 1076 (Percent)	Middle (Second Mailing) N = 378 (Percent)	Late (Telephone Follow-Up) N = 387 (Percent)
Current Reported Specialty*			
Family medicine or general practice	54.9	48.8	46.2
General internal medicine	28.1	34.6	38.5
General pediatrics	17.0	16.6	15.3
Faculty Appointment*			
Salaried	9.5	10.2	11.7
Volunteer	31.6	26.0	21.2
Non-faculty	58.9	63.8	67.1
Mean Hours Per Week			
Inpatient care	49.7	51.4	49.8
Total hours all services	55.9	57.3	56.7
Percent of Time in Office-Based Patient Care			
0 to 39 percent	27.0	27.5	30.5
40 to 79 percent	15.2	16.4	18.1
> 80 percent	57.7	56.1	51.4
Percent of Time Spent in Inpatient Setting*			
0 to 39	75.1	75.1	71.8
40 to 79	4.0	3.4	8.0
> 80	20.9	21.4	20.2

TABLE 2 *(continued)*

Questionnaire Variable	Respondent Status: Early (1st Mailing) N = 1076 (Percent)	Middle (Second Mailing) N = 378 (Percent)	Late (Telephone Follow-Up) N = 387 (Percent)
Percent of Time in Outpatient Clinic or Health Center			
0 to 39	93.2	94.2	91.2
40 to 79	5.5	4.2	7.2
> 80	1.3	1.6	1.6
Percentage Care Time In			
Suburb	19.5	20.3	18.1
Large city (500,000 or more)	20.8	24.2	24.2
Moderate city	22.5	24.5	22.5
Small	18.2	17.1	18.9
Rural	17.4	11.7	14.8
Other	1.7	2.1	1.5
Percentage Patients			
White*	72.4	69.9	66.6
Black*	13.8	16.2	20.3
Hispanic	8.6	9.2	8.7
Native American/Alaskan	1.8	1.4	1.8
Asian, Oriental, Pacific Islander	3.4	3.6	2.6
Basic Demographics			
Percentage male	67.4	67.5	64.5
Percentage female	32.6	32.5	35.6
Race of Physician			
White*, not Hispanic	91.9	86.1	82.5
Black*, not Hispanic	2.8	6.8	11.1
Hispanic	2.0	3.7	1.8
Native American/Alaskan	.3	0	1.0
Asian, Oriental, P.I.	3.0	3.4	3.6
Net Practice Income*			
Mean rating income Categories 1-5, 5 highest	3.3	3.3	3.2
Future Plans			
Primary care over 5 years			
Percentage: yes	96.2	95.8	95.2
Serve underserved 5 years			
Percentage: yes*	73.9	71.9	80.0
Mean Degree of Satisfaction			
With specialty (1-5)	1.9	2.0	1.8
Percentage Very Satisfied With Specialty*	39.8	36.0	50.6
Selected Factors that Influenced Practice Choise			
Clerkship experience in primary care	2.9	2.8	2.9
Clerkship experience with the underserved*	4.0	4.0	3.7
Desired practice setting	3.1	3.3	3.0
Percentage Had Experience			
Community or migrant health center	49.1	42.4	46.6
Indian health service	12.7	10.5	9.0
Other in rural area*	55.9	50.1	45.9
Poor area in city*	39.5	31.8	37.3
Inner city	74.0	75.4	73.3