ANALYSES OF NONRESPONSE TO THE MEDICAL PROVIDER VISIT ITEMS OF THE NATIONAL MEDICAL CARE EXPENDITURE SURVEY

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Introduction

The National Medical Care Expenditure Survey (NMCES) collected data on use and expenditures for medical care from a national sample of some 14,000 households in six separate rounds of interviews starting in January 1977 and going through early 1978. Questions which were asked of household respondents included ones on hospital stays and medical provider visits for all members of each household. For such stays and visits a schedule of questions was asked for each stay and each such visit. The National Center for Health Statistics conducted a similar study, the National Medical Care Utilization and Expenditures Survey in 1980 and a third similar, but expanded, study, the National Medical Expenditure Survey, is being organized to collect such utilization and expenditure data for the institutionalized as well as non-institutional populations. Data collection will cover calendar year 1987. These studies serve to guide Federal health policy development. They are repeated so as to have current data on policy relevant questions. With similar or identical questions being asked in very large national studies it is useful to undertake empirical studies to learn, for which questions and for what kinds of people are there relatively high (and low) nonresponse rates. Such information may alert us as to how we may design our studies so as to obtain more complete data. A study by Burt and Cohen (1984) examines nonresponse to items asked for each hospitalization for all people hospitalized from the 14,000 NMCES households. This study looks at nonresponse to items asked for each medical provider visit.

The Data

In the 14,000 households of the NMCES sample there were 29,999 people who reported one or more visits to a medical provider during 1977. These people had a total of 190,559 such visits. This is an average of 6.35 visits for those with at least one visit to a medical provider. As our plans for analyses of item nonresponse included computing standard errors, and having in mind the requirement of independent observations in order that the usual interpretations of the standard error would hold, a nonresponse proportion was computed for each of 35 items of the medical provider visit schedule. These proportions were then used in computing standard errors, i.e., the n was the 29,999 people with visits, not the 190,559 visits.

The recorded response or nonresponse was recoded as a (1), (2), or (3). The code (1) was for a legitimate response. A code (2) was used if there had been no response or if the response had been "Don't know". The code (3) was used for a skip, i.e., when responses to other questions indicated that the item or question would not have been asked of the person for the particular visit about which he or she was being questioned. A code (3) would have been used, e.g., for the question on amount of received or expected reimbursement if the person had answered "No" the the question, "Do you expect any source to reimburse you or pay you back?" If we call these type (1), (2) and (3) codes then the proportion of nonresponse computed for a particular item and individual, over the reports of his or her visits for the year or that part of the year in which he or she was in the study, is the number of type (2) responses divided by the sum of the type (1) and type (2) responses. Let us say, e.g., that we are working with records from John. He has six medical provider visits over the year and all questions are asked of John's mother. For each visit she is asked, "For what condition did John go to Dr. Jones' office on (data)?" If for three of the six visits she named one or more conditions but for the other three visits she gave no condition or said that she did not know the condition, then we would have three type (1) responses and three type (2) responses. The nonresponse proportion for John on this item is therefore $3/(3+3) = .5$. If the family paid for four of these visits but the other two visits were follow-ups for which Dr. Jones does not charge, then the question, "Do you expect any source to reimburse you or pay you back?" would, in this example, be asked for only four of the six visits. If a legitimate response were received, i.e., if a response of "yes" or "no" were recorded, we assigned a code (1). If no response or a "don't know" were recorded for this question the we assigned a code (2). In the two cases where the question was not asked a code (3) was assigned. Now let's say the mother reported that they expected their insurance company to reimburse them for two of the visits and that one visit was for cosmetic surgery which she knew would not be reimbursed. The fourth visit for which payment had been made was a routine physical examination. The mother did not know if their insurance company would pay for this kind of visit. We assigned such "don't knows" a code of (2). The two visits where the mother answered "yes" and the one visit where she answered "no" to the reimbursement question were each coded (1) for legitimate response. So the nonresponse proportion for this "expect reimbursement" item is $1/(3+1) = .25$.

In addition to calculating an overall nonresponse proportion based on all visits for the year, such proportions were calculated for each person with visits by (a) round of data collection, (b) whether the individual was responding entirely, partly, or not at all for her or himself, and (c) whether the interview was by phone or in person.

Bivariate Analyses of Nonresponse

Nonresponse proportions for 35 items from the medical provider visit section were tabulated

Table 1. Levels of item nonresponse for date of visit to medical provider (NMCES household data: United States, 1977)

Population characteristic	Missing proportion (Standard error)	Population characteristic	Missing Proportion (Standard error)
Overall	.0739 (.0034)	Education of family head	
		Less than 9 years	.0988 (.0060)
Sex		9 to 11 years	.0779 (.0058)
Male	.0770 (.0037)	12 years	.0618 (.0035)
Female	.0713 (.0035)	13-15 years	.0547 (.0037)
		16 years or more	.0566 (.0042)
Age in years		Unknown	.1763 (.0125)
Less than 6	.0546 (.0054)		
6 to 18	.0661 (.0044)	Race	
19 to 24	.0843 (.0058)	White	.0676 (.0030)
25 to 54	.0696 (.0038)	Nonwhite	.1224 (.0111)
55 to 64	.0808 (.0051)		
65 or older	.1041 (.0053)	Poverty index	
		Poor	.1127 (.0070)
Region		Near poor	.1159 (.0125)
Northeast	.0765 (.0058)	Low income	.0802 (.0054)
Central	.0562 (.0039)	Middle income	.0623 (.0038)
South	.0902 (.0083)	High income	.0650 (.0035)
West	.0704 (.0060)		
		Health insurance coverage	
Place of Residence		Covered all of 1977	.0706 (.0032)
16 largest SMSA	.0731 (.0055)	Other	.0937 (.0067)
SMSA > 500,000	.0811 (.0059)		
SMSA < 500,000	.0653 (.0068)	Medicare coverage	
< 60% rural	.0725 (.0095)	Covered all or part of 1977	.1070 (.0054)
Rural	.0757 (.0130)	No Medicare coverage	.0691 (.0034)
Perceived health		Round of collection	
Excellent	.0557 (.0032)	1	.0999 (.0048)
Good	.0760 (.0043)	2	.0638 (.0034)
Fair	.0956 (.0057)	3	.0611 (.0039)
Poor	.1163 (.0072)	4	.0546 (.0037)
Unknown	.1322 (.0117)	5	.0747 (.0049)
Marital status		Responding for self	
Never married	.0887 (.0056)	Entirely	.0543 (.0035)
Married	.0678 (.0032)	Partly	.0749 (.0078)
Widowed	.1199 (.0087)	Not at all	.0748 (.0053)
Separated	.1188 (.0133)		
Divorced	.0944 (.0094)	Type of interview	
Unknown	.1321 (.0164)	Personal	.0723 (.0035)
		Phone	.0657 (.0035)

against 11 sociodemographic variables along with proportions for three data collection variables: round, whether self response, and type of interview. Due to space limitations cross tabulations are presented here only for the first item, data of visit to the medical provider. These are shown in Table 1. Some results from the full set of 35 tables are given here. The original paper gives the complete set of tables. These statistics are weighted to give national estimates. For a report of the sample design and estimation methods, including the procedures used for developing weights see the report by Cohen and Kalsbeek (1981). Standard errors were estimated with the program SESUDAAN (Shah, 1981) which uses a first-order Taylor approximation. The tabulations are admittedly voluminous. Individual readers should study the detailed results of questions relevant to their own questionnaire design or data analysis concerns. The following is a summary of the overall results. We will address our comments primarily to those questions with overall high missing proportions (greater than .11). Differences between nonresponse percents examined here are all significant at the alpha = .01 level.

To the question on the name of the provider they saw during their medical visit, the average nonresponse rate was 16 percent (Item 2). Nonresponse to this was also associated with lack of response to the location (Item 3), the correlation, as reproduced from the factor analysis of Table 2, being .62. Lack of knowledge of these essential items could significantly hamper efforts to validate or supplement information by surveying the provider.

Two subjective responses were required: Was the wait to get an appointment too long? (Item 15) and Was the wait at the appointment too long? (Item 17). These questions have nonresponse rates of 11 and 2 percent, respectively. A possible explanation for the high rate for waiting to get an appointment is lack of expectations by the client as to an acceptable or unacceptable length of wait. There is also a lack of dramatic differences within various subpopulations. This suggests this particular question may not be a sensitive measure of access to care.

Items 18 to 23 relate to a series of questions concerning payments and reimbursement if the visit was an emergency room (ER) visit. High levels of item nonresponse were present for the following questions:

(1) Was any of the charge a separate charge for the ER? (Item 18)
(If yes) How much was that? (Item 19)
(2) How much of the charge has the family paid? (Item 20)
(3) Do you expect reimbursement? (Item 21)
(If yes) By whom? (Item 22)
(4) How much reimbursement? (Item 23)

Within the questionnaire, Items 19 to 23 are only asked if Item 18 is answered "yes". In turn, Items 22 and 23 are dependent on a "yes" to Item 21. The level of nonresponse for the continuous data items (dollars paid, and/or to be paid) are extremely high at 20.7 and 30.8 percent, respectively. This could lead to high bias of estimates for out of pocket expenditures. The impact of this high nonresponse rate is compounded by this information being less accessible to validation from another source. In contrast is the relatively low nonresponse rate for Item 23. There are multiple branches to get to this question; therefore those that get to this question may know the amount, or may know if all or none is to be reimbursed. Items 24 to 29 represent the same set of questions for lab work. Once again there is a similar pattern of nonresponse.

Items 30 to 35 are about all other charges. Item 30 is calculated from Items 11, 18, and 24, resulting in an extremely high nonresponse rate of 21 percent. This is in contrast to only 1.8 percent missing for "Total charge for visit" (Item 11). This high rate may reflect lack of knowledge about the details of the charges as "don't know" is a legitimate answer to Items 18 and 24. The proportion of the missing responses for total paid by the family (Item 31) is considerably lower than that for the component charges of Items 19 and 25--12.7 versus 20.7 and 19.0 percent respectively. Similarly, the 15.4 percent nonresponse for Item 32 is one half that for the parallel question regarding ER visits (Item 20).

The high levels of nonresponse for questions related to family expenditures (Items 19, 20, 25, 26, 31, 32) indicate the potential for huge biases in estimates of out of pocket expenditures for medical visits by the U.S. population. Variability in nonresponse in the subpopulations are greatest for components of the total charge (ER and lab). Major decreases in nonresponse are noted by round of collection. Comparing average nonresponse rates in rounds 1 and 2 with the rates in 4 and 5 for the 35 items we find a decrease for 29 items. The sign test shows this to be highly significant. This suggests that information collected in later rounds might be used to improve the imputation of missing data in earlier rounds. An individual's payment and reimbursement pattern will probably remain stable if their insurance coverage does not change. Future studies to compare the accuracy of data by round may reinforce or negate the potential of imputing from later rounds to earlier rounds within respondent. This finding of a general decrease in nonresponse over the five rounds of data collection may be the most important result from these analyses. Future research efforts should undertake to determine which aspect(s) of the NMCES study design most likely account for this improved response rate.

Relating Item Nonresponse Factors to Person Factors

An effort was made, which to date appears unsuccessful, to undertake analyses which would simplify and clarify the vast amount of data for the 35 items. We did derive one small table which to a degree represented much of the total data, i.e., the relationships between nonresponse and types of respondents, but we found very little. Perhaps indeed we did find "the truth",

i.e., that there are no important relationships.

A factor analysis of the 35 items scored proportion of nonresponse as described above was undertaken. When an item was a legitimate skip for all visits the person had, then this item was given a missing data code. Had all people with missing data for one or more items been eliminated fewer that 400 of the original 29,999 would have been retained, obviously unacceptable. So for the factor analysis of items, the item proportion mean was substituted for the missing data code each time the proportion was missing for an item. This would tend to reduce but not, as far as we can see, to seriously distort correlations between items on which the factor analysis is based. Thirteen principal axes factors were extracted accounting for 68 percent of the total variance. Table 2 gives the varimax rotated solution. Loadings greater than .67 are given with a larger type. The factors make good sense. We might describe them as follows:

1. Appointment
2. Total payment for emergency room (ER) and laboratory work
3. Were there any X-rays or tests?
4. Payments for use of the ER
5. Name and location of place seen if not a doctor's office
6. Family payment for lab work
7. How much reimbursement expected for lab work
8. Reimbursement for ER
9. Name and location of the provider
10. Were there separate charges for ER and lab work?
11. Date of visit
12. Condition for which seen
13. Expect reimbursement for lab

Next a factor analysis of the socio-demographic variables was undertaken. The region, marital status and population density variables, each nominal, were converted into one less than the number of categories of 0-1 variables. The conversion of two variables was perhaps a bit nonstandard and should be noted. These items were perceived health and years of education of head of household. Each was coded as unknown about 4 percent of the time and each was converted to two variables. If health (or education) was unknown then the first variable was coded 1 and the second 0. If health was known then the first variable was coded 0 and the second retained the original, 1-4, excellent to poor health code. The method has been recommended for use in multiple regression by Bottenberg and Ward (1963 and personal communication) and is thought to be reasonable in factor analysis. What we have done here has at least three consequences, namely, 1) some 2,000 cases with distinct characteristics, i.e. considerably different, we can be sure, from a random sample have been retained which otherwise would have been lost or would have been used in a way which would be expected to yield a correlation matrix which was not positive definite, 2) the two variables so treated as described here in each being made two variables have, in a sense, each been given a double weight and had this been a concern we would have multiplied each of the rows and columns of the correlation matrix for the two constructed health variables and the two constructed education variables by the reciprocal of $\sqrt{2}$ and factored the resulting covariance matrix and, 3) the correlation matrix obtained with these constructed variables is not singular.

Five factors were extracted, accounting for 42 percent of the variance. (The varimax rotated solution is not given due to space limitations.) These factors make reasonably good sense. They might be described as follows.

1. Older, married, nonpoor
2. Widowed, poorer, Medicare
3. Don't know responses on education of head of household and perceived health
4. Northeast (not South) and large city (not rural)
5. Nonwhite, cities of South (not West), separated or not married

To determine the relations between item nonresponse factors and person type factors, scores were computed for each of the 29,999 individuals with at least one medical provider visit on each of the 13 item factors and the five person type factors and a 13 by 5 matrix of item by person factors correlations was computed. One can see in looking at these correlations in Table 3 a slight trend for nonresponse to be more associated with socio-demographic factors 2 and 5, the two more disadvantaged factors as compared with factors 1 and 4 the more socially advantaged factors. The largest correlation .14, accounting for two percent of the variance, is between the don't-know-date-of-visit factor and the nonwhite, city, unmarried person factor. With an n of almost 30,000, all correlations greater than .01 are statistically significant. We must conclude, however, for all practical purposes the relationships are zero, and that our hopes of being able to see relationships as we reduced the complexity of the mass of statistics of the 35 tables of the original report to the simplicity of Table 3 were not realized. It seems to be the case that the relationship between socio-demographic variables and nonresponse to items of the medical provider visit schedule are too weak to be of practical importance. However, as noted earlier, the tendency for there to be less nonresponse in later rounds does appear to us to be of practical significance, suggesting greater efforts be made on the first round to train respondents to be better respondents.

Let us note in ending an additional type of factor analysis which we should perhaps undertake before finally concluding there are no important relationships to be discovered between the socio-demographic variables and types of items with regard to nonresponse. We factored each set of variables independently and then related the two sets of factors. We might have sought those two weighted sums, one from each set of variables, which correlate maximally. This is Hotelling's canonical analysis for which SAS programming is available.

Table 2. A varimax rotated factor analysis of items from the medical provider visit schedule (NMCES household data: United States, 1977)

Item	Factor 1	2	3	4	5	6	7	8	9	10	11	12	13
1. Date of visit	.07	−.09	−.02	.02	.02	.01	.02	−.02	.07	−.08	**.79**	.03	.04
2. Person seen	−.04	.06	.01	−.02	.08	−.02	−.01	−.01	**.78**	.04	.13	−.02	.01
3. City & state person seen	.05	.04	.04	.01	.06	.02	.00	.01	**.80**	−.02	−.04	−.00	−.01
4. Type of place—clinic, OPD, etc.	.09	.02	.06	.01	.41	−.01	−.00	.01	.25	−.02	.00	.09	−.06
5. Name of place if nonstandard	.03	.03	.08	.01	**.94**	.02	−.00	−.00	−.01	.02	.04	−.03	.03
6. Where is this place?	.03	.03	.07	.01	**.95**	.02	−.00	−.00	.01	.02	.03	−.03	.03
7. Conditions for which seen	.01	.01	−.00	.00	−.00	−.00	−.01	.04	.00	.03	−.04	**.68**	.29
8. Any X rays?	.16	.04	**.91**	.00	.08	.00	.00	.01	.03	−.00	.05	.00	.00
9. Any lab work?	.16	.03	**.93**	.00	.07	.00	−.00	.00	.02	.00	.06	−.00	−.00
10. Any EKG, Pap smears?	.15	.03	**.92**	.00	.07	.00	.00	−.00	.03	−.00	.05	.00	.00
11. Total charge for visit	.04	.22	.16	−.01	.04	.01	−.02	−.00	−.01	.08	.51	−.02	−.02
12. Appointment or walk-in	**.86**	.07	.18	.01	.07	.00	−.00	−.00	.05	.01	−.01	.00	.00
13. Appointment provider initiated?	**.82**	.05	.11	.00	.05	.00	−.00	.00	.03	.02	−.03	.01	−.01
14. How long a wait for appointment?	**.84**	.04	.08	.00	.03	.01	−.00	.00	.00	.00	.03	−.00	.00
15. Was wait too long?	.65	−.02	.00	−.01	−.00	.00	−.01	.00	−.11	−.02	−.03	.01	−.03
16. How long a wait in office?	.62	.03	.13	.01	.02	−.01	.03	−.01	.11	−.00	.25	−.05	.05
17. Was this wait too long?	−.03	.01	.00	.00	.03	.01	.02	−.04	−.01	−.02	.05	**.73**	−.27
18. Separate charge for ER?	.01	−.01	.00	.21	−.01	−.10	.03	−.04	.01	**.73**	−.06	−.01	−.02
19. How much has family paid (ER)?	.00	−.03	.01	**.87**	.02	.06	−.02	−.04	.00	.10	.01	.01	−.00
20. How much more will pay (ER)?	.00	.01	.00	**.92**	.00	.08	.02	.05	−.00	.02	−.00	−.00	.02
21. Expect reimbursement (ER)?	.00	.00	−.00	**.92**	.00	.06	−.01	−.08	.00	.03	.01	−.00	−.01
22. Who will reimburse (ER)?	.00	−.01	−.01	−.02	.00	−.00	.02	**.82**	−.01	−.01	.00	.01	−.05
23. How much reimbursement (ER)?	−.00	.00	.01	−.05	−.00	.01	.12	**.78**	.01	−.01	−.03	−.01	.07
24. Separate charge for lab?	−.00	−.01	−.00	−.05	.02	.21	−.03	.01	−.00	**.75**	.08	.01	.01
25. How much has family paid (lab)?	.01	−.04	.00	.09	.01	**.94**	−.04	−.02	.00	.06	.01	.01	−.01
26. How much more will pay (lab)?	.00	.01	.00	.11	.01	**.94**	.01	.02	.00	.04	.01	−.00	−.01
27. Expect reimbursement (lab)?	−.00	−.00	−.00	.00	.00	−.01	.01	.02	−.01	−.02	.04	.00	**.86**
28. Who will reimburse (lab)?	.00	−.01	−.02	.01	.02	−.02	.49	.23	−.03	−.04	.11	−.01	−.25
29. How much reimbursement (lab)?	−.00	.01	−.01	.01	−.00	−.09	**.68**	.15	−.04	−.04	.07	−.05	−.03
30. Total charge minus ER, lab	.02	.47	.01	−.02	.03	−.03	−.08	.03	.10	.33	.40	−.01	−.01
31. How much has family paid (total)?	.05	**.90**	.03	−.02	.02	−.02	−.01	−.01	.02	−.02	.03	.01	−.01
32. How much more will pay (total)?	.04	**.93**	.03	.01	.03	.02	.04	.00	.03	−.03	.02	.00	.01
33. Expect reimbursement (total)?	.05	**.90**	.03	.01	.03	−.02	−.02	−.01	.03	−.03	.03	.02	−.00
34. Who will reimburse (total)?	.00	−.01	.01	−.02	−.01	.03	.59	−.07	.04	.05	−.08	.06	.02
35. How much reimbursement (total)?	.00	−.02	.01	−.00	−.01	.05	**.75**	−.04	−.00	−.00	−.06	−.01	.15
	1	2	3	4	5	6	7	8	9	10	11	12	13

Table 3. Correlations between sets of factor scores from medical provider visit items and socio-demographic questionnaire items (NMCES household data: United States, 1977)

Medical provider visit, don't know factors	Socio-demographic factor				
	1. Older, married	2. Widowed, poorer, Medicare	3. Don't know education, health	4. Northeast, large city	5. Nonwhite, city, South, unmarried
1. About the appointment	-.01	-.02	.01	-.02	.00
2. Total payment for ER, lab	.04	.01	-.01	.01	.02
3. Any X-rays or tests?	.00	.01	.00	.00	.02
4. Payments for ER	.01	.00	.01	.00	.00
5. Place seen if not office	-.02	.00	.01	-.01	02
6. Payments for lab	-.00	.02	-.01	.01	.01
7. Reimbursement for lab	.06	.06	-.02	.02	-.07
8. Reimbursement for ER	.00	-.01	.00	.00	.00
9. Provider seen	-.10	-.01	.05	.05	.08
10. Separate charge for ER, lab?	-.04	.03	-.00	.01	.05
11. Date of visit	-.01	.12	.08	.00	.14
12. Condition	.00	.01	.03	-.03	.00
13. Expect reimbursement for lab	.02	.02	.00	.02	.00

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Acknowledgements

The amazing skill, speed and accuracy with which William W. Ashby prepared the tables herein from computer output as well as his typing of the text is much appreciated. Thanks also to Vernetta Smith who helped us greatly with some last minute changes.