

AN ESTIMATION STRATEGY FOR THE COMBINED POPULATION REPRESENTED BY THE NMES HOUSEHOLD AND NURSING HOME SURVEYS

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1. INTRODUCTION

The NMES-2 Household Survey (HHS) was designed to produce national estimates of the health care utilization, expenditures, insurance coverage and source of payments for the civilian non-institutional population in 1987. The NMES-2 Nursing Home Survey was designed to produce comparable estimates for the population resident in nursing and personal care homes in 1987. The core of the data collection effort for the non-institutionalized population was a series of interviews with a household sample that collected detailed information on health status, use of health care services, expenditures and sources of payments, insurance coverage, employment, income and assets, and demographic characteristics for calendar year 1987. The institutional population component (IPC) was designed to obtain similar types of information for the institutionalized population residing in nursing and personal care homes (NH), and in facilities for persons with mental retardation (MR) for calendar year 1987. As a consequence of the small representation of admissions from the community to facilities for persons with mental retardation in 1987, this component of the NMES-2 is not a focus of this paper.

Individuals who were admitted to eligible institutions from the community in 1987 were dually represented in the NMES-2 Household and Nursing Home Survey. This paper presents the estimation strategy adopted in NMES-2 to allow for population estimates of the combined population represented by these component surveys. Particular attention will be given to the derivation of per capita and total health care expenditure estimates that characterize the union of the population in the community and in nursing homes over the course of 1987. In addition, an example is also provided of the use of NMES-2 data to support analyses that estimate the extent of nursing home utilization in 1987 relative to the combined target population considered in this study. Limitations with respect to the

estimation strategy, as a consequence of the NMES-2 survey design are also discussed.

2. NMES-2 HOUSEHOLD SURVEY SAMPLE DESIGN

The adopted NMES-2 household survey sample design was a stratified area probability design with three stages of sample selection. (Cohen, DiGaetano and Waksberg, 1991). The sample of primary sampling units (PSUs) represented a union of the national sample frames of Westat, Inc., and NORC (National Opinion Research Center), the NMES-2 data collection organizations.

The final NMES-2 household screener sample consisted of 31,208 eligible dwelling units, of which 91.3 percent responded to the screening interview. Following the screening interview, a subsample of dwelling units was selected for the full panel household survey based upon person and household level demographic characteristics. Subsampling rates were specified to obtain the required sample size to meet NMES-2 precision specifications for person level estimates. Overall, the joint screener-NMES-2 Round One response rate for the NMES-2 household survey was 85.4 percent, based on 14,840 responding households and 36,753 responding individuals, residing in approximately 14,000 dwelling units.

At the end of four rounds of data collection, 2,294 out of 36,753 survey participants, or 6.2 percent, did not provide data for the entire period in 1987 during which they were eligible to respond. The overall response rate for the NMES-2 household sample was 80.1 percent.

3. NMES-2 NURSING HOME SURVEY SAMPLE DESIGN

The NMES-2 Nursing Home Survey (NH) was established to provide an assessment of the health care utilization, costs, sources of payment and health insurance coverage of the U.S. institutionalized population residing in nursing and personal care homes. The primary objective of the survey was to estimate the use of and expenses for health care services for all persons residing in eligible institutions at any time during calendar year 1987. To obtain a nationally

representative sample of the 1987 institutional user population, the survey included a sample of residents residing in selected facilities as of January 1, 1987, in addition to a representative sample of admissions to the selected facilities over the course of 1987. The union of these samples served to represent the 1987 institutional user population (Cohen, Potter, and Flyer, 1993).

The adopted NMES institutional population survey is a stratified, two stage probability design with two phases of facility selection. 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 second stage. The NH facility sample consisted of 851 eligible nursing and personal care homes. Facilities were considered to be respondents to the survey when they completed a Facility Questionnaire. A 95.2 percent facility level response rate was achieved for this survey. The design of the survey required that the institutional use and expenditure data for 1/1/87 residents were to be collected for their entire period(s) of institutionalization in 1987. In contrast, data collection for the admissions sample began with their first admission to a sampled eligible facility, independent of prior institutional stays over the course of 1987. Consequently, their 1987 institutional data collection period was constrained. For estimation purposes, individuals who responded for at least a third of their eligibility period of institutional data collection were considered respondents.

In the nursing and personal care sample, 805 participating facilities (94.6 percent) allowed for the selection of a sample of their residents as of January 1, 1987. Overall, 3,392 eligible residents as of January 1, 1987 were selected, representing a national nursing and personal care home population of 1.5 million residents. The response rate for residents as of January 1 providing data for at least one-third of their period of institutionalization in 1987 was 89.5 percent. This data was obtained through the administration of the Institutional Use and Expenditure Questionnaire (IUEQ), which was completed by facility staff (Edwards and Edwards, 1989).

The admissions sample consisted of 2,608 eligible sampled admissions to nursing and personal care homes. Sampled admissions were defined to be individuals who were admitted to the sampled facility during 1987 and had no prior admissions to that facility during the survey year. In the sample, 758 participating nursing and personal care homes (89.1 percent) allowed for the sample selection of admissions at all rounds of data collection. The NMES-2 response rate for admissions providing data for at least one-third of their period of institutionalization in 1987 was 81.2

percent for those sampled in nursing and personal care homes.

Data collected from facility respondents included facility level characteristics, health status and facility use and expenditure data for the institutionalized period. Sampled persons were followed throughout 1987; institutional data collection procedures were continued in each new facility. Since study objectives required data that facility staff could not be expected to provide, the study also included a set of questionnaires administered to community respondents who knew about sampled persons and their lives outside of institutions.

o The NMES Institutional User Population

The nursing and personal care home sample design consisted of two distinct selections of 1987 institutional users: the first selection was designed to provide a representative national sample of residents in eligible facilities as of January 1, 1987 (current residents); and the other selection was designed to provide a nationally representative sample of 1987 admissions to eligible facilities. The strict requirement of a single day of sample eligibility for the current resident sample resulted in a **single** opportunity of selection for each sampled current resident as of 1/1/87. Imposition of a similar restriction for the selection of admissions, requiring the selection of individuals experiencing their first institutional stay in 1987, would have simplified the sample design by allowing each sampled institutional user a single opportunity of selection. Since this information regarding an individual's prior periods of institutionalization was not available at the time of sample selection, and often unavailable from facility records, such a restriction could not be imposed. Resident history information for sampled admissions was often obtained through the Survey of Next of Kin, whereby community respondents who knew about sampled persons would be the primary source for information regarding prior institutional stays.

As a consequence of the sample selection scheme that was employed, an individual who experienced more than one institutional stay over the course of 1987 had multiple chances of selection into the institutional sample. Furthermore, a subset of sampled admissions was determined to have also resided in an eligible facility on 1/1/87, indicating an overlap with the independent sample of January 1 residents. In order to identify the sample of institutional users that had multiple opportunities of selection in the institutional sample, it was necessary to further classify the sample

of institutional users according to their institutional experience over the course of 1987.

The adopted estimation strategy restricted the admission sample to institutional users whose first institutional stay in 1987 was in a sampled facility (i.e., Group 5a - 5d in Table 1). Adoption of this approach does not require an imputation strategy to correct for missing time dependent data associated with institutional stays in 1987 prior to an institutional user's sampled admission (Cohen and Potter, 1993). Furthermore, the restriction of the admission sample to a sample of first institutional stays in 1987 does not require a multiplicity adjustment to estimation weights and an adjustment for dual frame representation of residents in facilities as of 1/1/87 (Sirkin, 1970). This is a consequence of limiting the sample of institutional users to a single opportunity of selection. Institutional users determined to have experienced institutional stays prior to their sampled admission would be defined as ineligible for the purposes of estimation (Cohen and Potter, 1993). Implementation of this approach resulted in a sample of 5,072 respondents.

4. NMES-2 EXPENDITURE DATA

The health care events for which medical expenditure data were collected in the NMES-2 household survey included inpatient hospital stays, inpatient physician services, ambulatory physician visits (office-based, hospital outpatient department, or emergency room), ambulatory nonphysician visits, outpatient prescribed medicines, dental visits, formal home health care visits and other medical expenses which included medical equipment (purchases or rentals), eyeglasses, contact lenses, and prostheses. A formal home care visit was defined as receiving treatment from either a self-employed provider (e.g. medical doctor, nurse or therapist), a provider working for a formal health care organization, or providers otherwise receiving payment for their services. Expenditures refer to charges with two exceptions. This occurred when charges were reduced to the amounts allowable by third-party payers (e.g., Medicaid), and for settings that do not specify dollar amounts for particular services (e.g., health maintenance organizations), where a dollar value was imputed from the expenses associated with similar types of services (Hahn and Lefkowitz, 1992).

In the NMES-2 nursing and personal care homes survey, data on facility charges were collected for each billing period in the facility for which a person was institutionalized (Edwards and Edwards, 1989). Expenditures for basic nursing home services reflect the

facility's basic daily charge, as limited by the amounts allowed by third-party payers such as Medicare, Medicaid, and private health insurers. Expenditures for ancillary items such as special supplies and services billed separately by the facility were also included. Furthermore, the services provided by facilities that do not generally charge for their care (e.g., public institutions financed by government budgets) were valued according to daily expenditures of similar patients in otherwise similar facilities (Lair, 1992). Expenditures for inpatient hospital stays (including physician services) were valued according to the mean per night expenditures incurred by patients with similar characteristics in the NMES-2 household survey. All other health care services covered by Medicare were also included in the expenditure estimates (Cohen, Carlson and Potter, 1994).

5. AN ESTIMATION STRATEGY FOR THE COMBINED POPULATION REPRESENTED BY THE NMES HOUSEHOLD AND NURSING HOME SURVEYS

In order to correctly use the NMES-2 survey data to derive estimates that represent the union of the civilian non-institutionalized population and the population in nursing and personal care homes, it was necessary to adjust the survey specific estimation weights. The adjustment corrected for the coverage in both component NMES-2 surveys of individuals who were members of the civilian non-institutionalized population and the population resident in nursing and personal care homes over the course of the survey year. More specifically, the combined population represented by the NMES-2 Household and Nursing Home Surveys is distinguished by the following four distinct, mutually exclusive and exhaustive groups (Figure 1) :

- a. individuals who were members of the civilian non-institutionalized population on 1/1/87 that never entered a nursing or personal care home over the course of 1987 (Group A);
- b. individuals who were residents in nursing and personal care homes as of 1/1/87 who never returned to the community in 1987 (Group B);
- c. individuals who were members of the civilian non-institutionalized population as of 1/1/87 who were subsequently admitted to an in scope institution over the course of the survey year (Group C); and

d. individuals who were residents in nursing and personal care homes as of 1/1/87 who subsequently entered the community in 1987 (Group D).

Individuals who were classified in Group A are only represented in the NMES-2 Household Survey with a single change of sample selection. Individuals who were classified in Group B were only represented in the NMES-2 Nursing Home Survey with a single change of sample selection. Alternatively, individuals that are classified in Group C are represented in both the NMES-2 Household and Nursing Home Surveys.

A subset of individuals that were classified in Group D also had a theoretical chance of being represented in both the NMES-2 Household and Nursing Home Surveys. Based on the design of the NMES-2 Household Survey, however, this could only occur if a person who was in an institution as of 1/1/87 had returned to a household in the community which included an additional family member. Furthermore, in order to be identified in the household survey, the 1/1/87 nursing home resident was also required to be physically present in the sampled household at the time the NMES-2 interview was administered in 1987. As a consequence of the significant undercoverage in the NMES-2 Household Survey of individuals classified in Group D, and the limited sample yield to support a population estimate, these individuals were represented in NMES-2 by the Nursing Home Survey.

Although demographic information was obtained from both surveys to characterize individuals residing in the community on 1/1/87 who were subsequently admitted to a nursing or personal care home over the course of 1987, data on the characteristics of the type of nursing home facility they entered were only collected in the Nursing Home Survey. Since additional analyses were to be conducted for the population represented by the union of the household and nursing home components, which required facility specific data for the institutional component, an analytical decision was made to represent individuals admitted to nursing and personal care homes in 1987 by the sample selected in the NMES-2 Nursing Home Survey.

The NMES-2 survey specific estimation weights that reflect each sample unit's selection probability were adjusted to support analyses directed to the target population represented by the union of the civilian non-institutionalized population and the population in nursing and personal care homes. The estimation strategy that was implemented corrected for the multiple chances of selection in the component surveys of individuals classified in Group C and D by only allowing the sample selected in the NMES-2 Nursing Home Survey to represent individuals admitted to

nursing and personal care homes in 1987. This sample restriction resulted in the exclusion of only 138 sample observations associated with the NMES-2 Household Survey that also represented individuals who were members of the civilian non-institutionalized population as of 1/1/87 who were subsequently admitted to an in scope institution over the course of the survey year.

The restriction of the admission sample to a sample derived only from the NH Survey obviated the need for a multiplicity adjustment. However, it was recognized that use of the unadjusted survey specific sampling weights to represent the civilian non-institutionalized population in 1987 by a combination of the Household Survey sample classified in Group A and the admission Nursing Home sample classified in Group C would result in a departure from more accurate estimates of the civilian non-institutionalized population obtained from the 1987 Current Population Survey. Consequently, the survey specific sampling weights for the restricted sample were further post-stratified to more accurate population totals. Population estimates were obtained from the full sample NMES-2 Household Survey since these NMES-2 estimates were already post-stratified to population totals obtained from the November 1987 Current Population Survey.

The following estimation strategy was implemented to adjust for the dual representation of individuals admitted to nursing homes from non-institutional settings in the NMES-2 Household and Institutional Surveys. Within weighting classes defined by cross-classifications of age, race and gender, individuals who were members of the civilian non-institutionalized population as of 1/1/87 and subsequently admitted to an in scope institution over the course of the survey year were separated into two distinct groups. The classification was dependent on the sample component from which they were selected. The categories of age considered in the weighting class adjustment were specified as : 0-21, 22-44, 45-64, 65-74, 75-84, 85+. Race was categorized as black and other. Since the individuals admitted to nursing and personal care homes in 1987 were only to be represented by the sample selected in the NMES-2 Nursing Home Survey, individuals selected in the NMES-2 Household Survey who subsequently experienced an admission to a nursing home in 1987 were not to be considered in the derivation of population estimates that characterized the combined population. The NMES-2 Household Survey estimation weights for the individuals without admissions to nursing and personal care homes over the course of 1987 were further adjusted within the defined weighting classes to insure that the population estimates derived from the combined sample of household survey non-admissions and the institutional sample of

admissions were equivalent to the population estimates derived from the entire NMES-2 Household Survey sample.

More specifically, the following steps were implemented:

1. Weighted sums were derived for each weighting class (c) defined by cross-classifications of age, race and gender, based on the sum of the Household Survey (HS) sample estimation weights (INCALPER) minus the Household Survey estimate for the sample that had an institutional stay. For each cell (c), SHHNOAD(c) was specified as:

$$\text{SHHNOAD} = \sum_{\text{in}(c)} \text{INCALPER} - \sum_{\text{in}(c)} \text{INCALPER} \text{ HHINST}=1$$

(Using full household sample with INCALPER > 0)

In the above equation, HHINST=1 identifies individuals selected in the NMES-2 Household Survey who were members of the civilian non-institutionalized population as of 1/1/87 who were subsequently admitted to an in scope institution over the course of the survey year.

2. Another set of weighted sums were derived to reflect independent sample estimates of the number of individuals who were members of the civilian non-institutionalized population as of 1/1/87 who were subsequently admitted to an in scope institution over the course of the survey year, based on estimates from the NMES-2 Nursing Home Survey (using the NH survey weight WIUEQEXP). For each cell (c), SHHNEW1(c) was specified as:

$$\text{SHHNEW1} = \sum_{\text{in}(c)} \text{INCALPER} - \sum_{\text{in}(c)} \text{WIUEQEXP}$$

HS INCALPER > 0 NH
USER = 5

(Using only household persons with positive INCALPER weights and for the NH survey, those with USER = 5 (NH persons with admissions)).

3. An adjustment factor was derived for each weighting class to insure that the population estimates derived from the combined sample of household survey non-admissions and the nursing home sample of admissions were equivalent to the population estimates derived from the entire NMES-2 Household Survey sample. For each cell (c) AHHADM1(c) was specified as:

$$\text{AHHADM1} = \text{SHHNEW1} / \text{SHHNOAD}$$

4. The new composite weight, WHHIPC1, was developed in the following manner to support analyses directed to the target population represented by the union of the civilian non-institutionalized population and the population in nursing and personal care homes:

$$\text{WHHIPC1} = \text{INCALPER} \times \text{AHHADM1}(c)$$

in(c) For Household Survey sample persons with INCALPER > 0 and not institutionalized (Group A).

$$\text{WHHIPC1} = \text{WIUEQEXP} \text{ For the NH sample (Group B and C)}$$

WHHIPC1 = 0 For sample persons in the Household Survey with admissions to NHs (Group C), NH residents as of 1/1/87 (Group D), HS persons with INCALPER = 0 and NH persons with WIUEQEXP = 0.

These estimation weights will support person level analyses for the combined populations represented by the NMES-2 Household and Nursing Home Survey that focus on demographic or health status measures. Population estimates of the subgroups represented by the combined target population are presented in Table 2.

The design of the NMES-2 allows for an analysis of the extent of nursing home use in the United States during 1987. In this vein, the estimation strategy that has been developed permits the derivation of the following type of estimates:

1. the proportion of the combined target population who spent any time in a nursing home during 1987; and
2. the proportion of the combined target population who entered a nursing home from the community (were members of the civilian non-institutionalized population as of 1/1/87) in 1987.

The estimates presented in Table 3 reflect the percent of the combined population, represented by the union of the civilian non-institutionalized population and the population in nursing and personal care homes, who used nursing homes in 1987. The estimates are further disaggregated by age. Relative to a combined population of 240.9 million individuals, 0.93 percent or 2.24 million used a nursing home at some point in 1987 (Feinleib, Cunningham and Short, 1994).

The estimates presented in Table 4 reflect the rates of nursing home admission in 1987 of elderly persons (age 65+) who were members of the civilian non-institutionalized population as of 1/1/87. Here, the rate of nursing home admission for elderly persons who

were members of the community on 1/1/87 was 22.4 admissions per thousand population (Feinleib, Cunningham and Short, 1994).

6. DERIVATION OF PER CAPITA HEALTH CARE EXPENDITURE ESTIMATES FOR THE COMBINED POPULATION REPRESENTED BY THE NMES-2 HOUSEHOLD AND NURSING HOME SURVEYS

An estimate of the mean annual expenditures incurred for health care could not be directly obtained in NMES-2 based on annual person level profiles for the combined target population under consideration. Furthermore, the NMES-2 design does not allow for an analysis of annual health care utilization and expenditure patterns that characterize individuals who moved between non-institutional and eligible institutional settings over the course of 1987. This was a function of the data collection strategy employed in the NMES-2 surveys. More specifically, if a sample participant in the household survey entered a nursing home during the course of 1987, data on his health care utilization and expenditure experience was only collected while he was a member of the civilian non-institutional population. Similarly in the nursing and personal care home survey, data on the health care utilization and expenditure patterns that occurred in the community prior to a person's first institutional admission in 1987 (or subsequent to a discharge from an eligible institution) was not acquired in sufficient detail and of acceptable quality to support analysis. The data collection design of the NMES-2 does not allow for a direct analysis of annual health care utilization and expenditure patterns for this subset of the combined target population.

In order to derive an average health expenditure estimate for the combined population represented by the NMES household and nursing home survey population, the following estimation strategy was adopted. The total health care expenditure estimate for the household survey was added to the total health care expenditure estimate for the nursing home survey, to obtain a combined population expenditure estimate. As a consequence of the data collection strategy employed in the NMES-2, there was no overlap in the health care expenditure estimates obtained by summing the respective survey component estimates to obtain a combined population estimate. In the NMES-2 component surveys, data on a sample member's health care utilization and expenditure experience only collected to cover the respective component population they were sampled to represent. This non-overlap in health care

expenditure data was applicable to individuals who were dually represented in the NMES-2 Household and Nursing Home Surveys.

An average expenditure estimate for the total population was obtained by dividing the expenditure total for the overall population by the estimated number of individuals in 1987 that characterized the overall population. This population estimate was derived by application of the estimation weights developed to adjust for the overlapping coverage in both surveys, of individuals who were members of the civilian non-institutionalized population as of 1/1/87 who were subsequently admitted to an in scope institution over the course of the survey year.

The estimates presented in Table 5 reflect the per capita personal health care expenditures for the combined population represented by the NMES household and nursing home survey population. An estimated \$533.4 billion dollars (in 1992 dollars) was spent by the civilian non-institutionalized population for health care in 1987. In addition, an estimated \$64.8 billion dollars was spent for health care in 1987 by the population in nursing and personal care homes. Overall, an estimated \$598.2 billion dollars (in 1992 dollars) was spent for health care received in 1987 by the combined community resident and nursing home resident populations. The estimated 1987 per capita personal health care expenditures of for the combined population represented by the NMES household and nursing home survey population was \$2,483 (Cohen, Carlson and Potter, 1994).

7. SUMMARY

This paper presents the estimation strategy adopted in NMES-2 to allow for population estimates of the combined population represented by these component surveys. Particular attention was given to the derivation of per capita and total health care expenditure estimates which characterize the union of the population in the community and in nursing homes over the course of 1987. In addition, an example was provided for the use of NMES-2 data to support analyses which estimate the extent of nursing home utilization in 1987 relative to the target population considered in this study. Limitations with respect to the estimation strategy, as a consequence of the NMES-2 survey design, were also addressed.

The references and tables for this report can be obtained directly from the authors by contacting Dr. Steven B. Cohen at (301) 594-1406.