CONSTRUCTING YEAR-LONG PROFILES OF RESIDENCE HISTORIES FOR A NATIONAL SAMPLE OF NURSING HOME USERS

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Introduction

Obtaining detailed and accurate data on the use and financing of nursing home care is vital for analyzing issues concerning the provision of long-term care services to the elderly. Knowledge about an individual's pattern of nursing home use over a certain period of time is essential for examining such issues as annual expenditures for nursing home care -- including out-of-pocket costs -- and changes in the source of payment while in the nursing home (e.g. from private sources to Medicaid). For persons who frequently move in and out of nursing homes, a longitudinal study can permit further analyses on issues pertaining to short-term hospitalizations, use and expenditures for health care while in the community, and transfers to other facilities.

These questions cannot be answered using data from cross-sectional samples of residents or samples of discharges; the cross-sectional sample of residents tends to have a higher representation of those with long stays while, samples of discharges have a higher representation of those with short stays (Liu and Palesch, 1981; Keeler et al, 1981). A combination of resident and discharge samples from the 1977 and 1985 National Nursing Home Surveys have been used to create representative samples of nursing home users for a one year period (Rice, 1989; Liu and Palesch, 1981). However, the total costs of nursing home utilization for the survey year could be obtained only indirectly (Rice, 1989) and no information could be obtained on time spent outside of the nursing home. Clearly, the ability to follow and track nursing home users over a one year period would enhance efforts to document patterns of nursing home use and expenditures. One attempt to do this was with the Institutional Population Component (IPC) of the 1987 National Medical Expenditure Survey (NMES). The methodology employed in the IPC (discussed in the following sections) allowed for the construction of year-long profiles of residents who spent some time in a nursing home during 1987. This includes time spent in the nursing home from which the individual was sampled as well as other facilities they transferred to during the year. Information on hospital stays that occurred before, during or after a nursing home stay was also collected as well as time spent in the community.

The purpose of this paper is to describe how these chronological profiles were constructed. The first part of the paper describes the NMES IPC sample design. This is followed by details on the methodology used to construct residence history profiles with multiple, and sometimes conflicting, data sources. The last part of the paper summarizes the methods used to impute missing residence history data.

Sample Design

The adopted NMES institutional population survey is a stratified, three stage probability design with facility selection in the first two stages. Current residents (residents on January 1, 1987) and admissions (persons admitted between January 1 and December 31, 1987) were sampled within participating facilities at the third stage. Three explicit sampling strata were used to select the facility sample: nursing and personal care homes; facilities certified under Medicaid as Intermediate Care Facilities for the Mentally Retarded (ICF-MR) with 3-15 beds; and other facilities for the mentally retarded (Cohen, Potter, and Flyer, 1989). The IPC facility sample consisted of 851 eligible nursing and personal care homes and 730 eligible facilities for the mentally retarded. Facilities were considered to be respondents to the survey when they completed a Facility Questionnaire. Consequently, the IPC facility level response rate was 95.2 percent for nursing and personal care homes and 94.7 percent for facilities for the mentally retarded. The analysis in this paper, however, is limited to the sample of nursing and personal care homes and sampled persons in those homes. Consequently, no future reference will be made to the facilities for the mentally retarded or the sampled persons in those facilities.

The operational implications of a selection of both current residents and admissions over the course of 1987 required several trips to each facility. More specifically, interviewers made four distinct visits to each cooperating facility at approximately four month intervals to facilitate sample selection and data collection in the institutions. This data collection effort was referred to as the Survey in Institutions (SII). During each visit, interviewers obtained or constructed lists of residents from each cooperating facility and proceeded to select the sample (Edwards and Edwards, 1989). The current resident sample was selected from a list of all residents in sampled facilities as of January 1, 1987. Similarly, the admissions samples were selected on three separate occasions in cooperating facilities from separate lists of all admissions that occurred during the following time periods in 1987: January 1 to April 30, May 1 to August 31, September 1 to December 31. Sampled persons were followed throughout 1987. For those who left the facilities in which they were selected, data were collected up to the time of discharge. If a sample person entered another IPC-eligible facility, the institutional data collection procedures were continued in the new facility.

Of the 810 responding nursing and personal care facilities, 99.4 percent (805 facilities) allowed sample selection of current residents, and 93.6 percent allowed both current residents and admissions sample selection for all rounds of data collection (758 facilities). A summary of facility level response rates for these facilities is presented in Table 1.

The current resident sample consisted of 3,392 eligible residents in nursing and personal care homes. The admissions sample consisted of 2,608 eligible "new" admissions. New admissions were defined as individuals who were admitted to the sampled facility during 1987 and had no prior admissions to that facility during the survey year. When combined, the current resident and new admission samples formed a sample of 6,000 nursing home (NH) users, i.e., persons who at any time during

1987 used a nursing or personal care home.

Data collected in the Surveys in Institutions included facility level characteristics, physical and mental health status and functional limitations of sampled persons, socio-demographic characteristics, and residential history data. Information on health care utilization and expenditures were collected from the facility three times during the year with the Institutional Use and Expenditure Questionnaire (IUEQ). The IUEQ also collected data on types of facility services provided, sources of payment, and hospitalizations. Residence history information associated with movement to and from the NH was also collected.

One of the objectives of the Institutional Population Component was the collection of utilization and expenditure data for all of 1987. This required the collection of use and expenditure data for periods of time when the sampled person was not a resident of the nursing home. Since facility staff could not be expected to provided this kind of data, the IPC also included a Survey of Next of Kin (SNK). This survey consisted of a set of questionnaires administered to community residing respondents (usually relatives) who knew about the sampled person. The SNK interviews were done by telephone, using a computer-assisted telephone interviewing system, from the offices of the data collection contractors (Westat and NORC). The system allowed for the collection of very complicated residence history information and linked use and expenditure information to specific residence periods. Interviews also covered living arrangements outside institutions, perceptions of health status and functional limitations, and arrangements for informal care. For 79 percent of the nursing home users sampled, at least one SNK interview was completed with a community respondent. When no suitable community respondent could be identified, facility staff were asked a subset of the SNK questions. For additional information on the data collection procedures see Edwards and Edwards (1989).

Constructing Year-Long Residence History Profiles From Multiple Date Sources

Because of the operational difficulties in collecting new information distinguishable from information already collected from facility respondents, the design of the next-of-kin survey specified the collection of information about the NH user while the user was in the sampled facility as well as outside of the sampled facility. This resulted in multiple data sources, sometimes providing conflicting residence history data. While this facilitated data collection operations, it made the construction of 1987 year-long profiles, also known as timelines, a complex method-ological problem. Several assumptions were made to facilitate the process; the following section details these.

The most important assumption was that sampled facilities could accurately report periods of nursing home use for persons residing in their facilities. We therefore began constructing the timelines (i.e., residence history profiles) using data collected with the Institutional Use and Expenditure Questionnaire (IUEQ). We began by working with the reference dates for each of the IUEQs (anywhere from one to three IUEQs were collected per person depending upon how long the NH user was in the sampled facility). These dates were laid end to end chronologically and for each reference period it was determined whether or not the sampled person (SP) was ever discharged from the sampled facility.

A graphic representation of the most simple of these scenarios is shown in Figure 1. This figure illustrates a current resident who was in the sampled facility for all of 1987. Timelines were constructed for 2,539 current residents by this method (75 percent of the current resident sample)(Table 2). Figure 2a illustrates a new admission who once admitted to the sampled facility remained in the sampled facility for the remainder of 1987. Fifty percent of the new admissions sample followed this profile; time periods that occurred prior to admission are discussed below. (Unaccounted for time periods are shown on the figures as dotted lines. Solid lines represent time periods when the location of the sampled person is known. Short vertical lines represent start and end dates for unique stays.)

Other examples of possible scenarios are shown in figures 2b-d. Figure 2c illustrates a person who was admitted to the sampled facility during 1987 (a new admission) and subsequently discharged, never to be readmitted to the sampled facility during 1987. Figure 2d illustrates a January 1 resident (a current resident) who was discharged and subsequently readmitted to the sampled facility and was there for the remainder of 1987.

Our second assumption was that the facility could accurately report discharges from the sampled facility to an acute care hospital and subsequent readmission to the sampled facility from that hospital. The Institutional Use and Expenditure Questionnaire (IUEQ) was designed to capture this information and IUEQ hospital stay data were subsequently used to fill in any timeline gaps associated with a hospital stay.[1] For example, Figure 3a shows a NH user's timeline using data reported by the facility for periods of time the SP was in the sampled facility (labeled as line segments A). Figure 3b shows the same NH user's timeline after the hospital stay information (line segment B) was used to complete the NH user's timeline.[2] Of NH users with residence history data, 6 percent (8 percent current residents and 5 percent new admissions) used sampled facility-reported data on hospital stays as a data source in the construction of their residence history profile (Table 3).

Since the survey attempted to follow sampled persons as they moved throughout the year, we were also able to use facility-reported data as reported by transfer NH's (i.e., NH's other than the sampled facility that SP's spent some time in during the year). For all facilities considered to be IPC eligible facilities, the design specified the administration of Institutional Use and Expenditure Questionnaire(s) to cover the period of time the SP was in the transfer NH.[3] Transfer facility stay data, and associated hospital stay data as reported by the transfer facility, were then used in the construction of residence history profiles. Two examples of using this type of data are shown in Figures 4a-4b (a current resident) and Figures 4c-4d (a new admission); time spent in the sampled facility is represented by the line segments labeled A; time spent in the transfer NH is represented by line segments B and time spent in the hospital associated with the transfer facility by line segment C. Transfer facility stay data were used in the construction of slightly more than 6 percent of the NH user population with residence history data.

We also made the assumption that facilities could accurately report data on the stay that occurred immediately after discharge from the sampled facility (or

after discharge from the transfer facility). Figure 5b, line segment B represents this type of stay. Among persons with residence history data, this type of facility-reported data were used for 8 percent of the current residents and 26 percent of the new admissions. Data reported by the facility on the stay two stays removed from the sampled facility (Figure 5b, line segment C) were only used in the construction of residence history profiles for 30 persons (.5 percent).

For some cases, we were unable to determine from facility-reported data all stays that occurred after discharge from the sample facility. In this event, we used data from the Surveys of Next of Kin (SNK) to supplement information on post-discharge stays.[4] Next-of-kin reported data on these stays were used for a scant 4 percent of current residents and 16 percent of new admissions. For new admissions, next-of-kin reported data were used primarily to account for stays that occurred between January 1, 1987 and the date of admission to the sampled facility. We made the assumption that next-of-kin, or other knowledgeable person residing in the community who served as the SNK respondent, would be better able to provide information on the periods of time that occurred prior to admission to the sampled facility (e.g. Figure 6b, line segment B). SNK reported pre-admission data were used for the majority of the new admissions (76 percent) with timeline data.

Unfortunately, not all NH users had next-of-kin data. Some NH users simply outlived potential next-of-kin. Other potential respondents refused to participate in the survey or participated for only part of the survey year. Therefore, in an attempt to complete timelines for persons with gaps still remaining in their pre-admission residence history profiles, we used facility-reported data on the stay(s) immediately prior to the sampled facility stay.[5] Our assumption was that while this data might be subject to error, the facility-reported data were better than having no information. Residence history profiles were constructed for 513 (22 percent) new admissions using facility-reported pre-admission data on the stay immediately prior to admission to the sampled facility (Figure 7b, line segment B). Slightly more than 8 percent used facility data on the stay that was two stays before admission (Figure 7b, line segment C).

We also collected date of death information from both the facility and the next-of-kin. We made the assumption that persons who were discharged from the NH to an acute care hospital and subsequently reported as deceased within three weeks of discharge, died in the hospital. By making this assumption we were able to complete 1987 residence timelines for an additional 1 percent of the NH users with residence history data.

In sum, by utilizing all possible IPC data sources we were able to construct 1987 residence history profiles for 91 percent (3,100) of the NH users sampled as current residents (Table 2). Among the new admissions sample, residence history profiles were completed for a smaller proportion (75 percent) after utilizing all possible data sources. In total, 1987 residence history profiles were completed for 5,044 (84 percent) sampled NH users. At the completion of this process we had a file containing some 34,400 residence history records. Generally, a record represented a stay. However, it was possible for multiple records to represent a stay. For example, in the case of a current resident who was in the sampled facility

for all of 1987, three records were generated to represent the NH stay, one for each Institutional Use and Expenditure Questionnaire administered for the SP. Each residence history record contained data on: the start and begin dates for the stay; the place of the stay (e.g., NH, retirement center); whether the place was an IPC eligible facility, an acute care hospital, the community or a non IPC institution; the questionnaire source for each record; link identifiers that permitted the linking of the timeline to other IPC data files (including a name and address file for each place in the timeline file); and date indicator variables associated with the start and end dates.[6] However, gaps still remained in some of the NH users timeline profiles. Records, called gap records, were then created for periods of time for which residence history data were still missing. Two types of gap records were created; real and potential. Real gap records represented time periods when the location of the sampled person was unknown. For example, an SP was discharged from the sampled facility on September 29th to an unknown place and no other residence history data were available for the period September 29 to December 31. Thus, a real gap record was created for the September 29 to December 31 period. Potential gap records represented potential intervening stays between two known stays. For example, a SP was discharged from the sampled facility on September 29th to a hospital. The SP was also known to have been in a transfer NH on December 31th. No other residence history data were available on the period September 29 to December 31. Thus, the end date for the hospital stay and the begin date for the transfer NH stay were unknown. Also unknown were whether an intervening stay(s) occurred between the hospital stay and the transfer NH stay. In this case a potential gap record was created to represent a potential intervening stay(s) between the hospital stay and the transfer NH stay. Of 34,417 records initially created for the residence history file, 1.3 percent were classified as real gap records and 2.8 percent as potential gap records.

Imputation of Missing Data in the Construction of Year-long Profiles of Residence History

To meet the strict estimation requirements imposed on all NMES primary survey components, both household and institutional, the sample was restricted to only those individuals who responded for at least a third of their period of eligibility.[7] Since the nonresponse adjustment strategies employed to correct for part-year response would be dependent on a respondent's data profile for his period of participation in the survey, it was necessary to impose a threshold on what constituted a minimally acceptable time representation of partial data for making annual national estimates (Cohen and Potter, 1990; Cohen, Johnson, and Carlson, 1989). In NMES, the minimum part-year response requirement of data for at least one third of a respondent's period of eligibility followed the approach taken in the 1980 National Medical Care Utilization and Expenditure Survey (National Center for Health Statistics). Consequently, the respondents with less than a third of their period of eligibility (i.e., the conditional nonrespondents) were treated as complete nonrespondents. Thus, 246 conditional respondents and 169 nonrespondents were treated as complete nonrespondents for estimation purposes (Table 4).[8]

As previously mentioned, residence history profiles were completed for 5,044 NH users using all possible data

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sources (Table 2). After excluding the conditional respondents and the nonrespondents from the sample of 6,000, 541 NH users still remained who were missing some of their 1987 residence history profile data (Table 4). Referred to as partial respondents, this group represented approximately 10 percent of the responding NH user population. About 80 percent of the partial respondents were sampled as new admissions. Approximately 53 percent were missing pre-admission residence history data, 39 percent were missing post-discharge data, and only 8 percent were missing both pre-admission and post-discharge data (calculated from Table 4). Our goal was to have complete residence history data, including start and end dates for all partial respondents. For this reason we chose the weighted sequential hot-deck imputation procedure to impute residence history data for nursing home users with gaps still remaining in their timeline. The weighted sequential hot-deck procedure was designed to impute data from individuals with complete information to individuals with missing data but with similar characteristics. Variables with known values that have been determined to be significant predictors of the measures to be imputed are used to form groups of recipients who are missing information. Within such groups, data are assigned from donors to recipients, taking into account the weights associated with each person in the complex survey (Iannachione, 1982). Most commonly, the procedure is used to impute data used to make distributional estimates, such as income. Here, the procedure was used to impute information on stays before or after the stay to the primary sample facility, including the type of place as well as beginning and end dates for those stays.

The actual procedures to impute missing residence history data were conducted separately for the period of time prior to admission to the sampled facility (used for new admissions only) and for the period of time after discharge from the sampled facility. Separate imputation procedures were conducted largely due to differences in the availability of existing information on location prior to admission and after discharge. For example, many cases with missing pre-admission data did have some data on the location of the person on January 1, and/or their place of residence prior to admission. What was not known for these cases was the end date of the January 1 place, the begin date of the prior residence stay and any intervening stays that occurred. Information that was available could be used as classification variables in the hot-deck procedure in order to increase the accuracy of the imputation. Variables used included month of admission, age, sex, marital status, level of functional activity, as well as available residence history data. In total, six distinct imputation subgroups were identified based on the amount of available pre-admission data contained in their timelines. These are shown in Table 5.

Using available information to impute post-discharge stays was more complicated. There frequently were data on the transfer place, some intervening stays, as well as the place the person was on December 31, 1987. The post-discharge imputation procedures utilized attempted to maximize this available residence history data. In addition to demographic variables, information on the transfer place, the December 31 place and the length of stay in the sampled facility were used as classification variables for those partial respondents with this residence history data.

Information on the number of post-discharge stays were used to create appropriate donor and recipient pools -- for example, for partial respondents known to have two post-discharge stays (Figure 8, line segments B and C), the corresponding donor pool contained complete respondents with two or more post-discharge stays. In all, eighteen imputation subgroups were identified based on the amount of post-discharge information contained in their timelines (Table 6).

Upon completion of the imputation process, year-long residence history profiles were considered complete for 5,585 NH users, 93 percent of the sampled NH population (Table 2). Among current residents, 95 percent had completed timelines and the completion rate among the new admissions was only slightly lower at 91 percent.

SUMMARY

Information on patterns of nursing home use over a given time period is essential for the provision and planning of long-term care services to the elderly. However, obtaining detailed data on utilization, expenditures and transfers to other facilities is often not feasible. While respondents in the facility can report on the time spent in that facility, they often cannot provide detailed data on the period of time prior to admission or the period of time subsequent to a discharge. Respondents in the community -- such as next-of-kin respondents -- may be able to provide this additional information. These respondents, however, are often difficult to locate and their ability to provide an accurate residential history is inconsistent.

The sample design of the Institutional Population Component (IPC) of the 1987 National Medical Expenditure Survey (NMES) enabled us to combine data from several sources in order to construct year-long chronological profiles of residents who spent some time in a nursing home during 1987. Data from facility respondents were obtained on time spent in the nursing home, intervening hospitalizations and, to some extent, transfers to the community or other facilities. Data from a survey of next-of-kin were used to supplement and complete the chronologies for many sampled persons, especially for the period of time prior to admission to the sample facility. Finally, partial residence history data were imputed for the small number of sample persons who still had gaps in their profiles.

One of the limitations of the methodology employed in this study was the possibility that data from different sources on a similar time period would be overlapping, and even contradictory. Thus, assumptions had to be made as to the priority of sources used to complete a particular piece of the chronology. For example, it is reasonable to assume that facilities could report accurately on time spent in the facility. What is not clear is the accuracy of reporting of other nursing home stays during the year by the next-of-kin respondent, of which a small but significant number are included in the chronological profiles constructed from the IPC. Differences in reporting would also have an effect on the imputation of stays. Future research will attempt to evaluate the feasibility of using data from next-of-kin respondents to report on nursing home stays, as well as evaluate alternative methods for constructing residence history profiles.

ENDNOTES

1. Some hospital stays are not indicated because no formal discharge from the sampled facility was associated with the hospital stay.

2. If hospital stay dates overlapped with discharge and admission dates as reported by the sample facility, we chose to believe the facility-reported data for the sampled facility stay.

3. A facility was considered an eligible facility if it was certified by Medicare or Medicaid as a Skilled Nursing Facility or Intermediate Care Facility; or was a separate place or unit of another institution that was licensed or officially recognized by a state and had three or more beds and that provided patients with personal care assistance. Excluded are non-certified places licensed as hospitals and residential facilities that limit care exclusively to persons with specific physical, mental or emotional conditions.

4. This information was collected with the Personal History Questionnaire and the Community Use and Expenditure Questionnaire, see Edwards and Edwards (1989) for additional details.

5. This information was collected with the Baseline Questionnaire and the New Admissions Questionnaire, see Edwards and Edwards (1989) for additional information.

6. The latter indicated whether the dates associated with a stay were actual dates as reported by the source (e.g., the sampled person was discharged from place A on September 29th), whether a date was a point in time estimate (e.g., indicating that the SP was in Place A as of September 29th but that no information was available on whether the SP was ever discharged from Place A after September 29th), or a boundary date (e.g., the SP was discharged from Place A and could have been discharged as late as September 29th, but an exact date of discharge was unknown).

7. This was operationalized by using the constructed residence history profiles to determine periods of eligibility, i.e., periods of time for which a SP was a resident in an eligible facility. Gaps in residence history profiles were assumed to be eligible periods.

8. Overall, the response rate for the NH respondents providing data for at least one-third of their period of eligibility in 1987 was 89.5 percent for NH users sampled as current residents (.946 facility level response rate x .946 resident level response rate). The response rate for NH users sampled as new admissions was somewhat lower, 81.2 percent (.891 facility level response rate x .911 new admission response rate).

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Table 2. Numbers of sampled nursing home users with complete 1987 residence history profiles, by IPC data source and sample type (NMES Institutional Population Component: United States, 1987)

IPC data source used to construct 1987 residence history profiles	All nursing home users		Sample type			
			Current Residents		New Admissions	
	Number	Percent	Number	Percent	Number	Percent
Sampled facility reported data on time spent in the sampled facility	3,834	63.9	2,539	74.8	1,295[a]	49.6[a]
All possible facility or next-of-kin reported data sources	5,044	84.1	3,100	91.4	1,944	74.5
All possible data sources including imputation	5,585	93.1	3,209	94.6	2,376	91.1
Eligible total	6,000	100.0	3,392	100.0	2,608	100.0

[a] Numbers represent those cases with complete residence history profiles from date of sampled admission in 1987 until December 31, 1987.
Source: Agency for Health Care Policy and Research.

Table 3. Frequency of IPC data sources used to construct 1987 residence history profiles for persons with some residence history data, by sample type, unweighted. (NMES Institutional Population Component: United States, 1987).

IPC data source used to construct 1987 residence history profile	All nursing home users		Sample type			
			Current residents		New admissions	
	Number	Percent	Number	Percent	Number	Percent
1. Sampled facility reported data on time spent in the sampled facility.	5,585	100.0	3,209	100.0	2,376	100.0
2. Sampled facility reported data on hospital stays associated with a discharge and subsequent readmission to the sampled facility.	350	6.3	241	7.5	109	4.6
3. Transfer NH(s) reported data on time spent in transfer NH(s).	347	6.2	176	5.5	171	7.2
4. Transfer NH(s) reported data on hospital stays associated with a discharge and subsequent readmission to the transfer NH(s).	22	.4	16	.5	6	.3
5. Faculty Reported data on stay immediatly after discharge from sampled facility or transfer facility.	858	15.4	244	7.6	614	25.8
6. Facility reported data on stays two or more stays after discharge from sampled facility.	30	.5	12	.4	18	.8
7. Next of kin reported post-discharge data.	492	8.8	115	3.6	377	15.9
8. Next of kin reported pre-admission data.	1,802	32.3	n/a	n/a	1,802	75.8
9. Facility reported data on stay immediately prior to admission to the sampled facility.	513	9.2	n/a	n/a	513	21.6
10. Facility reported data on stay that was two stays before admission to sampled facility.	197	3.5	n/a	n/a	197	8.3
11. Facility reported data on date of death and discharge to hospital.	60	1.1	27	.8	33	1.4
PERSONS WITH SOME RESIDENCE HISTORY DATA	5,585	100.0[a]	3,209	100.0[a]	2,376	100.0[a]

[a] Percents do not add to 100 because categories are not mutually exclusive.
Source: Agency for Health Care Policy and Research.

Table 4. Classification of nursing home users, by respondent and sample type, unweighted (NMES Institutional Population Component: United States, 1987).

Respondent type	All nursing home users Number/percent		Sample type			
			Current resident Number/percent		New admission number/percent	
Complete respondents (R=1)	5,044	84.1	3,100	91.4	1,944	74.5
Partial respondents (.33 ≤ R < 1)	541	9.0	109	3.2	432	16.6
Pre-admission partial	288	4.8	n/a	n/a	288	11.0
Post-discharge partial	212	3.5	109	3.2	103	3.9
Pre-admission & post-discharge partial	41	.7	n/a	n/a	41	1.6
Conditional respondents (0 < R < .33)	246	4.1	57	.7	189	7.2
Nonrespondents (R=0)	169	2.8	126	3.7	43	1.6
Eligible total	6,000	100.0	3,392	100.0	2,608	100.0

"R" is the proportion of eligible time for which there was a response.
Source: Agency for Health Care Policy and Research (AHCPR).