

## A MULTI-MODE LONGITUDINAL STUDY: THE LONGITUDINAL STUDY OF AGING

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"In research on growth, development or change, longitudinal studies play a special part" (1).

The National Center for Health Statistics in collaboration with the National Institute on Aging is conducting the Longitudinal Study of Aging, a study that reflects this philosophy.

### I. Overview

The Longitudinal Study of Aging, the LSOA, has as its base a national probability sample of noninstitutionalized people age 55 and over living in the United States in 1984. They are being followed for 6 years through multiple methods for collecting data including reinterviews and linkage with death and administrative records. This paper describes the baseline surveys, the 1986 reinterview, the 1987 decedent follow-up, the record matches, and the methods of obtaining the data.

The LSOA is designed to:

(a) provide mortality rates by demographic, social, economic, and health characteristics that are not available from the vital statistics system, (b) measure change in the functional status and the living arrangements of older people, and (c) provide measures of health care use.

It is also designed to describe the continuum from functionally independent living in the community through dependence, possibly institutionalization, and finally to death.

The full study will constitute a data set gathered by using many of the established survey data collection methods.

They include: personal interviewing in the household of household respondents and self-respondents, telephone interviewing by computer assisted telephone interviewing and interviewing with paper questionnaires, mail questionnaires, and record linkage with death records and administrative records.

The data files resulting from the LSOA will provide extensive information about the sample people from a number of sources.

The sources include:

1984 National Health Interview Survey (NHIS) Health Insurance Supplement Supplement on Aging (SOA); National Death Index (NDI) records; Death certificates; Medicare, Part A records; Reinterviews with participants in the SOA or the contacts they named.

(Figure 1) In the LSOA:

(1) all 16,148 people in the SOA are being followed for at least six years through NDI matches, (2) all 11,497 people in the SOA ages 65 years and over in 1984 are being followed for at least six years through Medicare matches, and (3) Selected samples of the people in the SOA are being followed through reinterviews; the first was in 1986.

### II. The Baseline Surveys

#### A. The National Health Interview Survey

The LSOA starts with the large continuing survey of the civilian noninstitutional population of the United States, the National Health Interview Survey (NHIS), that has been carried out by the National Center for Health Statistics for thirty years. The NHIS is a household interview survey based on a national probability sample with personal interviewing throughout the year by Bureau of the Census interviewers.

Households are selected through a multistage probability sampling process and divided into weekly samples. Under the sample design in effect in 1984, there were 42,000 eligible households. All interviews were conducted in person by Bureau of the Census interviewers trained in the procedures of the NHIS. A family member most knowledgeable about the health of the family could be the respondent for all family members although other adult members were asked to participate if possible.

The NHIS multistage probability sample is designed to produce national estimates for the civilian, noninstitutional population of the United States. The estimation procedures use the same population as the Current Population Survey for post-stratification; population estimates by age, sex, and race agree with estimates from that survey.

The design and procedures for the NHIS have been published by the National Center for Health Statistics (2). Basic data for each year and the questionnaires used that year are published by the National Center for Health Statistics in Current Estimates, Vital and Health Statistics, Series 10.

#### B. The Health Insurance Supplement

A second source providing baseline data for the LSOA is the 1984 Health Insurance Supplement to the NHIS. It was designed to obtain information about whether each person in the household had health insurance for hospital care and doctor visits and whether the insurance was public or private. There were also questions about loss of employment and health insurance. Information about receipt of military retirement, Veteran Administration pensions, and eligibility for veterans' medical care and disability compensation was also obtained.

#### C. The Supplement on Aging

The major baseline source for the LSOA is another supplement to the 1984 NHIS, the Supplement on Aging the SOA. This thirty-minute interview following the NHIS interview was designed to obtain special information about 16,148 people age 55 and over who were living in the 42,000 households included in the NHIS. The 16,148 consisted of half of the people age 55-64 (all that were needed for precision in this age range) and all of the 11,497 people age 65 and older.

The SOA interviews were usually personal interviews following the regular NHIS interview in the sample persons' homes. When the sample person could not be interviewed in the household, the interviewer sometimes telephoned rather than relying on a proxy respondent. A broad spectrum of topics related to health, social functioning, and living arrangements of older people was covered.

Because the SOA was designed to be the baseline for a longitudinal study, information needed for follow-up was collected as part of the interview. All respondents (or their proxies) were told that they might be contacted again and were asked to provide the name, address, and telephone number of someone who did not live in the household and who would know about them. They were also told that NCHS would like to link the interview data with other records of the Department of Health and Human Services and were asked for all the information (including Social Security number) that is

recommended for linkage with the National Death Index (3).

All people included in the SOA responded for themselves if possible. The interviews were conducted with 14,783 (91.5 percent) of the sample people themselves. The remaining 1,365 interviews for people unable to respond for themselves were with proxy respondents who were almost always a relative living in the same household and knowledgeable about the sample person. Only rarely was the knowledgeable person unrelated to the sample person or not a resident of the household.

The SOA was designed to produce national estimates for the civilian noninstitutional population of the United States age 55 and over. It was independently post-stratified using the population used for the Current Population Survey to take the half-sample for people ages 6664 and the slight additional non-response into account.

The design and procedures for the SOA have also been published by the National Center for Health Statistics (4). Data from the SOA have been published in a series of Advance Data from Vital and Health Statistics reports.

The SOA is a cross-sectional study that stands on its own right. Its importance in the current context is that it was also designed as the baseline for a longitudinal study; information needed for recontact and linkage, and permission to link with other data files were obtained during the interview.

#### **D. Data Release**

The 1984 NHIS, SOA, and Health Insurance Supplement micro-data files were released to the public in the fall and winter of 1986. The files can be linked to one another. However, the public-use tapes do not contain any personal identifiers, information about contact people, or information, such as the Social Security number, that is used to link the file of SOA participants to other record files.

#### **III. The Longitudinal Study of Aging 1986 Reinterview**

The 1986 reinterview was designed to measure change and use of medical care since 1984. The information included changes in marital status and living arrangements, current status and changes in functional abilities, and use of medical care.

##### **A. Sample Selection**

(Figure 2) The sampling frame was the 7,541 persons in the SOA who were age 70 or over in 1984.

The sample was selected in stages to accomplish three major goals while staying within fixed costs:

- (1) select as many of the "oldest-old" as possible;
- (2) select as many minority people as possible; and
- (3) select all family members age 70 and over of people selected in steps 1 and 2.

First, all SOA households with a person age 80 and over were selected. All persons age 80 and over and their relatives ages 70-79 in these households were selected. Second, all other households with a person ages 70-79 were selected. From these households, all black persons and their relatives ages 70-79 were selected. Third, the remaining households with a person ages 70-79 were selected, randomly sorted, and one-half of the households were selected. If there was more than one person age 70-79 in the household, all were included. Because the sample was selected from the SOA file before the editing was completed, 5 people who would have been selected from the final edited file were omitted.

##### **B. Data Collection**

Before data collection began, the sample of 5,151 persons was matched with the 1984 National Death

Index (NDI) to identify people who had died between the 1984 interview and the end of 1984. This match identified 46 people who matched on all 10 NDI criteria (3). They were kept in the sample and included in the decedent follow-up, but no other recontact was attempted.

The 1986 LSOA reinterview and the 1987 decedent follow-up relied almost entirely on telephone interviewing; mail questionnaires were used when necessary. The decision to do so was based on research. Herzog et al have said that telephone interviewing is as feasible a method for surveys of older people as for the general population if done carefully (5). When we reported the results of the study that was conducted to test the feasibility of the LSOA, we concluded that "A linked telephone survey of the elderly is eminently feasible" if certain procedures are followed (6).

Therefore, the households were classified by whether or not a telephone number of the sample person or a contact person had been given on the SOA. People with this information constituted a telephone sample; those without it constituted a mail sample.

Approximately three weeks before interviewing began, a letter that explained the study, cited the legislative authority, and provided assurances of confidentiality was sent to each sample person. The letters were addressed to the person by name and mailed first class. Address corrections were requested from the postmaster.

The letter was the first page of the questionnaire for the 96 people in the initial mail sample. They were asked to complete and return the questionnaire. The 5,055 people in the initial telephone sample were provided with the content of the telephone interview and told that these were the topics that would be covered when the interviewer telephoned.

Two procedures were used to gather the information:

(1) telephone interviews using CATI

(2) mail questionnaires for (a) people without information for telephone calls (b) people with no response to the telephone calls (c) contracts who were reluctant to answer without some written confirmation about the study.

##### **Computer Assisted Telephone Interviewing**

Computer Assisted Telephone Interviewing (CATI) was conducted seven days a week, from 8 AM to 9 PM respondent time on weekdays and to 3 PM on weekends, in August and September of 1986. The daily starting time was changed from 10 AM, the standard starting time for telephone interviews, because the interviewers found that older people had no objections to being called this early. Bureau of the Census staff programmed the CATI and conducted the interviews.

Tracing procedures included incorporating the new address information requested from postmasters as part of the advance mailing, use of Directory Assistance services, and information provided by contact persons.

Interviewer training included classroom instruction on the sample, the questionnaire, how to administer the automated interview, on administrative procedures for keeping records, and observation of five practice interview scripts.

Standard procedures for rotation of calls and for quality control in the interviewing were followed. The use of a CATI system facilitated these aspects of sample management and quality control in the field operations. It provided the advantages of a computerized questionnaire and continuous supervision of the interviewers. The CATI procedure also included updating the file with address and telephone number

changes for the sample and contact persons to be used in later reinterviews.

The respondent rule for the 1986 LSOA reinterview was identical to that for the 1984 SOA, i.e. self-response was sought; a proxy response was used for people whose impairments or language difficulties prevented their answering for themselves. The proxy respondent was, preferably, a relative living in the sample person's house. One of the advantages of the advance letters including telling potential respondents what they would be asked about was that it provided the opportunity for people whose impairments prevented their participating in telephone interviews and people who did not speak English to discuss the information with proxy respondents.

The CATI system, like all other procedures for the study, is in place. Future reinterviews will be readily implemented with the updated sample list.

#### Mail Questionnaires

A self-administered version of the questionnaire, with a letter on the cover explaining the survey and a franked return envelope addressed to the Bureau of the Census, was sent to the 96 sample people who had no telephone and no contact person with a telephone. After the CATI portion of the study had been completed, mail questionnaires were also sent to the people who did not respond to the telephone contacts or who could not be reached by telephone, and to contact persons who were reluctant to give information over the telephone.

The two mailings, both by first class mail and addressed to the person by name, provided considerable information in addition to that on the questionnaires.

Postmaster return requests for forwarding and new address notification requests provided updated addresses in some cases. Some post offices also returned undeliverable mail with the information that the addressee was deceased.

Questionnaires and a letter were also sent to contact people who were reluctant to divulge information about the sample person without more information about the study. Few of the contacts had been told by the SOA respondent that they had been named as someone who could provide information. They had not been sent an advance letter and a few asked for written confirmation about the study when they were reached by telephone. When sent the mail questionnaire, most responded.

Questionnaires were eventually mailed to 706 persons; only 274 were returned. However, because people in the initial mail sample were more likely to be people of less education, lower income, and in poorer health, use of mail questionnaires reduced the potential bias. In addition, non-response bias can be assessed using the 1984 demographic and health status information about the entire sample.

#### C. Response Rates

(Figure 3) The status of 92 percent of the 5,151 sample persons was ascertained through the reinterview. Most (3,938) were still living in the community; 192 were living in institutions. We anticipate that some of the 417 persons who were not located will be found through matches with the NDI and Medicare records.

(Figure 4) People who had died were more likely than those still alive to be men, to have been age 80 and over, or to have had difficulty in

Activities of Daily Living in 1984. People who were not located were more likely than those who were located to have lived alone or to have been without telephones in 1984. Also, people who had died or who

located to have lived alone or to have been without telephones in 1984. Also, people who had died or who were in institutions were more likely than others to have had proxy respondents in 1984, which substantiates the poorer health status that we observed for people with proxy respondents on the SOA (4).

The majority of the people in the 1986 LSOA reinterview sample who were able to do so also responded for themselves. Of the 3,938 people who were located and still living in the community in 1986, 3,100 (78.7 percent), responded for themselves.

#### D. Statistical Considerations

The 1986 LSOA reinterview was also designed to make national estimates. Since the sample did not include all SOA participants age 70 years and over, weights were calculated using the same post-stratification procedures as the NHIS and SOA (4). There was no additional adjustment for non-response to the 1986 reinterview; the weights are for the sample drawn from the 1984 SOA files, and the 1984 data for the non-respondents are on the file.

We knew from the SOA sample counts that there would be few LSOA sample persons in many of the Primary Sampling Units (PSU's). Therefore, some of the PSU's were combined for the 1986 LSOA reinterview file. The combination preserved the sample design, including the ability to make estimates for regions and for metropolitan and non-metropolitan areas, and was designed to yield an expected 10 sample persons in each of the pseudo-PSU's used to estimate variances.

#### IV. The 1987 Decedent Follow-up

The 1986 reinterview yielded the information that 604 sample people had died since the 1984 SOA interview (including the 46 identified from the NDI match to 1984 deaths). The CATI interview asked only the date and place of death for these people. Because other information, especially about use of nursing homes, was wanted, a follow-up was conducted with the sample person's named contact or the household respondent. This follow-up was also by telephone but, because the number in the sample was small and the sample would not need to be updated for future contact, it was done using paper questionnaires rather than CATI. It was conducted by the Bureau of the Census in January 1987 after the files from the CATI and mail questionnaires were complete.

The decedent follow-up interview had questions about hospitalizations and nursing home stays of the sample person prior to death. With these data, the history of inpatient care for the decedents was complete and comparable to the information that was obtained for the sample people still alive in 1986.

(Figure 5) Response rates to the decedent follow-up were also high. They were actually higher than we had hoped for. We were asking about events, perhaps painful to recall, that had occurred much earlier; 128 of the people had died in 1984 and 251 had died in 1985.

#### V. Record Linkage

The LSOA protocol includes matching with the National Death Index, the computerized records of deaths in the United States maintained by the National Center for Health Statistics, and matching with the Medicare Part A (hospital@ files maintained by the Health Care Financing Administration.

##### A. National Death Index match

The NDI match provides information about the date and place of death for the entire LSOA study sample - not just those who were in the reinterview sample. After the NDI match, copies of the death certificates, which are needed to ascertain the cause of death, are obtained from registrars for the people who are

presumed to have died according to the match criteria.

Merging the mortality data with the data from the NHIS and the SOA for the entire sample of 16 thousand people will provide the opportunity to estimate mortality rates for social, demographic, and other characteristics that are not available from death certificates. Merging the mortality data with the 1986 (and subsequent) LSOA reinterview data for the 5 thousand people on changes in functional status, living arrangements, marital status, and medical care use experience will provide the opportunity for studying changes prior to death.

#### B. Medicare Match

The Medicare Part A (hospital) match is for people who were age 65 and over in 1984. It will add information about hospitalizations, including data on diagnoses, surgical procedures, and charges. Health Insurance Claim numbers were obtained as part of the 1986 reinterview to improve the match for the older members of the sample.

#### VI. Data Release

The LSOA is being conducted by the National Center for Health Statistics and the National Institute on Aging for the use of the entire research community. All data files will be available as soon as possible after the data have been collected, edited, and linked to the main files.

There will eventually be at least two LSOA files.

(1) One is based on the people selected for reinterview in 1986. It will contain the information from the 1984 surveys, the reinterview surveys, the NDI and Medicare linkages, and the death certificates. It will be updated and released annually.

The first version of this file, The 1986 Longitudinal Study of Aging Public-Use File, was released at the Public Health Conference on Records and Statistics in July 1987 (7,8).

(2) A second file will be based on the entire SOA sample. It will contain the same data from the 1984 files and data from the NDI matches and the death certificates as the first file, but there will be no reinterview data. The first release will not be until there are five years of NDI matches, when there should be enough deaths of the younger population for analysis.

(3) There may be other files if there are follow-up surveys of other populations. For example, the SOA was designed to obtain a great deal of information about retirement and the ability to work. If there is a follow-up reinterview of these younger persons to determine what they actually did as they approached retirement age, those files will be released just as the 1986 Reinterview was.

#### VII. Conclusions

Our experience with the LSOA indicates that: The supposedly hard-to-interview elderly population is responsive to telephone interviewing. Mail recontact is also needed to reduce bias.

Longitudinal study of this population is enhanced and richly productive if such study uses multiple sources and methods for collecting the relevant data.

It is essential to use proxy respondents if the sample person is unable to respond. Failure to do so introduces major biases since all evidence is that the proxies are responding for the sickest members of the population.

Sending the advance letter to the sample person by name, including the topics with the letter, the shortness of the interview, the concerted effort to trace people, and the use of the Bureau of the Census for collecting the data contributed to the high response rates.

#### References:

1. Goldstein, H.: The Design and Analysis of Longitudinal Studies Their Role in the Measurement of Change, Academic Press, London, 1979, pp. vii.
2. National Center for Health Statistics, M.G. Kovar and G.S. Poe: The National Health Interview Survey Design, 1973-84, and Procedures, 1975-83. Vital and Health Statistics. Series 1, No. 18. DHHS Pub. No. (PHS) 85-1320. Public Health Service. Washington. U.S. Government Printing Office, August 1985.
3. National Center for Health Statistics: Users Manual, The National Death Index. DHHS Pub. No. (PHS) 81-1148. Public Health Service. Hyattsville Md. U.S. Government Printing Office, Sept. 1981.
4. National Center for Health Statistics, J.E. Fitti and M.G. Kovar: Supplement on Aging to the 1984 National Health Interview Survey. Vital and Health Statistics. Series 1, No. 21. DHHS Pub. No. (PHS) 87-1323. Public Health Service. Washington. U.S. Government Printing Office, July 1987.
5. Herzog, R., W.L. Rogers, and R.A. Kulka: Interviewing Older Adults: A Comparison of Telephone and Face-to-face Modalities. Public Opinion Quarterly. Vol. 47, pp.405-418, 1983.
6. Kovar, M.G. and J.E. Fitti: A linked Follow-up Study of Older People, Proceedings of the American Statistical Association, Section on Survey Research Methods, 1985.
7. Kovar, M.G.: The Longitudinal Study of Aging: The 1986 Reinterview Public-use File, Proceedings of the 1987 Public Health Conference on Records and Statistics, July, 1987.
8. Kovar, M.G.: The Longitudinal Study of Aging: Some Estimates of Change Among Older Americans, Proceedings of the 1987 Public Health Conference on Records and Statistics, July, 1987.

Figure 1

## The Longitudinal Study of Aging

1984 NHIS Core --->	S O A	<---	Health Insurance Supplement
	(16,148)		
	L S O A		
<b>Full Sample</b>		<b>Reinterview Samples</b>	
	Year	Activity	
	1986	Reinterviews (5,151)	
	1987	Medicare Match 1984-86	
NDI Matches	1988	Reinterviews (?)	
Death Certificates	1988	Reinterviews (?)	
Deaths in 1984-90	1999	Medicare Match 1987-88	
	1990	Reinterviews (?)	
	1991	Medicare Match 1989-90	
1992	Last NDI match		
1994	Last Public-Use File		

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SOURCE: NCHS, Longitudinal Study of Aging

Figure 2

## The 1986 LSOA Reinterview Sample

	SOA	LSOA	
	Number	Number	Percent
Total	7,541	5,151	68.3
Age in 1984			
70-79 years	5,446	3,061	56.2
80 years and over	2,095	2,090	99.8
Race			
White	6,891	4,535	65.8
All other	650	616	94.8
Black	563	560	99.5
Other	87	56	64.4

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SOURCE: NCHS, Longitudinal Study of Aging, 1986

Figure 3

## Response to the 1986 LSOA Reinterview

	Number	Percent
Total	5,151	100.0
Status known	4,734	91.9
Alive	4,130	80.2
Live alone	1,597	31.0
Live with others	2,323	45.1
Live in institution	192	3.7
Not reported	18	0.3
Deceased	604	11.7
Not located	417	8.1

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Note: Some who were not located will be located through NDI matches.  
SOURCE: NCHS, Longitudinal Study of Aging, 1986

Figure 4  
**Response Status of 1986 LSOA Reinterview Sample  
 by 1984 Characteristics**

Characteristics in 1984	Total	Response status in 1986			
		<u>Located</u>			Not Located
		Total	Deceased	Alive	
		Number			
	5,151	4,734	604	4,130	417
		Percent			
Total	100.0	100.0	100.0	100.0	100.0
Age 80 and over	40.6	40.5	<b>59.9</b>	37.7	41.5
Male	36.0	36.3	<b>48.0</b>	34.6	33.1
White	88.0	88.3	90.2	88.1	84.6
Lived alone	38.9	36.6	30.3	37.5	<b>45.6</b>
No telephone	3.2	3.5	3.1	2.4	<b>11.3</b>
With ADL difficulty	28.8	29.1	<b>51.2</b>	25.9	32.1

SOURCE: NCHS, Longitudinal Study of Aging, 1986

Figure 5  
**Response Status of 1987 LSOA Decedent Follow-up**

	<u>Number</u>	<u>Percent</u>
Total	604	100.0
Interviews	548	90.7
Telephone	526	87.1
Mail	22	3.6
Refusal (telephone)	23	3.8
No contact	33	5.5

SOURCE: NCHS, Longitudinal Study of Aging, 1987