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Bureau of the Census
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MEMORANDUM FOR Thomas C. Walsh
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Subject: Source and Reliability Statement for the Long Term Care Survey (LTC)

Attached to this memorandum is the source and reliability statement for the 1982 LTC. This statement should accompany copies of the LTC public use file.

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SOURCE & RELIABILITY STATEMENT FOR THE LONG TERM CARE SURVEY

SOURCE OF DATA

The data were obtained during the period June through September 1982 from the Long Term Care Survey (LTC) conducted by the Bureau of the Census. The LTC collected data primarily on the health of the civilian noninstitutionalized population 65 years and over. Each sample person was asked a series of questions designed to identify persons having certain disabilities or other health problems lasting three months or longer. The identified persons were designated for detailed interviews regarding their impairments, treatment, personal care, financial arrangments for care and treatment, and other subjects.

The LTC sample of persons was selected through a series of five steps described below.

1. Selection of Medicare Enrollees

Persons eligible for the LTC sample (i.e., noninstitutionalized, civilians of age 65 and over) were selected from files maintained by the Health Care Financing Administration. These files covered most of the desired population; undercoverage is discussed below. In most areas, a 10 percent sample of Medicare enrollees as of December 31, 1981 was selected from a December 1981 Medicare file. The sample was updated with a 10 percent sample of persons added to the file from January 1 through March 31, 1982. In areas with no December sample, a 50 percent sample was selected from all persons on the March file. The initial sample described here was selected in order to reduce the amount of processing required during the rest of the sample selection. The 50 percent sample was selected only in areas thought to require a sampling fraction greater than 10 percent.

2. Selection *of* A-sample PSUs

To reduce costs, the LTC sample was clustered in primary sampling units (PSUs) that consisted of individual counties or groups of adjoining counties. The sample of PSUs for the LTC was selected from the Census Bureau's A-sample of PSUs. The A-sample of PSUs was selected for use in a number of the Census Bureau's ongoing current surveys, including the Current Population Survey and the Health Interview Survey. Selection *of* the A-sample was as *follows.*

Prior to selecting the A-sample, the entire land area of the United States was divided Into 1924 PSUs. 'The PSUs were grouped into 376 strata based on criteria including geographic region, level of urbanization, percentage of **population that is nonwhite, and per capita retail sales. One PSU was selected** from each stratum. A PSU's selection probability was-equal to its 1970 population as a proportion of the total 1.970' population in its stratum.

One hundred fifty-six strata consist of but one PSU; these are called selfrepresenting (SR) PSUs. Each of the remaining 220 strata contain a number of nonself-representing (NSR) PSUs.. As mentioned above, one sample NSR PSU was selected from each of these Z20 strata.

3. Selection of LTC PSUs

Before a subsample of A-sample PSUs was selected for the LTC, some A-sample PSUs were combined to form LTC PSUs. This was done so that as many LTC PSUs as possible consisted of whole counties or groups of whole counties, thus facilitating the use of Medicare files, which have counties as their most detailed level of geography. Most LTC PSUs consisted of just one A-sample PSU.

For the LTC, A-sample strata were collapsed to form 173 LTC strata. Thirty-nine of the strata consisted of only one A-sample PSU. Each had a 1978 Medicare population of 87,000 or greater. These are called LTC SR PSUs. The remaining LTC PSUs were grouped to form 134 strata according to their proportions of population 65 years and older and enrolled in Medicare.

Each of the remaining

134 strata contained an estimated Medicare population of about 90,000. A stratum's Medicare population was estimated by inflating its A-sample PSUs' Medicare populations by the inverse of their probabilities of selection for the A-sample and summing those estimates. One LTC PSU was selected from each stratum with probability proportional to its A-sample stratum's estimated 1978 Medicare population. These sample PSUs are called LTC NSR PSUs.

4. Selection of Medicare Enrollees for Screening

Once the LTC sample PSUs were selected, the initial sample of Medicare enrollees was reduced by eliminating all those who lived outside the 173 LTC sample PSUs. The file was sorted into four age (as of March 31, 1982) strata (65-74, 75-79, 80-84, 85+). The first and second age groups were then sorted into substrata by the original reason for Medicare entitlement (age, disability). All strata were subsampled at the same rate, ensuring proportional representation of persons by age and, as much as possible, by original reason for entitlement. The original reason for entitlement was not known for persons over 79 years of age. Therefore it was not possible to ensure proportional representation for this variable for such persons. The sample was reduced to approximately 55,000 persons.

Within each LTC PSU, the sampling rate was inversely proportional to the LTC PSUs' probability of selection. That is, the product of the within-PSU probability of selection and the probability of the PSUs being selected was equal to a constant. The constant is the overall probability of selection which is the same for each sample person.

5. Sample Reduction

The initial LTC sample of about 55,000 persons was systematically divided into 101 reduction groups. **Ultimately, 66 reduction groups were retained in the** sample, resulting in a sample of about 36,000 persons.

A large sample was chosen initially because 6,000 detailed interviews were desired and the exact rate at which persons would qualify for the detailed interview was unknown. This was primarily due to the fact that the LTC definition of impairment was not identical to that used in previous surveys.

Of the 36,000 persons designated for screening interviews, about 2,600 persons were found to have been deceased or institutional ized when the sample was drawn or ineligible for sample for some other reason. Approximately 1,300 persons were eligible for interviews but interviews were not obtained because the persons had become deceased or institutionalized since the sample was drawn or could not be located or were unavailable for some other reason. About 6,400 persons qualified for detailed interviews; approximately 300 of these persons refused to be interviewed or were unavailable for some reason.

Persons 65 years and over who are not Medicare enrollees are missed by the sampling frame. This undercoverage is estimated to be no more than 3.7 percent of the population of interest. Undercoverage varies by age, race, and sex. Generally, undercoverage is greater for black persons less than 85 years old than for the corresponding nonblack persons; and for either race, is greater for those less than 70 years than for those 70 years and over. Bias due to undercoverage is partially corrected for by post-stratification, described later.

ESTIMATION

The estimation procedure used in this survey involved several stages of weight adjustments. Each interviewed person received a screener weight and, if the person screened in (i.e., qualified for detailed interview), LTC-3 weights both with and without ratio adjustments. The LTC-3 interview is for those who screened in because of impairments reported during the screening interview.

Screener Weights

Each interviewed person received a final screener weight equal to the product of:

base weight screener noninterview adjustment factor first-stage ratio estimate factor second-stage ratio estimate factor

The final weight should be used for analyses.

The base weight is the inverse of a person's probability of selection. Al 1 persons were assigned equal base weights. based on the fact that all *had an* equal probability of selection.

Each interviewed person also received an "unbiased'l weight equal to the base weight times the screener noninterview adjustment factor. This weight will generally not be used. The unbiased screener weight is located in characters 223 through 234 on the LTC-2 user file and in characters 1285 through 1296 on the LTC-3 user file.

The final screener weight is found in characters 337 through 348 on the LTC-2 user file and in characters 1297 through 1308 on **the** LTC-3 user file.

lThe term 'unbiased" is not technically correct; a true unbiased weight would equal the base weight.

Two broad classes of screener noninterviews were encountered during the LTC. Type C noninterviews were persons who did not belong in-the LTC universe and were therefore not adjusted for. The universe consisted of persons in the scope of the LTC on the date of sample selection, April 1. 1982. Type C noninterviews then were those persons who were selected for the sample but who actually were deceased or institutionalized or had moved outside the country before that date. Type A noninterviews were persons who belonged in the LTC -universe and thus were adjusted for. Specifically, type A noninterviews were persons who refused to be interviewed, could not be contacted or located, or could not respond, or who became deceased or institutionalized or moved outside the country after April 1, 1982.

Each screened person's weight was adjusted to account for type A noninterviews. Noninterview adjustment was done by cells defined by age, original reason for Medicare entitlement, and LTC PSU. Cells were often collapsed over a number of LTC PSUs to provide enough cases to yield reliable noninterview adjustment factors. Cells were never collapsed over ages or original reasons for entitlement.

A first-stage ratio estimate factor was applied to the weight of each person in an LTC NSR PSU to account for the LTC NSR PSUs' not having population distributions identical to those of the strata from which they were selected. This adjustment provides lower variance of the estimates. Factors were applied according to Census region (Northeast, North Central, South, West), whether a person resided in a Standard Metropolitan Statistical Area (SMSA), and age.

Finally, each person received a second-stage ratio estimate factor causing the weighted number of sample persons to agree with independent estimates of the total civilian noninstitutional population of the United States on August 1, 1982 by age, race, and sex. These independent estimates are based on civilian noninstitutional population controls from Decennial Censuses and statistics on births, deaths, immigration, and emigration. The independent estimates used for this survey were derived from the 1980 Census of Population and were adjusted for population changes between Census Day (April 1, 1980) and August 1, 1982.

LTC-3 Weights

Each person who screened in and completed the LTC-3 interview received two LTC-3 weights.

The final LTC-3 weight equals the product of the final screener weight and LTC-3 noninterview adjustment factor P. Thi - s weight is to be used for analyses.
The unbiased LTC-3 weight equals the product of the base weight, screener noninterview adjustment factor and LTC-3 noninterview adjustment factor #2.
The two LTC-3 noninterview adjustment factors are described further below.

The final LTC-3 weight is found in characters 1309 through 1320 of the LTC-3 user file. The unbiased LTC-3 weight is found in characters 1321 through 1332 of the LTC-3 user file.

LTC-3 noninterviews; are persons who refuse to be interviewed, are unable to respond, or cannot be located, or who become deceased or institutionalized or move outside the country after the screener was completed. All LTC-3 noninterviews are type A noninterviews, since all persons eligible for the LTC-3 interviews were screened and therefore must have been members of the LTC universe.

LTC-3 noninterview adjustment factor 11 was c - omputed using final screener weights and was defined by residence (residing in an SMSA or not), Census region, and type of impairment reported during the screening interview.

LTC-3 noninterview adjustment factor #2 was computed using unbiased screener weights and was defined for the same cells as was LTC-3 noninterview adjustment factor #1.

RELIABILITY *OF THE ESTIMATES*

Since the LTC estimates are based on a sample, they may differ somewhat from the figures that would have been obtained if a complete census had been taken-using the same questionnaires, instructions, and enumerators. There are two types of errors possible in an estimate based on a sample survey: sampling and nonsampling. The standard errors primarily indicate the magnitude of the sampling error. They-also partially measure the effect of some nonsampling errors in response and enumeration, but do not measure any systematic biases in the data. The full extent of nonsampling error is unknown. Consequently, particular care should be exercised in the interpretation of figures based on a relatively small number of cases or on small differences between estimates.

Nonsampling variability. Nonsampling errors can be attributed to many sources; e.g., inability to in information about all cases in the sample, definitional difficulties, differences in the interpretation of questions, inability or unwill ingness of the respondents to provide correct information, inability to recall information, errors made in collection such as in recording or coding the data, errors made in processing the data, errors made in estimating values for missing data, and failure to represent all persons with the sample (undercoverage).

An error in creating the sampling frame caused Railroad Retirement beneficiaries in 14 counties to have no chance of selection Railroad Retirement beneficiaries aged 65 years through 65 years and 3 months at the time of selection were given no chance of selection in the remaining sample areas. This omission resulted in a bias of less than 0.2 percent in survey estimates of the total population age 65 and over. Bias could be greater for other estimates.

Besides the above error, undercoverage in the LTC results from persons missed in the sampling frame as described above. It is known that undercoverage varies by age, race, and sex. Ratio estimation to independent age-race-sex population controls, as described previously, partially corrects for the bias due to survey undercoverage. However, biases exist in the estimates to the extent that, in a given age-race-sex group, missed persons have different characteristics than interviewed persons. Further, the independent population controls used have not been adjusted for undercoverage in the Decennial Census.

Sampling variability. The standard errors given in tables 1 -and 2 are primarily measures of sampling variability; that is, of the variation that occurred by chance because a sample rather than the entire populat io n was surveyed. The sample esti mate and its standard error enable one to construct confidence intervals - ranges" that would Include the average result of all possible samples with a known prob ability. For example', if all possible samples were selected, each of these being surveyed under essentially the same general conditions and using the same sample design, and if an estimate and Its standard error were calculated from each sample, then:

1. Approximately 68 percent *of* the intervals from one standard error below the estimate to one standard error above the estimate would include the average result of all possible samples.

2. Approximately 90 percent of the intervals from 1.6 standard errors below the estimate to 1.6 standard errors above the estimate would include the average result of all possible samples.

3. Approximately 95 percent *of* the intervals from two standard errors below the estimate to two standard errors above the estimate would include the average result *of* all possible samples.

The average estimate derived from all possible samples either is or is not contained in any particular computed interval. However, for a particular sample, one can say with a specified confidence that the average estimate derived from all possible samples is included in the confidence interval.

Standard errors may also be used to perform hypothesis testing - a procedure for distinguishing between population parameters using sample estimates. The most common types of hypotheses are 1) the population parameters are identical and 2) they are different. An example of this would be comparing the number of persons impaired in their activities of daily living (ADL) to those limited in their instrumental activities of daily living (IADL). Tests may be performed at various levels of significance, where a level of significance is the probability of concluding that the parameters are different when, in fact, they are i dentical.

Note when using small estimates. Because of the large standard errors involved, there is little chance that summary measures would reveal useful information when computed on a base smaller than 115,000. Estimated numbers appear in table I however, even though the relative standard errors of these numbers are larger than those for corresponding percentages. These smaller estimates are provided primari, to permit such combinations of the categories as serve each user's needs.

Table 1. Standard Errors of Estimated Numbers

Numbers in thousands)

Size of Estimate	Standard	Size of Error I/	Standard Estimate	Error I/
25	*5.1*	*1,000*	*31.4*	
SO	*7.2*	*2,000*	*43.5*	
100	*10.1*	*3,000*	*52.1*	
250	*15.9*	*4,000*	*58.8*	
Soo	*22.4*	*519000*	*64.2*	
750	*27.3*			

I/These values must be multiplied by the appropriate "f" factor in **table** 3 to **obtain the correct standard error.**

Standard error tables and their use. A number of approximations were required to derive standard ,errors that would apply to a large number of estimates and that could be prepared at a moderate cost. Therefore, instead of providing an individual standard error for each estimate, generalized sets of standard errors are provided for various types of characteristics. As a result, the sets of standard errors provided give an indication of the order of magnitude of the standard error of an estimate rather than the precise standard error.

The figures presented in tables 1 and 2 are approximations to standard errors of various estimates for persons in the United States. Estimated standard errors for specific characteristics cannot be obtained from tables I and 2 without the use of the "f" factors in table 3. These factors must be applied to the generalized standard errors to adjust for the combined effect of the sample design-and the estimating procedure on the value of the characteristic.

Table 2. Standard Errors of Estimated Percentages of Persons

Base of estimated percentage (thousands)	Estimated percentage				
50					
2 or 98		5 or 95	10 or 90	25 or 75	0
25	2.8	4.4	6.1	8.8	10.11
50	2.0	3.1	4.3	6.2	7.2
100	1.4	2.2	3.0	4.4	5.1
250	0.9	1.4	1.9	2.8	3.2
500	0.6	1.0	1.4	2.0	2.3
750	0.5	0.8	1.1	1.6	1.8
1000	0.4	0.7	1.0	1.4	1.6
2000	0.3	0.5 -	0.7	1.0	1.1
3000	0.3	0.4	0.6	0.8	0.9
4000	0.2	0.3	0.5	0.7	0.8
50 00	0.2	0.3	0.4	0.6	0.7

1/These values must be multiplied by the appropriate Of" factor in table 3 to obtain the correct standard error.

Standard errors for intermediate values not shown in the generalized tables of standard errors may be approximated linear interpolation

Two parameters, "a* and "b" are used to calculate the standard errors for each type of characteristic - they are presented in table 3. The values of a and b are determined by fitting curves of variances in terms of estimates, i.e., by treating the variance of an estimate as a function of the estimate itself. This procedure is useful because It tends to produce a smoothing effect on the variance estimates and, perhaps more importantly, because It enables the analyst to quickly compute variance estimates for any item of interest whereas It would clearly be impossible to publish variance estimates for every possible item of interest.

The a And b parameters were used to calculate the standard errors in tables I and 2 and to calculate the "f" factors in table 3. They also may be used to directly calculate the standard errors for estimated numbers and percentages, as explained in the following sections.

Standard <u>errors of estimated</u> numbers. The approximate standard error, Sx, of an estimated number can be obtained in two ways. It may be obtained by use of the formula

Sx - fS

where f Is the appropriate "f' factor from table 3, and S is the standard error on the estimate obtained from table 1. Alternatively, it may be approximated by using formula (2), from which the standard errors in table 1 were calculated. Use of this formula will provide more accurate results than the use of formula M.

x V TX-71 -, + bx (2)

Here x is the size of the estimate and a and b are the parameters in table 3 associated with the particular type of characteristic.

<u>Standard errors of</u> estimated <u>percentages.</u> The reliability of an estimated percentage, computed using sample data Tor both numerator and denominator, depends upon both the size of the percentage and the size of the total upon which this percentage is based. Estimated percentages are relatively more reliable than the corresponding estimates of the numerators of the percentages, particularly if the percentages are 50 percent or more. When the numerator and denominator of the percentage are in different categories, use the Of* factor or parameters from table 3 indicated by the numerator. The approximate standard error, S(X.P). of an estimated percentage can be obtained by use of the formula

S(X.P) - f S (3)

In this formula, f is the appropriate factor from table 3 and S is the standard error on the estimate from table 2. Alternatively, it may be approximated by using formula (4) from which the standard errors in table 2 were calculated. -Use of this formula will give more accurate results than use of formula (3).

S(X.P) - 4~Tp (100 P) (4)

x

Here x is the size of the subclass of persons which is the base of the percentage, p is the percentage (O<p<100), and b is the parameter in table 3 associated with the particular type of characteristic in the numerator of the percentage.

Illustration of the use of standard error tables. According to the LTC there were 1,190,764 aged persons requiring personal help bathing in 1982. Table 1 shows the standard error of an estimate of this size to be approximately 33,700. In this situation no or' factor has to be applied to the standard error, i.e., f is equal to 1.0. Alternatively, using the parameters in table 3 in formula (2), the standard error is computed as

Sx (-.00004027)(1,190.764)2 -t- (1025)(1,190,764)

34,109

Table 3. "am and "b" Parameters and "f" Factors for Computing Approximate Standard Errors of Estimated Numbers and Percentages of Persons

Characteristic	Parameters a	Parameters b	"f" factor
-87a-cKpersons or persons receiving medicaid	-.000082271	2094	1.4
All other	-.00004027	1025	1

The 68 percent confidence interval as shown by the data is from 1,156,655 to 1,224,873. Therefore, a conclusion that the average estimate derived from all possible samples lies within a range computed in this way would be correct for roughly 68 percent of all possible samples. Similarly, we could conclude with 95 percent confidence that the average estimate derived from all possible samples lies within the interval from 1,122,546 to 1,258,982 using twice the standard error.

Of the 628,472 persons requiring personal help in toileting or feeding, 13.6%. were black. Table 2 shows the standard error of 13.6 percent on a base of 628,472 to be approximately 1.9 percent. (An "f" factor of 1.4 was applied here.)

Alternatively, this standard error could have been derived by using the "b" parameter for black persons (table 3) in formula (4).

Consequently, the 68 percent confidence interval as shown by these data is from 11.7 to 15.5 percent, and the 95 percent confidence interval is from 9.8 to 17.4 percent.

Standard error of a difference. For a difference between two sample estimates the standard error is approximately equal to

S ₗₙV 5i + 5Y - zP5x5y9

X-Y x y

where Sx and SY are the standard errors for the estimates x and y (from tables I through 3). respectively. The estimates Can be numbers, percents, ratios, etc. The correlation coefficient p is not generally available and can be assumed to equal zero. Making this assumption will result in accurate estimates of standard errors for the difference between two estimates of the same characteristic in two different areas, or for the difference between separate and uncorrelated characteristics in the **same area.** If, however, there is a high positive (negative) correlation between the two characteristics, the formula will- overstate (understate) the true standard error.

Illustration of the computation of the standard error of a difference in estimates. LTC estimates show the number of 65-74 year old persons requiring personal help in toileting or feeding was 229,213 and the corresponding number of 75-79 year olds was 19,544. The apparent difference is 109,669. The standard error on the

-estimate 229,213 is 15,259 and the standard error on the estimate 19,544 is 10,580

.(both computed using formula (2)). The correlation coefficient in this case Is known to equal zero. The standard error associated with the estimated difference of 109,669 is 18,568.

This means that the 68 percent confidence interval around the 109,669 difference .is from 91,101 to 128,237, i.e., 109,669 + 18,568. A conclusion that the average estimate of the difference derived from all possible samples lies .within a range computed in this way would be correct for roughly 68 percent of all possible samples. Thus, we can conclude with 68 percent confidence that the number of 65-74 year old persons requiring personal help in toileting or feeding is greater than the number of 75-79 year old persons requiring personal help in toileting or feeding.