NONRESPONSE IN A SURVEY OF NURSING HOME RESIDENTS

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INTRODUCTION

Past research has demonstrated that survey nonresponse is an important problem for statisticians and survey researchers (Cornfield, 1942). Nonresponse can seriously bias survey estimates and distort inferences, and the topic is well covered in sampling texts (Cochran, 1963; Kish, 1965).

Typically, statisticians use response rates as proxy measures of nonresponse bias because they lack the necessary data to calculate the nonresponse mean and thus determine the relative bias associated with survey nonresponse[1]. Data from the 1987 National Medical Expenditure Survey (NMES) provides a unique opportunity to calculate the relative bias, as data for responders and nonresponders are available.

The NMES Institutional Population Component (IPC) was established to provide an assessment of the health care utilization, costs, sources of payment, and health status of the U.S. institutionalized population in nursing and personal care homes, and in facilities for the mentally retarded. This paper will focus on nonresponse as a possible source of bias in the NMES IPC sample using data on nursing home residents. The NMES design provides a unique opportunity to compare data for responders to that of nonresponders. Given knowledge of the characteristics of the nonresponders, key determinants of the probability of response will be measured and the direction of the bias resulting from nonresponse examined.

MATERIALS AND METHODS

The NMES IPC is a year long panel survey that was designed to provide data for a major research effort at the National Center for Health Services Research and Health Care Technology Assessment (NCHSR). Data were collected by Westat, Inc., and NORC. Data used for these analysis are for the first round of data collection only.

The targeted universe for the NMES IPC was all persons who spent one or more nights in a nursing or personal care home during 1987. The survey was designed as a stratified, three stage-probability design with individual facilities selected in the first two stages, and current residents (residents on January 1, 1987) and admissions (persons admitted between January 1, and December 31, 1987) sampled, within sampled and cooperating facilities, at the third stage. The sample was designed to yield unbiased national and regional estimates at the facility level and for the overall institutional user population, according to type of institution (nursing and personal care homes, or facilities for mentally retarded persons) (Cohen, Potter and Flyer, 1989).

In the first round of data collection, interviewers selected the sample of current residents from each responding in-scope facility and administered a Baseline Questionnaire (BQ). BQ's were attempted for each sampled person (SP) and collected information on health status, resident history, demographics and identified persons familiar with the SP's life prior to their institutionalization. Facility respondents were encouraged to use the SP's medical record as the source of all information.

Once a BQ was completed and returned to the home office, a Personal History Questionnaire (PHQ) was attempted for each sampled person. Respondents for the PHQ were persons identified as knowing about the person's life prior to institutionalization. These person are collectively referred to as the community residing next-of-kin (NOK). Potential NOK were defined as community residing relatives (82.8 percent of the NOK identified were relatives), friends or neighbors (3.3%), guardians (1.8%), lawyer or accountant (0.8%), or case managers (1.0%). Person's residing in, or working in the nursing home were explicitly excluded from serving as community residing next-of-kin (6.2% of the NOK identified were nursing home staff).

The Personal History Questionnaire collected information on the sampled person's demographics, income, insurance, living arrangements, residence history and health status prior to admission to the nursing home. It was conducted as a Computer Assisted Telephone Interview (CATI) and was conducted with the respondent identified as the "best" respondent to contact for the SP's past health and living experiences. For additional details on the data collection methods, the reader is referred elsewhere (Edwards and Edwards, 1989).

Ideally all SP's with a completed BQ, were to have had a PHQ completed. However, for a variety of reasons PHQ's were only completed for 76 percent of SP's with completed BQ's. Since BQ data are available for all PHQ nonrespondents, it is possible to profile nonresponse associated with SP's missing a completed PHQ interview. That is the purpose of these analyses. Thus, SP's with both a BQ and PHQ interview are referred to as the PHQ "responders" and SP's with only a BQ are referred to as the PHQ "nonresponders".

Both univariate analyses and multivariable logistic regression analyses were used to assess the difference between responders and nonresponders. The logistic regression model, in the form of:

$$\log \frac{p}{1-p} = \beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k$$

(Cox, 1970), was used to assess the simultaneous effects of potential confounding and effect modification by qualitative and categorically defined quantitative variables, and to obtain marginal probability estimates associated with being a responder. This analysis proceeds in three stages.

First, univariate analyses were used to screen variables prior to inclusion in the model. Z-tests were used to assess statistically significant differences between population

proportions. Standard errors were calculated using software appropriate for analysis of complex survey data (Shah, 1981).

Second, an ordinary backwards stepwise logistic regression procedure was used to further screen variables for inclusion in the model. This was run as a SAS utility procedure using the BMDP LR program (Engelman, 1985). T-statistics for tests of significance were used to determine which parameters were to be deleted from the model and which parameter cells were to be collapsed to improve fit. Goodness-of-fit was assessed using the Hosmer and the Brown chi-square statistics (Hosmer and Lemeshow, 1980; Prentice, 1976).

Finally, the final model was run weighted using complex survey design software for the logistic regression procedure (Shah et al., 1984).

RESULTS

Baseline Questionnaires were completed for 3,347 sampled persons; 98 percent of the SP's within responding and eligible nursing homes (Table 1) for an overall survey response rate of 93.3 percent. Personal History Questionnaires were completed for 2,545 SP's or 75 percent of the SP's within responding and eligible nursing homes for an overall survey response rate of 71.1 percent.

Among nonrespondents, refusals to do the PHQ interview only accounted for 15 percent of the cases (Table 2). However an additional 16 percent of the nonrespondents were cases where the facility refused to provide the SP's name. For these SP's no NOK information was obtainable, therefore no PHQ was completed. For 11 percent of the nonresponders no community residing relatives were identified. By far, the largest single category of nonresponse was for cases where NOK were identified, but when contacted turned out to be staff members of the nursing home (39%), a group not eligible to serve as PHQ respondents. The remaining 19 percent were distributed among the not locateables, not at home after 12 calls, language problems, and other nonresponse.

It was hypothesized that the characteristics of SP's without NOK might differ from the other nonresponders (primarily refusals). For this reason the nonresponders were divided into two groups for subsequent analyses. The first group is comprised of field nonresponders, i.e., both types of refusals, the not locatable, maximum number of calls and other nonresponse. These are collectively referred to as "refusal nonresponders". The second group, referred to as "NOK nonresponders", is comprised of those nonresponders with no NOK and those for whom the respondents identified were not NOK. Of the 802 nonrespondents, exactly half were in each of the nonresponder groups.

Comparison of Resident Characteristics

When comparing the NOK nonresponders with the PHQ responders it was determined that the two groups differed significantly in demographic profiles ($p \leq 0.05$) (Table 3). Significant differences ranged from a high of 31 percent for living siblings, to a low of 4.5 percent for those aged under 65. NOK nonrespondents were more likely to be age 74 or younger than their PHQ responding counterparts who had the higher representation of age 85 and older. NOK nonrespondents were more likely to be men (37 to 26 percent), black (16 and 6 percent), never married (28 to 16 percent), have no living children (53 to 33) or no living siblings (43 to 36). It is intuitively appealing that the never married, those without siblings or children would be more likely to be NOK nonresponders.

When comparing the refusal nonresponders to the responders a similar pattern was observed for the refusal nonresponders. The nonresponders tended to be age 65 or younger, black, and never married. In contrast, the responders were more likely to be age 85 or older, have siblings or children, and to be no longer married.

Characteristics of the SP's nursing home residence history were also examined (Table 3). When comparing the refusal nonresponders to the responders, length of nursing home residency and location of the SP prior to admission were found to be significantly associated with response status. Refusal nonrespondents were more likely to be associated with a nursing home stay of between 181 days and 365 days in comparison to their responding counterparts who were more likely to be associated with a stay of between 1 and 2 years. None of the other stay categories were significantly associated with response classification. Refusal nonrespondents were more likely to be associated with SP's with a prior place of residence in an acute care hospital; however, the difference between refusal nonresponders and responders was small, only 4 percent. No differentials were observed for the NOK nonresponders and nursing home residence.

Characteristics of the SP's nursing home were also analyzed (Table 3). Both nonresponder groups appeared to differ from their respondent counterparts with respect to the geographic location of the nursing home. Location in a SMSA and in core counties with one million or more in population were found to be significantly associated with the SP's response classification. However, these variables are highly correlated[2]. Responders were also more likely to have a institutionalized relative in a nursing home located in the Central Census region. Conversely, refusal nonresponders were more likely to have a relative reside in a nursing home located in the Northeast. Both bed size and certification of the SP's nursing home by Medicare or Medicaid for reimbursement also distinguished the respondents and nonrespondents.

Age is known to be significantly associated with health status. For this reason the health status variables were stratified by age to determine which of the health indicators to included in the saturated logistic regression model. Because of small cell size the youngest age groups -- less than 65 and 65-74 -- were collapsed into a single category. The stratified results are shown in Table 4. Those marked with a "+" have a relative standard error greater than or equal to 30 percent; significance tests were not preformed on these estimates. Not shown on the table are the complement groups, which includes those with unknown conditions. The mean number of unknowns for these groups is less than

1 percent of the total.

Among the <75, a lack of Activities of Daily Living (ADL)[3] deficits was found to be significantly associated with SP's response classification. The ratio of proportionate representation for NOK nonresponders to responders was almost 2.5:1 and the ratio of proportionate representation for refusal nonresponders to responders was more than 3:1. No pattern could be observed among the other age groups for persons with no ADL deficits as the estimates were considered unreliable. No significant differences were observed, among any of the age groups, for those with 2-3 ADL deficits. However, when analyses are limited to the refusal nonresponder and responder groups aged <75 and 75-84, the responders were more likely to have 3 or more ADL deficits in comparison to their nonresponding counterparts. A similar pattern of response was observed among the old except it was not significant. Finally, no differential was observed between NOK nonresponders and responders with 3 or more ADL deficits among any of the age categories.

Heart disease was the only health condition to have significant results among both of the responding groups though the findings were limited to the youngest age group. Among those 74 years old or younger, responders were more likely to have heart disease as a condition listed in their medical records than the nonresponders, by a ratio of almost 2:1. Heart disease was also found to be significantly associated with response when compared to the NOK nonresponders who are 85 and older.

A significant association was found among those 85 years old and older indicating that responders were more likely to have stroke listed in their medical records than nonresponders. A similar pattern was not observed among the other age groups. Among the refusal nonresponder group, no association with response classification was observed.

Also found to be significantly associated with response classification were the mental conditions of depressive disorders and schizophrenia. The significant association was for the NOK nonresponders only. Among those 74 and younger, NOK nonrespondents were less likely to have their institutionalized relative diagnosed with depressive disorders than were the respondents. Conversely, among those 75-84, nonrespondents were more likely to have their relative diagnosed as having schizophrenia than the respondents. The proportionate representation of schizophrenic nonrespondents to respondents was observed at 3:1.

No observed patterns could be observed for the remaining health conditions and none of these were found to be significant associated with response classification.

Models to Predict Response

A summary of the operational definitions of the dependent and independent variables included in the saturated backward stepwise logistic regression models is provided in Table 5. The saturated model was run two times: (1) comparing the refusal nonresponders to the responders and (2) comparing the NOK nonresponders to the responders. All analysis variables determined to be significant for the univariate analysis were included in the saturated models. This excluded from further consideration the variables on nursing home discharge prior to initial survey contact, whether the SP had a catheter or not, and a majority of the health conditions.

The original saturated models included three categories for race, but T-tests of difference between coefficients found no significant differences between black and other races. Thus, this variable was recoded and the models rerun. None of the other variables were similarly recoded as the T-statistics found significant differences between categories.

The final logistic regression models for estimating the probability of being a community residing responder are shown in Tables 6 and 7. Limiting analysis to the refusal group and the respondents shows that among the demographic variables, only race, marital status and living siblings were significant when included in the model. SP's for whom race was black or other races were significantly more likely to have community residing NOK that refused to do a PHQ interview. This decreased the marginal probability[4] of response by almost 8 percent. SP's with no living siblings or who were never married also had community residing NOK respondents who were significantly more likely to refuse. Marginal probabilities for these two important variables were 8 percent and 10 percent, respectively.

None of the residence history variables were significant, but the following facility level variables, bed size, SMSA, Census region and certification by Medicare or Medicaid were found to be significant predictors of PHQ response. Location of the SP's nursing home in a SMSA was found to be a significant predictor of nonresponse when responders were compared to the refusal group. This decreased the probability of response by 9 percent. Conversely, location in the Central Census region was a predictor of response, as was certification by Medicare or Medicaid, and bed size of between 150 and 249 beds. The latter increasing the probability of response by 12 percent.

Also found to be a significant predictor of nonresponse was a lack of any ADL deficits, i.e., SP's without functionally disabilities are significantly more likely for their NOK to refuse to participate in the study. In fact, SP's with no ADL deficits decreased the probability of response by 12 percent over that of SP's with three or more ADL deficits.

When analysis are limited to the no NOK group and the the respondents, the model that was built is somewhat different from the refusal model. Like the refusal model, nonwhite race and no living siblings were found to be significant predictors of nonresponse. However, the marginal probability for no siblings in the no NOK model is almost twice that of the refusal model (14 vrs 8 percent). Unlike the refusal model, the NOK model found that gender and no living children were also predictors of nonresponse. The latter increasing the probability of nonresponse by 15 percent over that of those with children. Found to increase response in the NOK model was

facility certification, location in the Central Census region and location in a small metropolitan or nonmetropolitan counties.

Also included in the no NOK model because of their improvement to model fit were age, marital status, and the health conditions of schizophrenia, depressive disorders, and heart disease. These were not significant at the a=.05 level.

DISCUSSION

Past research has demonstrated that survey nonresponse is an important problem for statisticians (Cornfield, 1942). Nonresponse can seriously bias survey estimates and distort inferences, and the topic is well covered in sampling texts (Cochran, 1963; Kish, 1965).

Typically, statisticians use nonresponse rates as a proxy measure of nonresponse bias because they lack the necessary data to calculate the nonresponse mean and thus determine the relative bias associated with survey nonresponse. Data from the 1987 National Medical Expenditure Survey provided a unique opportunity to calculate the relative bias, as data for nonrespondents and respondents were available.

The NMES Institutional Population Component was designed to yield unbiased national and regional estimates for the institutional user population in nursing and personal care homes, and facilities for the mentally retarded. The focus of this paper was on nonresponse as a possible source of bias in the NMES nursing home sample. Baseline Questionnaire data on institutionalized sampled persons were used to characterize response to the Personal History Questionnaire. The PHQ was administered to the institutionalized SP's community residing next-of-kin. The analysis consisted of modeling the probability of being a NOK respondent. Two models were developed, one each for: refusal nonresponders including the not locateables and those with maximum number of calls; and those with no community residing NOK to report on the institutionalized sampled person.

There are limitations to the data. These analyses were conditioned on the completion of a Baseline Questionnaire for the sampled person. There were prior levels of nonresponse -- at the facility level and the SP level -- for which no BQ data exists. The profile of individuals without BQ data may differ from that of the BQ respondents and thus bias these analysis. However, the BQ interview was completed for 98 percent of the SP's within responding and eligible facilities for an overall response rate of 93 percent. Thus, no serious bias is expected in these data.

When analyses are limited to the refusal group and the responders, the results for three of the parameters suggest replication of earlier findings found for household surveys. Benus and Ackerman (1971) and Steech (1981) reported that urban areas have a higher proportion of nonresponse than do nonurban areas. While SMSA is not a direct measure of urban/rural status it can be thought of as a proxy measure. Location in the Central Census region significantly improved response when compared to the Northeast, an area with a higher concentration of urban centers. Finally, nonwhite race was also found to be a significant predictor of nonresponse, a finding that mirrors Census Bureau work on survey coverage for the minority races (Shapiro and Kostanich, 1988).

Sampled persons with no living siblings were more likely to have NOK that refused to participate in the PHQ interview. This may be a function of a distant relative not wanting to or not being able to participate but those that are close relatives, such as a sibling, are willing to, or are able to participate. To examine this hypothesis the relationship of marital status to response was examined. Both the married and the no longer married -- a group likely to have children -- responded similarly and were more likely to respond in comparison to the never marrieds, a group found to be a significant predictor of nonresponse. The findings provide some evidence that SP's with living close relatives are more likely to have a community residing NOK that agrees to participate in the survey than SP's with no close living relatives.

Of particular interest was the finding for ADL's -- sampled persons with no ADL deficits are significantly more likely to have NOK that refuse to participate in the survey. It may be that community residing NOK are guilty about institutionalizing relatives that have no limitations to their Activities of Daily Living and therefore refuse to participate. An alternative hypothesis, is that the SP's while not functionally impaired are cognitively impaired. Their NOK may refuse to participate because the cognitive impairment is a stimatizing condition.

Also found to be a significant predictor of response were certification of the facility. Certification can be thought of as a proxy measure for the quality of care in the institution -- certified facilities providing a higher level of care than noncertified facilities. This suggest that the community residing NOK may be more likely to participate if the respondent believes the institutionalized SP is receiving the best possible care.

The data on bed size indicates that SP's in medium size facilities (150-249 beds) were significantly more likely to have NOK that agreed to participate. Again this may be a quality of care issue on the part of the NOK nonrespondent.

In summary, the picture of the refusal nonrespondents is not a picture of the traditional nursing home resident or that of a typical nursing home. Refusal nonrespondents were likely to lack ADL deficits and therefore not require nursing services, to be black, to have never been married, and to be residents of noncertified facilities in large metropolitan areas.

When analyses are limited to the no NOK group and the responders, SP's with no living siblings or no living children were significantly more likely to have no next-of-kin to respond. This was to be expected and the importance of these parameter in the model (marginal probability 14 and 15 percent, respectively) was not understated.

The findings for sex and race -- that men and nonwhites are significantly more likely to have no NOK to respond is of interest. There is no long-term care literature to suggest why these

groups are different from white females with respect to community residing NOK.

The NOK model found that facility certification was a predictor of availability of a responding community residing NOK for the institutionalized SP. An understanding of this parameter is not clear at this time. Perhaps certified facilities keep better records on residents and thus the NOK were more easily identifiable.

The finding for Central Census region, nonmetropolitan and small metropolitan areas indicates that small towns and rural areas are more likely to have NOK respondents. Possibly indicative of farm based multigenerational families, or close knit communities, groups likely to have or know about NOK.

In conclusion, two of the variables identified as significant predictors of response -- certification status and bed size -- were identified a piori and used as preliminary weighting class variables in the nonresponse adjustments. Of the remaining variables, those that are identified in subsequent analysis as predictor variables of health care utilization or expenditures are the most important. These will be used to define class variables for hot deck imputations of missing data and subsequent non-response weighting class adjustments.

Perhaps this research is of most importance to long-term care researchers. Surveys of persons institutionalized in nursing homes are increasingly undertaken given the rising costs of institutional care and the aging population. Given the resources necessary for a longitudinal survey, the sole source of information on nursing home residents prior to their institutionalization becomes their community residing next-of-kin. The NOK are also the only source of important policy relevant information such as income prior to institutionalization. These analyses indicate that the nonresponse associated with not having a community residing NOK is quite different from traditional nonresponse. It would be inappropriate to control for PHQ nonresponse through imputation procedures or a weighting class adjustment without consideration for the reason of nonresponse. These analyses may also offer some insight into the profile of nursing home residents without community residing next-of-kin.

NOTES

[1]The relationship between nonresponse and the sample mean can be defined as:

$$\bar{Y} = W_1\bar{Y}_1 + W_2\bar{Y}_2$$

where W_1 and W_2 are the proportion of respondents and nonrespondents (including both refusal and no NOK nonrespondents). Such that, the relative bias is:

$$RB(\bar{Y}_1) = W_2 \frac{(\bar{Y}_1) - (\bar{Y}_2)}{\bar{Y}}$$

[2]The core county designation is based on the Human Resource Profile County Code, established by the Office of Management and Budget. Core counties are counties that are the core of an SMSA with at least 1,000,000 or more in population, i.e., central cities. Fringe counties are counties that are contiguous to core counties in metro areas; these counties also contain 1,000,000 or more in population. Medium metro counties have 250,000 to 999,999 in population. Lesser metro counties are metropolitan areas with between 50,00 and 249,999, in population. Nonmetro counties have less than 50,000 in population.

[3]Activities of Daily Living (ADL's) were defined to include help with at least one of the following activities: bathing, dressing, toileting, transferring, feeding or walking.

[4]Marginal probabilities were computed as:

where:

$P_1 = B_1 \times [P \times (1 - P)]$

P_1 = the marginal probability of the independent variable x_1

B_1 = The logistic coefficient of the independent variable x_1

P = the mean of the 0/1 dependent variable

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