

QUALITY OF DATA ELICITED BY SUCCESSIVE MAILINGS IN MAIL SURVEYS

By: Monroe G. Sirken and Morton L. Brown
National Center for Health Statistics
National Vital Statistics Division

Introduction

It is customary in mail surveys to conduct additional mailings with nonrespondents in order to increase the number of respondents and thereby decrease the potential impact of bias error due to nonresponse. Typically, the gains resulting from each additional mailing are measured in terms of the increment to the response rate.[1] In effect, it is assumed that the quality of reporting in the survey is essentially the same regardless of whether the first mailing or one of the additional mailings elicits the reply. Findings based on a mail survey conducted by the National Vital Statistics Division do not bear out this assumption. On the contrary, the adequacy of reporting in this survey was highest for survey questionnaires elicited by the first mailing and was successively lower for questionnaires elicited by each subsequent mailing. This finding, if generally applicable, would suggest that the costs of additional mailings should be justified on the basis of marginal gains in the proportion of adequate responses rather than solely on the basis of reductions in the nonresponse rate.

Survey Design

Recently, the National Vital Statistics Division conducted a survey for the Population Research and Training Center, University of Chicago, involving a probability sample of 9,541 persons who died during the 4-month period, May through August 1960. The 9,541 decedents were selected from the Current Mortality Sample—a ten-percent sample of death certificates which the 54 independent Registration Areas in the Nation transmit monthly to the National Vital Statistics Division.

The mortality sample survey was one phase of a large-scale project to match the death certificates for a sample of approximately 340,000 deaths out of 536,000 occurring in the 4-month period, May through August 1960, with the enumeration records for these decedents in the 1960 Census. "It [the project] is designed to provide nationwide statistics on mortality differentials by the full range of social and economic characteristics collected in the 1960 Census of Population and thus to circumvent the restrictions imposed on mortality analysis by the limited information reported in the official death record." [2] It was anticipated that the matching operation would be unsuccessful in locating a census record for about one-fifth of the decedents. The primary purpose of the mortality survey is to provide "Census" information for a sample of decedents not matched with the 1960 census records in the large-scale matching operation. However, the mortality survey was conducted in advance of the matching operation

for a sample of all decedents included in the larger project, since it was considered inadvisable to delay the survey until the fall of 1962—the earliest date by which the "unmatched" decedents could be identified.

Data collection in the mail survey was started in the summer of 1960 and was completed less than one year later. The survey was undertaken as soon as feasible after the decedent was selected into the sample in order to avoid non-response losses due to migration of the respondent and also to reduce the risk of response error due to memory loss. Nevertheless, there was an average delay of about 6 months between the date of death and the date that the respondent replied to the mail survey.

The death certificate informant—the person who provided the funeral director with information about the decedent for the death certificate—was the principal respondent in the mortality survey. (Henceforth, we will refer to this person as the "informant.") The name and address of the informant, who is usually a close relative of the decedent, appears on the death certificate. The first questionnaire was sent to informants by regular mail, and nonrespondents were sent 2 additional mailings at 2 week intervals—the first by certified mail, and the second, a special nonresponse letter, by regular mail. Finally, arrangements were made with the Bureau of the Census to conduct personal interviews with nonrespondents in the mail survey who resided in counties included in the sample design of the Current Population Survey and in adjacent counties.

Questionnaires returned in the mail survey were reviewed and evaluated in terms of the "adequacy" of the reported information. In essence, adequacy is a measure of codeability. The rules for measuring adequacy were based entirely on the completeness and internal consistency of the information reported on the mail questionnaire. Obviously, the concept "adequacy" in this sense is not necessarily a measure of validity, since an adequate response may or may not be a valid response. On the other hand, an inadequate response can hardly be a valid response, and for this reason, the adequacy measure would appear to have utility as an index of the quality of response, particularly in those surveys where the absence of a criterion source makes it impossible to validate the reported information.

The absence of a criterion source was not, however, the justification for assessing the "adequacy" of responses in the mortality survey, since eventually the information as reported in

the 1960 census will be available—at least for the "matched" decedents. The measure of adequacy was a by-product of the editing procedure in the mortality survey where it was used in deciding whether or not follow-up mailing actions were indicated in order to improve the quality of reporting on the "original" questionnaire. (By the "original" questionnaire we mean a questionnaire that was elicited by the first, second, or third mailing as distinguished from forms that were elicited by special mailing actions that were undertaken subsequently to improve the quality of reporting.)

The questionnaire covered most of the items contained either in the 100-percent or in the 25-percent sample schedule of the 1960 Census of Population. Specified items in each part of the questionnaire were considered essential (Chart I). If, for any of these essential items, the information was missing or incomplete, or was inconsistent with information reported elsewhere on the questionnaire, the part of the questionnaire containing this item was assessed to be not adequate. The adequacy of each of the 5 parts of the questionnaire was assessed independently and the sum of the adequate parts (ranging from 0 to 5) was the overall measure of the questionnaire's adequacy.

In order to improve the quality of information reported in the mail survey, special mailing actions were frequently undertaken for cases in which the original questionnaire was evaluated as not adequate. The special mailing actions involved either mailing a questionnaire to a referral respondent identified by the informant or mailing a special letter to the informant enclosing a form containing only those questions which were not adequately answered on the original questionnaire. The basic rules for conducting special mailing actions were: (1) a questionnaire was mailed to a referral whenever one was given, or (2) a special letter was mailed to the informant if one or at most two parts of the original questionnaire were not adequate. Prior experience contraindicated conducting follow-up actions routinely with informants whose reports were generally inadequate throughout the original questionnaire.

At the discretion of the director of the mortality survey, however, special letters were occasionally mailed to informants even though more than 2 parts of the original questionnaire were not adequate. On the other hand, follow-up actions with informants who adequately completed most of the parts of the original questionnaires were occasionally contraindicated by public rela-

CHART I - ESSENTIAL ITEMS OF INFORMATION ON EACH PART OF THE QUESTIONNAIRE

PART OF QUESTIONNAIRE	ESSENTIAL ITEMS
I: PLACES OF RESIDENCE OF THE DECEDENT.	PLACE OF RESIDENCE AS OF APRIL 1, 1960 (STREET ADDRESS, CITY OR TOWN, AND STATE).
II: HOUSEHOLD IN WHICH DECEDENT WAS A MEMBER.	NAMES, DATES OF BIRTH, SEX, RACE, MARITAL STATUS, AND RELATIONSHIP TO HEAD OF HOUSEHOLD OF EACH PERSON LIVING WITH THE DECEDENT ON APRIL 1, 1960.
III: CHARACTERISTICS OF THE DECEDENT.	DATE HE LAST WORKED AT A JOB. EMPLOYMENT STATUS DURING LAST WEEK OF MARCH 1960. OCCUPATION AT WHICH LAST WORKED. INDUSTRY IN WHICH LAST WORKED.
IV: CHARACTERISTICS OF DECEDENT'S SPOUSE (OR PARENT IF DECEDENT WAS A CHILD).	DATE HE LAST WORKED AT A JOB. EMPLOYMENT STATUS DURING LAST WEEK OF MARCH 1960. OCCUPATION AT WHICH HE LAST WORKED. INDUSTRY IN WHICH HE LAST WORKED. (NOTE: THESE ITEMS REQUIRED ONLY FOR HUSBANDS OF DECEASED MARRIED WOMEN AND FOR PARENTS OF DECEASED UNMARRIED CHILDREN 17 OR UNDER.)
V: INCOME CHARACTERISTICS OF DECEDENT AND HIS FAMILY.	INCOME OF THE DECEDENT FROM WAGES OR SALARY, FROM PROFITS AND FEES, OR FROM ANY OTHER SOURCE. INCOME OF DECEDENT'S SPOUSE (OR PARENT) FROM WAGES OR SALARY, FROM PROFITS AND FEES, OR FROM ANY OTHER SOURCE. INCOME OF OTHER RELATIVES LIVING WITH THE DECEDENT FROM WAGES OR SALARY, FROM PROFITS AND FEES, OR FROM ANY OTHER SOURCE.

tions considerations or on evidence that the informant did not know the missing information.

After replies were received from the special follow-up mailings, the adequacy of the combined information reported on the original questionnaire and on the follow-up forms was re-evaluated.

Response and Adequacy Rates

About 45 percent of the informants replied to the first mailing and the response rate was raised to 83 and 88 percent, respectively, after the second and third mailings had been completed. The response rate after completion of personal interviews was 94 percent. (Personal interviews were completed with about 82 percent of the 691 informants with whom they were attempted. Personal interviews were not attempted, however, with 496 respondents to the mail survey representing principally those who lived in counties not covered by the interviewers.) Considerable care was exercised in establishing which of the three mailing actions elicited the reply. For example, when necessary, postmarks on returned envelopes were used in order to establish which mailing had elicited the reply.

Not quite 50 percent of the questionnaires returned in the mail survey were completely adequate. For the remainder, the information was not adequately reported in one or more parts of the questionnaire. Special mailing actions were instituted for about three-fifths of the original questionnaires that were evaluated to be not entirely adequate. A questionnaire was mailed to 296 referrals identified by the informants and special letters were mailed to 2,404 informants. Subsequently, the cases were re-evaluated based on the combined information reported on the original questionnaire and on the report forms returned as a result of the special mailing actions. These special actions were successful in improving the adequacy of reporting in the survey (Table 1). The proportion of cases replying to the mail survey for which completely adequate information was obtained increased from about one-half to about two-thirds.

Special follow-up mailing actions improved the adequacy of reporting for every part of the questionnaire (Table 2). Parts of the questionnaire for which information was relatively less well reported on the original questionnaire had the largest absolute improvement. Thus, the proportion of cases for which income was reported adequately increased from 63 to 72 or about 9 percentage points, and the adequacy of residence reporting, which was originally 97 percent, improved by less than 1 percentage point. Nevertheless, the five parts of the questionnaire are ranked by percent adequate in the same order before and after the special mailing actions were conducted. The part of the questionnaire pertaining to the place of residence of the decedent on April 1 was most often adequately completed and the part pertaining to the 1959 income of the decedent and his family was least often adequately completed.

The overall adequacy of reporting in this mail survey is not typical of mortality surveys that have been conducted in recent years by the National Vital Statistics Division.[3] By comparison, the informant response rates to this mail survey were slightly lower, and the adequacy of the reported information was poorer. All mortality surveys have a distinct methodological problem; namely, the respondent reports not-for-self. There were additional factors, particular to this survey, pertaining to the items of information collected which probably depressed the adequacy of the derived statistics. The survey questionnaire was lengthy and relatively complex since every attempt was made to duplicate the concepts employed in the 1960 Census. With few exceptions the census question wording and categories of response were adhered to **strictly**. Thus, April 1, the Census date, was the reference date in many of the questions. This was a somewhat arbitrary, if not an artificial date of reference when applied to persons who died in the four-month period, May through August, and about whom the mortality survey collected information approximately 6 months later. The problem presented by adhering to the Census reference date was even more difficult for such items of information as income and weeks worked for which the reference period was 1959.

TABLE 1. NUMBER OF PARTS OF THE QUESTIONNAIRE FOR WHICH ADEQUATE INFORMATION WAS REPORTED BEFORE AND AFTER SPECIAL FOLLOW-UP MAILINGS WERE CONDUCTED

Number of Adequate Parts	Proportion of Questionnaires That Were Adequate	
	Prior to Follow-up Mailings	After Follow-up Mailings
5-----	47.6%	65.7%
4-----	29.1	17.6
3-----	14.2	8.7
2-----	5.5	5.1
1-----	1.6	1.5
0-----	2.0	1.4

TABLE 2. ADEQUACY OF THE INFORMATION REPORTED IN EACH PART OF THE QUESTIONNAIRE BEFORE AND AFTER THE SPECIAL MAILING ACTIONS

Part of Questionnaire	Percentage of Questionnaires Returned Adequate		
	Prior to Follow-up Actions	After Follow-up Actions	Absolute Change
Part I - Residence of decedent-----	96.5%	97.3%	0.8%
Part II - Household composition-----	78.7	86.5	7.8
Part III - Characteristics of decedent-----	81.5	88.2	6.7
Part IV - Characteristics of related person---	89.9	92.9	3.0
Part V - Income-----	62.8	71.8	9.0

The adequacy of reporting in the mail survey would have been considerably higher except for the income items which represented by far the least adequately completed part of the questionnaire. Excluding the income items, the reported information was entirely adequate for 64 percent of the returned original questionnaires and this was increased to 78 percent after the special follow-up mailing actions were conducted.

Results by Successive Mailings

The procedures for evaluating the adequacy of the information reported on the original questionnaires were independent of the mailing wave that elicited the reply. There were, nevertheless, significant differences in the adequacy of the reported information on the original questionnaire according to the wave that elicited the reply (Table 3). Questionnaires elicited by the first mailing had relatively the highest adequacy level of reporting, and those elicited by the third mailing had the lowest adequacy level. The proportion of questionnaires elicited by the first, second, and third mailings in which the reported information was entirely adequate was 50 percent, 45 percent, and 40 percent, respectively. Although the special mailing actions improved the adequacy of the information reported on the original questionnaires elicited by each of the mailings, the special action was most effective in improving the information reported on questionnaires that had been elicited by the first mailing, and the gains were successively smaller for information reported on questionnaires that had been elicited by the second and third mailings. Consequently, the disparity in the adequacy of information reported on the questionnaires elicited by the first, second, and third mailings was increased as a result of the special mailing actions.

The difference between the mailing waves in the adequacy of the reported information was observed for each of the five separate parts of the questionnaire (Table 4). The difference between mailing waves was greatest for Part V of the questionnaire which was the least adequate part of the questionnaire and the difference was least for Part I which was the most adequate part of the questionnaire. Thus, for Part V, the

difference in the percentage of adequate reports between questionnaires elicited by the first and third mailing waves was 12 percentage points; for Part I, the difference was 2 percentage points. For virtually every part of the questionnaire, the special mailing actions produced the largest absolute gains for questionnaires returned to the first mailing and these actions produced the smallest absolute gains for questionnaires returned to the third mailing. Consequently, the disparity between the mailings on the adequacy of every part of the questionnaire was greater after than before the special mailing actions were conducted.

Three factors help to explain the differential effectiveness of the special follow-up mailing actions in improving responses to the questionnaires elicited by the first, second, and third mailings: (1) differences in the proportion of inadequate original questionnaires for which special mailing actions were undertaken, (2) differences in the response rates to the special mailing action, and (3) differences in the adequacy of reporting on the forms returned to the special mailing action. For each of these factors, the results favored the questionnaires elicited by the first mailing most and those elicited by the third mailing least.

A special mailing action was initiated with 64 percent, 60 percent, and 56 percent, respectively, of the informants whose questionnaires were elicited by the first, second, and third mailing. The questionnaires elicited by the later mailings were more likely to contain expressions of disinterest or of lack of information, conditions under which special mailing actions were contraindicated.

There was a differential response rate to the special follow-up mailing actions according to the mailing that elicited the original questionnaire. Thus, the response rates to the special follow-up mailing were 79 percent, 70 percent, and 46 percent, respectively, according to whether the original questionnaire had been elicited by the first, second, or third mailing.

Finally, the adequacy of reporting on forms elicited by the special mailing action favored

TABLE 3. NUMBER OF PARTS OF THE QUESTIONNAIRE FOR WHICH ADEQUATE INFORMATION WAS REPORTED BY THE MAILING WAVE THAT ELICITED THE ORIGINAL QUESTIONNAIRE

Number of Adequate Parts	Proportion of Questionnaires That Were Adequate		
	First Mailing	Second Mailing	Third Mailing
<u>Prior to special follow-up mailing</u>			
5-----	50.1%	45.5%	40.3%
4-----	28.9	29.3	28.7
3-----	12.6	15.3	19.7
2-----	5.0	6.1	6.4
1-----	1.7	1.5	1.9
0-----	1.7	2.3	3.0
<u>After special follow-up mailing</u>			
5-----	68.9%	62.5%	51.4%
4-----	15.9	19.0	22.5
3-----	7.0	9.8	16.7
2-----	4.8	5.6	5.1
1-----	1.5	1.5	1.5
0-----	1.1	1.6	2.8

TABLE 4. ADEQUACY OF INFORMATION REPORTED IN EACH PART OF THE QUESTIONNAIRE BY WAVE ELICITING THE ORIGINAL RESPONSE BEFORE AND AFTER THE SPECIAL MAILING

Part of Questionnaire	Proportion of Returned Questionnaires That Were Adequate		
	First Mailing	Second Mailing	Third Mailing
<u>Prior to special mailing</u>			
Part I - Residence of decedent-----	96.8%	96.3%	94.4%
Part II - Household composition-----	80.1	77.6	74.7
Part III - Characteristics of decedent-----	81.9	81.3	77.9
Part IV - Characteristics of related person-----	90.9	88.8	88.8
Part V - Income-----	65.7	60.3	54.0
<u>After the special mailing</u>			
Part I - Residence of decedent-----	97.7%	97.1%	94.9%
Part II - Household composition-----	88.5	84.8	80.5
Part III - Characteristics of decedent-----	89.1	87.5	84.6
Part IV - Characteristics of related person-----	94.0	91.9	90.4
Part V - Income-----	75.3	69.4	58.0

cases where the original questionnaires were elicited by the earlier mailings. For example, of the inadequate questionnaires for which replies to the special mailing actions were returned, 64 percent became adequate if the original questionnaire was elicited by the first mailing, whereas 52 percent and 33 percent became adequate if the original questionnaire had been elicited by the

second and third mailings, respectively. Stated in terms of the proportion of inadequate questionnaires which were not improved at all by the special follow-up action, the results were 30 percent, 47 percent, and 58 percent, respectively, depending on whether the original questionnaire had been elicited by the first, second, or third mailing.

Discussion

We have no simple explanation for the observation that the level of adequacy of the reported information was highest for questionnaires elicited by the first mailing and that it was successively lower for questionnaires elicited by each additional mailing. It seems likely to us that the respondents' ability to answer the questions and their motivation to reply are interrelated factors influencing both the mailing wave to which they reply and the adequacy of the information which they report.

We suspect that the general relationship between the mailing wave eliciting the response and the adequacy of response observed in this survey may be typical of most mail surveys. Preliminary findings derived from this survey indicate that this relationship appears to hold for demographic subgroupings of the decedents. We were particularly curious to investigate this matter for white and nonwhite decedents since earlier mortality surveys [4] had established the fact that response rates were consistently higher for white decedents than those for nonwhite decedents, and in particular, that the response rate to the first mailing was substantially greater for white than for nonwhite decedents. The expected differential response rate by color was also observed in this survey (Table 5). On the basis of the difference in the pattern of response to the 3 mailings we hypothesized that the adequacy of the reported information would be higher for whites than for nonwhites. The statistics substantiated the hypothesis. Fifty-three percent of the original questionnaires returned for white decedents were adequate as compared to 28 percent of the questionnaires returned for nonwhite decedents.

Within each grouping of the decedents by color, the adequacy of reported information was highest for questionnaires elicited by the first mailing and it was successively lower for questionnaires elicited by the second and third mailings (Table 6). We had, however, incorrectly anticipated that the adequacy level for white and nonwhite decedents would be about the same for questionnaires elicited by the same mailing. As it turned out, the information was much more adequately reported for white decedents than for nonwhite decedents for questionnaires elicited by each mailing. It is noteworthy that the ade-

quacy of reporting on questionnaires for white decedents elicited by the third mailing is superior to that for nonwhite decedents elicited by the first mailing. Thus, it appears that the difference in the adequacy of the reported information in the mail survey for white and nonwhite decedents is a function of at least two parameters, the nonresponse rate as well as the proportion of replies elicited by each mailing action.

Summary and Conclusions

In a mail survey involving the collection of household composition and socioeconomic and related demographic characteristics for a national sample of decedents, the initial response rate from relatives of decedents was almost doubled from 45 to 88 percent by means of conducting 2 additional mailings with nonrespondents. The adequacy (i.e., the codeability) of the reported information on the returned questionnaires was substantially improved as a result of mailing special queries to respondents in order to obtain data which originally were not reported adequately. Thus, the proportion of decedents for whom completely adequate reports were obtained increased from about one-half to about two-thirds as a result of the information reported in response to the special mailing actions.

The adequacy of the information reported in the mail survey was dependent upon the mailing action that elicited the original reply. Informants who replied to the first mailing reported most adequately and those who replied to the third mailing reported least adequately. The special mailing actions were relatively more successful in improving the adequacy of information reported on questionnaires elicited by earlier rather than later mailings. Consequently, the special mailings had the effect of increasing the variation in the adequacy of reporting among the mailing waves that elicited the original reply.

There were substantial differences among the 5 parts of the questionnaires in the proportion of returned questionnaires for which the information was adequately reported. Information on income was least adequately reported; for only about 72 percent of the decedents was this information reported adequately after the special mailing actions had been completed. By contrast,

TABLE 5. RESPONSE RATES BY COLOR OF DECEDENT AND BY MAILING WAVE THAT ELICITED THE RESPONSE

Action Eliciting Response	Response Rate		
	Total	White	Nonwhite
Number of decedents-----	9,541	8,254	1,287
Response to mail survey-----	87.8%	88.8%	81.7%
First mailing-----	45.5	46.5	39.2
Second mailing-----	37.4	37.5	36.9
Third mailing-----	4.9	4.8	5.6

TABLE 6. NUMBER OF PARTS OF THE QUESTIONNAIRE FOR WHICH ADEQUATE INFORMATION WAS REPORTED BY COLOR OF DECEDENT AND MAILING WAVE THAT ELICITED THE ORIGINAL QUESTIONNAIRE

Number of Adequate Parts of Questionnaire	Proportion of Questionnaires That Were Adequate					
	First Mailing		Second Mailing		Third Mailing	
	White	Nonwhite	White	Nonwhite	White	Nonwhite
Number of decedents-	3,835	504	3,096	475	395	72
<u>Prior to special follow-up mailing</u>						
5-----	52.9%	28.4%	48.6%	25.0%	43.8%	20.8%
4-----	28.9	29.4	29.1	30.7	28.9	27.8
3-----	11.2	23.0	14.3	21.7	18.2	27.8
2-----	4.0	12.5	4.8	14.3	4.6	16.7
1-----	1.4	3.8	1.0	4.8	1.5	4.2
0-----	1.5	3.0	2.1	3.4	3.0	2.7
<u>After special follow-up mailing</u>						
5-----	73.2%	44.0%	65.9%	40.3%	55.2%	30.5%
4-----	15.0	22.4	18.7	20.8	22.0	25.0
3-----	5.7	17.1	8.5	18.3	15.2	25.0
2-----	3.9	11.3	4.3	13.9	3.5	13.9
1-----	1.2	3.6	1.1	4.2	1.3	2.8
0-----	1.0	1.6	1.5	2.5	2.8	2.8

adequate information pertaining to place of decedent's residence was reported for 97 percent of the decedents. Regardless of the mailing wave that elicited the original reply, the 5 parts of the questionnaires were ranked in the same order on the basis of the proportion of questionnaires for which the information was adequately reported. Differences in adequacy of reporting among the 3 sets of questionnaires elicited by the first, second, and third mailings, respectively, were least for the most adequate part of the questionnaire and were increasingly larger for each of the less adequately reported questionnaire parts.

The relationship between mailing wave that elicited the reply and the adequacy of the reported information was observed for both white and nonwhite decedents. These two groups of decedents were investigated because they exhibited

different patterns of response (proportion replying to each mailing wave) and different response rates (total responding to the mail survey). Substantial differences were detected between the color groups in the adequacy of the reported information—being better for white than for nonwhite decedents. This difference was partially explicable in terms of the proportions of the returned questionnaires that were elicited by the first, second, and third mailing, respectively; that is the average number of mailings that was required to elicit the original reply was smaller for white than for nonwhite decedents. In addition, however, the adequacy of reporting on questionnaires elicited by each of the three mailing waves was substantially superior for the white decedents who also had the better response rate to the mail survey.

No simple explanation is proposed to account for the relationship observed in this survey between adequacy of the reported information and the mailing wave that elicited the original reply. It is doubtful that the relationship is unique to this survey even though the information collected here was complex and detailed and therefore produced a relatively low level of adequate reporting. Perhaps, the respondents' ability to answer the questions and their motivation to reply are interrelated factors influencing both the mailing wave to which they reply and the adequacy of the information which they report. From this viewpoint, it seems likely that the observed relationship between adequacy of response and the mailing wave that elicited the reply would apply to all mortality surveys conducted by the National Vital Statistics Division and perhaps to mail surveys generally. The finding implies a reconsideration of the model for allocating resources in mail surveys so that the costs of additional mailings and of conducting follow-up interviews are justified on the basis of gains in the proportion of adequate responses rather than solely on the basis of reducing nonresponse.

REFERENCES

- [1] Hanson, M. H. and Hurwitz, W. N., "The Problem of Non-Response in Sample Surveys," Journal of the American Statistical Association, Vol. 41, (December 1946) 517-529.
- [2] Kitagawa, E. M. and Hauser, P. M., "Methods Used in a Current Study of Social and Economic Differentials in Mortality," The Milbank Memorial Fund Quarterly forthcoming.
- [3] Sirken, M. G., Pifer, J. W. and Brown, M. L., "Design of Surveys Linked to Death Records," U. S. Department of Health, Education, and Welfare, National Center for Health Statistics (September 1962).
- [4] Sirken, M. G., Pifer, J. W. and Brown, M. L., "Survey Procedures for Supplementing Mortality Statistics," American Journal of Public Health, Vol. 50, No. 11 (November 1960) 1753-1764.