

1994 LTC Cross-Sectional Estimates: Source and Accuracy Statement

I. SOURCE OF DATA

The 1994 Long-Term Care Survey (LTC) was conducted during the period June 6, 1994 through September 30, 1994 by interview from the U.S. Bureau of the Census. The 1994 LTC was designed to collect data regarding the health and function of the U.S. population age 65 years and older. The 1994 survey contacted persons from the 1982, 1984 and/or 1989 survey plus an additional sample of persons who reached age 65 between April 1988 and April 1994, and an additional sample of persons aged 95+ as of April, 1994. Sample persons defined as unimpaired in the 1989 LTC survey or newly selected for the 1994 LTC survey were asked a series of screening questions. The questions were designed to identify persons who, at the time of the 1994 LTCS, had certain disabilities or health problems lasting three months or longer. Those newly identified as "impaired" persons and all other sample persons previously identified as impaired (those impaired or institutionalized in 1982, 1984, and/or 1989) were assigned to detailed interviews involving the person's impairments, personal care, treatment, financial arrangements for care and treatment, and other subjects. Also, for the first time, a sample of "healthy" persons were given detailed interviews to provide data on unimpaired, noninstitutionalized persons age 65 and over. Persons identified as impaired or institutionalized in 1989 were given a partial screener instead of a full screener that updated their address and determined if the person was still in scope. To be defined as out of scope, sample persons must have been deceased, in jail, or living outside the survey areas. Note that impaired or institutionalized persons still in scope received detailed interviews in 1994 LTC regardless of changes in medical condition (i.e. no longer impaired or institutionalized).

The definition of persons in scope for the 1989 and 1994 LTC survey were the same. For both, data was collected on the health of the institutionalized and noninstitutionalized population, but not for deceased persons. This is in contrast to the 1984 LTC where data was retrospectively collected from the next of kin for deceased persons. Three changes did take place from the 1989 LTC survey to the 1994 LTC survey. First the 1994 survey did not include a survey of caregivers which was part of the 1989 survey. Second, administering detailed interviews to a sample of "healthy" persons was new to the 1994 LTCS. Third, an over sample of persons aged 95+ was drawn for the 1994 LTCS.

II. SAMPLE SELECTION

The sample for the 1994 LTC survey consisted of a total of 19,171 Medicare enrollees divided into seven components. "Screened-in" persons were those from the selected sample who were actually eligible to receive a detailed interview following the screener. Five of the seven components came from the 1984 or the 1989 LTC sample and constituted the "longitudinal" portion with the following 13,631 persons:

- All 2,701 persons assigned a detailed community interview in the 1989 LTC round (screened-in as impaired noninstitutional in 1989);
- All 395 person assigned a detailed institutional interview in the 1989 LTC round (screened-in as institutional in 1989);
- A subsample of 4,500 persons selected from those screened-out of the 1989 LTC sample (i.e., unimpaired noninstitutional who, therefore, were not assigned a detailed interview in the 1989 round);
- All remaining 2,528 persons aged 75 years and older (before April 1, 1994) among the 1989 screened-out persons not selected in the above component;

- All 3,507 screened-out (unimpaired noninstitutional) persons from the 1984 LTC sample who were not selected for the 1989 round (all under 75 years of age in 1989).

The sixth component was the "aged-in" component consisting of:

- A sample of 5,000 Medicare persons who reached their 65th birthday on or after April 1, 1988 and before April 1, 1994.

The seventh component corresponded to the "95+ supplement" consisting of:

- A supplemental sample of 540 persons 95 years of age and older selected from a Medicare maintained subfile.

At the same time, a subsample of 1,762 persons was selected from the 18,236 persons in five of the above components (excluding institutionalized and 95+) and designated a priori to receive a detailed interview even if determined by the screener to be unimpaired and noninstitutional. This group was known as the "healthy" component. (Normally, persons determined by the screener to be unimpaired and noninstitutional would not have been interviewed further.)

The LTC interviewing involved first a screener questionnaire, which determined if the sample person "screened in", that is, was eligible for a detailed interview. The detailed interview began with a control card where it was determined which of the two "detailed" questionnaires would be administered: either the institutional questionnaire or the community questionnaire.

The screener determined eligible persons as follows. The sample person identified could not be deceased, in a correctional facility, or living outside the survey area (if so, no interview was conducted). First, a determination was made as to whether the sample person was in an institution or not. Those in institutions were screened "in" at that point for the detailed interview and those not in institutions were checked further. The next check separated out those who were given detailed interviews in 1989 and, for that reason, were only supposed to receive a partial screener in 1994. This group was thus screened "in" at that point while the full screener interview continued for the others. The latter were asked a series of questions aimed at determining impairment status. Those who were determined to be impaired were screened "in" at that point while the unimpaired went through one more check. In this final check, those among the unimpaired who were designated in the healthy subsample were screened "in". The remaining unimpaired, those without the "healthy" designation, received no detailed interview, that is, were screened "out".

If sample persons died after their screener interview but before their detailed interview, they should be treated as interviewed for the screener weighting and as ineligible and noninterviewed for their detailed-interview weighting. Those deceased before the screener interview should be treated as out-of-scope and designated as noninterviewed. The following is a discussion on each component of the 1994 LTC:

A. Automatic "Screened-In"

The 2,701 surviving Medicare enrollees assigned detailed community interviews in the 1989 LTC and the 395 surviving Medicare enrollees assigned detailed institutional interviews in the 1989 LTC were given a partial screening. Enrollees were then automatically assigned their respective detailed interviews in the 1994 LTC due to the longitudinal aspect of the survey.

B. Unimpaired Medicare Enrollees (1989)

First a systematic sample of 4,500 Medicare enrollees were selected from 8,873 surviving Medicare enrollees defined as unimpaired in 1989. They were selected across all ages using a sampling interval of 1.97. If unselected, all Medicare enrollees unimpaired in 1989 and 75 years or older as of April 1, 1994 were placed in the sample. This selection brought an additional 2,528 Medicare enrollees into the 1994 sample.

C. Unimpaired Medicare Enrollees (1984)

This included persons who were initially defined as unimpaired from the 1984 LTC and who were not subsampled back into the 1989 LTC (i.e., not systematically sampled and not 75 years of age in 1989). All persons meeting these criteria were included for an additional 3,507 Medicare enrollees.

D. 'Aged-In' Component

(Selection of the sample follows closely the steps outlined in the February 4, 1992 memorandum from Waite to Courtland "Source and Accuracy Statement for the 1989 Long-Term Care Survey (I-TC)".)

1. Medicare Enrollee Selection

The 5,000 Medicare enrollees who turned age 65 on or after April 1, 1988 and before April 1, 1994 (including institutionalized and noninstitutionalized persons 65 and over) were selected from files maintained by the Health Care Financing Administration (HCFA). These files covered most of the desired population; undercoverage was dealt with as described below.

Most sample areas had an initial 10 percent sample taken from a March 1994 file, which contained Medicare enrollees who turned 65 between April 1, 1988 and April 1, 1994 and were alive as of March 1, 1994. Initial 50 percent samples were selected in areas thought to require sampling fractions greater than 10 percent. The initial sample described here was implemented to reduce the amount of processing required in the rest of sample selection.

2. Selection of LTC PSUs

The LTC sample is a subsample of the 1970 current survey A-design sample. An A-design PSU consists of a county or a group of contiguous counties. All counties in the entire United States are grouped into 376 A-design strata. One hundred fifty-six of the strata consist of only one PSU; these are called self-representing (SR) PSUs. The remaining 220 strata are formed from counties with a similar total 1970 census population and other characteristics such as SMSA presence, percent of population urban, percent of population with race as non-white, number of farms, and per capita retail sales. A PSU is then selected from each A-design stratum with probability proportional to its 1970 population. These 220 sample PSUs are called non-self-representing (NSR) PSUs.

For the LTC survey, the A-design strata are collapsed to form 173 LTC strata. Thirty-nine of the LTC strata consist of only one PSU. These PSUs are automatically included in the LTC sample and are called LTC self-representing (SR) PSUs. The remaining 134 LTC strata are formed by combining A-design strata with similar characteristics. The combining of A-design strata into LTC strata is based on the proportion of the population 65 years and older and enrolled in Medicare (referred to below as Medicare population) as estimated for the A-design sample PSU in each A-design stratum.

In each of the remaining 134 LTC strata with approximately equal Medicare populations, one A-design stratum is selected with probability proportional to its estimated 1978 Medicare population. The A-design sample PSU from that stratum is then selected as an LTC sample PSU. These sample PSUs are called LTC non-self-representing (NSR) PSUs.

3. Selection of Medicare Enrollees from LTC PSUs

Once the LTC sample PSUs were selected, the initial sample of Medicare enrollees was reduced by dropping all persons who lived outside the 173 LTC PSUs. The resulting Medicare file was then sorted into strata defined by original reason for Medicare entitlement (age, disability). Both strata were subsampled at the same rate to ensure proportional representation of persons by original reason for entitlement.

Within each sample 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 PSU's probability of selection was equal to a constant. That constant represented the overall probability of selection, which was equal for each sample person.

E. 'Age 95+' Supplement

The 540 persons 95 years of age or older on April 1, 1994 were selected from files maintained by HCFA. The file was edited so that persons already in the 1994 LTC were eliminated. Next persons deceased or outside LTC PSUs were removed from the file. A sample was then taken from this reduced '95+ eligible' subfile. Selection followed the same steps as the 'Aged-In' component except the subfile was not sorted into strata defined by original reason for Medicare entitlement. The reasoning was many persons 95+ may not have entered the Medicare system initially at age 65 since the system started in 1967 after those persons were already 65.

F. 'Healthy' Supplement

The universe for the healthy supplement included the Medicare enrollees in sample except the '95+' supplement and the automatic 'Screened-In' institutionalized. From the remaining 18,236 Medicare enrollees, a subsample of 1,762 persons was selected. These persons were designated before the survey to receive a detailed interview even if screened initially as noninstitutional unimpaired.

III. ESTIMATION

A. Summary

Each interviewed person received two final weights: a screener weight and a detailed-interview weight. The screener weights produce the national cross-sectional estimate of persons aged 65 and over while the detailed-interview weights or "detailed" weight produce estimates for the three major domains of interest: institutional persons, impaired noninstitutional persons, and unimpaired (healthy) noninstitutional persons. The screener weight was applied to all LTC sample persons interviewed with the screener questionnaire, screened-in as well as screened-out persons.

The final screener weight is the product of four factors: the screener base weight, the screener noninterview adjustment factor (NIAF), the first-stage (ratio estimate) factor, and the second-stage (ratio estimate) factor:

Screener Weight = Screener Base Weight x Screener NIAF x FSF x SSF

The detailed weight is applied only to the screened-in persons interviewed with the detailed questionnaire. It is different from the screener weight because it takes into account the differential probability that those in the "healthy" group had of being given a detailed interview and because it includes an additional NIAF for the detailed interview. The final detailed weight is the product of five factors:

Detailed Weight = Detailed Base Weight x Screener NIAF x FSF x SSF x Detailed NIAF

- Cross-sectional estimates for 1994 are to be made by summing weights as follows:
- The national cross-sectional estimate of persons aged 65 and over as of April 1994 will be obtained by summing screener weights.
- The estimate of institutional persons will be obtained by summing the detailed weights for those with an institutional questionnaire.
- The estimate of impaired persons not in institutions will be obtained by summing the detailed weights for those with a community questionnaire determined by the detailed interview to be impaired (regardless of impairment status at screening).
- The estimate of unimpaired persons not in institutions will be obtained by summing the detailed weights for those with a community questionnaire determined by the detailed interview to be unimpaired (regardless of impairment status at screening).
- The estimate of the subset of persons aged 95 and over for any of the above three domains will be obtained by restricting the summation of detailed weights only to persons who are 95 and over.

Regardless of their institutional or impairment status at the time they were selected or screened-in (either full screening or partial screening), for estimation purposes, individuals are assigned to the domain they are determined to belong to by the detailed interview. That is, they are assigned to the institutional, the impaired noninstitutional, or the unimpaired noninstitutional populations, based on the outcome of the detailed interview, regardless of their status when screened-in. However, their estimation weights properly reflect the original probability of being given the detailed interview, as determined by the screener.

B. Noninterview Adjustment Factors for Screener

Eligible Screener Noninterview Types

In 1994 estimates, the following types of screener noninterviews are to be adjusted for (that is, are to be included among the "eligible" persons in the target population which is divided into respondents and nonrespondents):

Personal Visit or Telephone Screening

Unable to locate/moved, address unknown
 No one home Sample person temporarily absent/proxy unavailable
 Refused

Sample person unable to respond/proxy unavailable
Other -- Specify

C. Ratio Estimate Factors

The ratio estimate factors represent ratio adjustments of the weights to known population totals. The first-stage ratio estimate factors adjust for differences between the characteristics of the LTC sample NSR PSUs (at the first stage of sample selection) and the population NSR PSUs, based on the census frame from which the PSUs were selected.

The first-stage factor for NSR LTC PSUs is calculated separately for each of 32 cells based on region, age group, and residence status. Sample persons in SR PSUs are given a first-stage factor of 1.0.

The second-stage factors represent ratio adjustments to adjust for the difference between weighted sample counts of persons and independent estimates of the total number of persons, within certain defined cells. For the population aged 85+ the independent estimates or "population controls" are projections based on the unadjusted 1990 Census population counts. Additional age detail was added for the 85+ population from Census estimates prepared by Day '93 and '96. The second-stage factors are computed separately for the institutional and noninstitutional population for each of 20 age x race x sex cells. Within each cell, the ratio of the independent population estimate to the weighted number of LTC sample persons is the second-stage ratio estimate factor.

The second-stage ratio estimate factors for the 1994 LTC estimates are based on an expanded definition for "Institutional" persons, first introduced with the 1989 estimates. This expanded definition is more consistent with the definition used in the population controls and, therefore, provides more accurate second-stage factors. The 1994 estimates are directly comparable with the 1989 estimates. To calculate alternative 1994 estimates for purposes of direct comparison to 1982 and 1984 estimates, the limited definition for 'Institutional' persons must be applied to the 1994 (and 1989) LTC survey. Specifications for these comparisons were described in the 1994 LTC Weighting Specifications for Cross-Sectional Estimates, Appendix A.

D. Noninterview Adjustment Factors for Detailed Questionnaire

Eligible Community and Institutional Noninterview Types

A noninterview adjustment factor was applied to the weight of each community and institutional interviewed person to adjust for the following types of noninterview. Other types of noninterview were considered ineligible cases.

For Community and Institutional Questionnaires:

- Unable to locate/moved, address unknown
- No one home
- Sample person temporarily absent/proxy unavailable
- Refused -- Institution
- Refused -- Sample person
- Sample person unable to respond/proxy unavailable
- Other -- Specify

IV. ACCURACY OF ESTIMATES

There are two types of errors possible in an estimate based on a sample survey: sampling errors and nonsampling errors. Standard errors (the square root of the variance) primarily indicate the magnitude of the sampling error. Since the LTC estimates are based on a sample, they may differ from the figures that would have been obtained if a complete census had been taken using the same questionnaires, instructions, and enumerators. 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.

A. Nonsampling Errors

Nonsampling errors can be attributed to many sources such as: inability to obtain information about all cases in the sample, definitional difficulties, differences in the interpretation of questions, inability or unwillingness 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).

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 younger than 85 years old than for the corresponding nonBlack persons; and for either race, is greater for those younger than 70 years than for those 70 years or over. Bias due to undercoverage is partially corrected for by post-stratification, described later.

The inability to obtain information for all cases in the sample has several causes. Of the 19,171 persons designated for screening interviews, there were 17,594 interviews, 651 eligible noninterviews, and 926 ineligible noninterviews (out-of-scope). These 926 persons were ineligible because they were deceased before April 1, 1994, were in a correctional facility, moved outside the survey area, or for some other reason. Interviews were not obtained for 651 persons who were eligible because these persons could not be located, refused to be interviewed, could not be found home, were temporarily absent, or were unable to respond and a proxy was unavailable. The noninterview rate is thus, excluding ineligible noninterviews, 651 over 18,245 or 3.568 percent.

The application of the screener resulted in 7,120 screened-in persons and 10,474 screened-out persons. Hence, there were 7,120 persons designated for detailed interviews. This included 1,377 persons in institutions and 5,743 persons not in institutions. For the community questionnaire, there were 5,089 interviews, 375 eligible noninterviews, and 279 ineligible noninterviews. Reasons for the eligible noninterviews were that persons: could not be located, were not at home, were temporarily absent and proxy was not available, refused to be interviewed were unable to respond and a proxy was unavailable, or some other eligible noninterview reason. The ineligible noninterviews were due to persons who were in a correctional facility, were deceased on or after April 1, 1994 but prior to the detailed interview, moved outside the survey area, or some other ineligible noninterview reason.

For the institutional questionnaire, there were 1,330 interviews, 9 eligible noninterviews, and 38 ineligible noninterviews. Reasons for eligible and ineligible institutional noninterviews were the same as those for the community questionnaire.

Besides the above error, undercoverage in the LTC results from persons missed in the sampling frame. 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.

B. Sampling Variability

The standard errors given in Tables 1-4 are primarily measures of sampling variability, that is, of the variation that occurred by chance because a sample, rather than the entire population, was surveyed. The sample estimate and its standard error enable data users to construct confidence intervals -- ranges that would include the average results of all possible samples with a known probability. 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 1 standard error below the estimate to 1 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 results of all possible samples.
3. Approximately 95 percent of the intervals from 2 standard errors below the estimate to 2 standard errors above the estimate would include the average results 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 the same, 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 the same.

C. 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 1-4 are approximations to standard errors of various cross-sectional estimates for persons in the United States. Standard errors for intermediate values not shown in these tables may be approximated by linear interpolation.

TABLE 1
Standard Errors for Estimated Counts of

Noninstitutionalized Persons
(in thousands)

Size of Estimate	Standard Error	Size of Estimate	Standard Error
25	6.2	1,000	36.0
50	8.7	2,000	45.5
100	12.3	3,000	48.4
250	19.2	4,000	45.9
500	26.6	5,000	36.9
750	31.9		

Use Table 1 to obtain standard errors for any 1994 estimated total of noninstitutionalized persons (for example, the total number of 65+ noninstitutionalized persons who are incontinent in 1994).

TABLE 2
Standard Errors for Estimated Counts of Institutionalized Persons
(in thousands)

Size of Estimate	Standard Error	Size of Estimate	Standard Error
25	5.2	1,000	35.8
50	7.2	2,000	46.3
100	10.1	3,000	48.2
250	15.1	4,000	45.6
500	19.1	5,000	36.7
750	20.4		

Use Table 2 to obtain standard errors for any 1994 estimated totals of institutionalized persons (for example, the number of 1994 institutionalized persons requiring personal help eating).

TABLE 3
Standard Errors for Estimated Percentages of Noninstitutionalized Persons

Base of Estimated Percentage (thousands)	Estimated Percentage				
	2 or 98	5 or 95	10 or 90	25 or 75	50
25	3.5	5.4	7.5	10.8	12.4
50	2.5	3.8	5.2	7.6	8.7
100	1.7	2.7	3.7	5.3	6.2
250	1.1	1.7	2.3	3.4	3.9
500	0.7	1.2	1.7	2.5	2.8
750	0.6	1.0	1.4	1.9	2.2
1000	0.5	0.9	1.2	1.7	1.9
2000	0.4	0.6	0.9	1.2	1.4
3000	0.3	0.5	0.6	1.0	1.2
4000	0.3	0.4	0.6	0.9	1.0
5000	0.2	0.4	0.5	0.7	0.9

Use Table 3 to obtain standard errors for the percentage of 1994 noninstitutionalized persons with a particular characteristic (for example, the percentage of noninstitutionalized persons who are ADL-impaired and IADL-impaired).

TABLE4
Standard Errors for Estimated Percentages of Noninstitutionalized Person

Base of Estimated Percentage (thousands)	Estimated Percentage				
	2 or 98	5 or 95	10 or 90	25 or 75	50
25	2.9	4.6	6.3	9.0	10.4
50	2.0	3.2	4.5	6.4	7.3
100	1.5	2.2	3.1	4.5	5.2
250	1.0	1.4	2.0	2.9	3.3
500	0.6	1.1	1.4	2.0	2.3
750	0.5	0.8	1.2	1.6	1.9
1000	0.4	0.7	1.0	1.4	1.6
2000	0.3	0.4	0.7	0.8	1.0
3000	0.3	0.4	0.5	0.8	1.0
4000	0.2	0.3	0.5	0.7	0.8
5000	0.2	0.3	0.4	0.6	0.7

Use Table 4 to obtain standard errors for the percentage of 1994 institutionalized persons with a particular characteristic (for example, the percentage of institutionalized persons who require help getting out of bed).

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. However, smaller estimates are provided in some tables primarily to permit such combinations of the categories as serve each user's needs.

D. Calculation of Standard Errors with the GVF Parameters

Two parameters, "a" and "b", are used to calculate the standard errors for each type of characteristic; they are presented in Table 5. They are called the generalized variance function or GVF parameters. 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 as it would be clearly impossible to publish variance estimates for every possible item of interest.

TABLE5
The "a" and "b" Parameters for Computing Approximate Standard Errors of Estimated Totals and Percentages

Subpopulation	Parameters	
	a	b
Noninstitutionalized Persons	-.00025455	1545

Institutionalized Persons	-.00070004	1079
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The a and b parameters were used to calculate the standard errors in Tables 1-4. They also may be used to directly calculate the standard errors for estimated totals and percentages, as explained below.

Standard Errors of Estimated Counts. The approximate standard error, $s(x)$, of an estimated count can be obtained in two ways. It may be obtained by using the standard error on the estimate obtained from one of Tables 1-4, or alternatively, it may be approximated by using Formula 1 from which the standard errors in Tables 1-4 were calculated.

$$s(x) = \sqrt{ax^2 + bx}$$

Here x is the size of the estimate, and a and b are the parameters in Table 5 associated with the particular type of characteristic.

Standard Errors of Estimated Percentages. The reliability of an estimated percentage, computed using sample data for both numerator and denominator, depends upon both the size of the percentage and the size of the population upon which this percentage is based. Estimated percentages tend to be 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 “f” factor or parameters from Table 5 indicated by the numerator. The approximate standard error, $s(p)$, of an estimated percentage can be obtained by using the standard error on the estimate from Table 3 or 4, alternatively, it may be approximated by using Formula 2 from which the standard errors in Tables 3 and 4 were calculated. Use of this formula will give more accurate results than use of Tables 3-4.

$$s(p) = \sqrt{\frac{b}{x} p(100 - p)}$$

Here x is the size of the subclass of persons which is the base of the percentage, p is the percentage ($0 < p < 100$), and b is the parameter in Table 5 associated with the particular type of characteristic in the numerator of the percentage.

Illustration of the Use of GVF Parameters. According to the 1994 LTC there were 3,015,757 persons requiring personal help bathing. Table 1 shows the standard error of an estimate of this size to be approximately 48,360. Alternatively, using the parameters in Table 5:

$$s(x) = \sqrt{(-0.00025455)(3,015,757)^2 + 1545(3,015,757)} = 48,418$$

The 68 percent confidence interval is from 2,967,339 to 3,064,175. 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 2,918,921 to 3,112,593 using twice the standard error.

Of the 659,247 persons requiring help in eating, 11.5 percent were Black. Table 3 shows the standard error of 11.5 percent on a base of 659,247 to be approximately 1.57 percent.

Alternatively, this standard error could have been derived by using the "b" parameter for noninstitutionalized persons (Table 5) in Formula 2. Consequently, the 95 percent confidence interval is from 8.4 to 14.6 percent.

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

$$s(x - y) = \sqrt{s^2(x) + s^2(y) - 2\rho s(x)s(y)},$$

where $s(x)$ and $s(y)$ are the standard errors for the estimates x and y (from Tables 1-4), respectively. The estimates can be totals (levels), percents, ratios, etc. The correlation coefficient ρ is not generally available and, in lieu of information, 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 two uncorrelated characteristics in the same area. If however, there is a high positive (negative) correlation between the two estimates, 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 eating was 198,316 and the corresponding number of 75-79 year olds was 105,407. The estimated difference is 92,909. The standard error on the estimate 198,316 is 17,216 and the standard error on the estimate 105,407 is 12,650 (both computed using Formula 1). The correlation coefficient in this case is known to equal zero. The standard error associated with the estimated difference of 92,909 is:

$$\sqrt{456,413,156} = 21,364$$

This means that the 95 percent confidence interval around the 92,909 difference is from 51,036 to 134,782, i.e., $92,909 \pm 1.96 (21,364)$. 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 95 percent of all possible samples. Thus, we can conclude with 95 percent confidence that the number of 65-74 year old persons requiring help eating is greater than the number of 75-79 year old persons requiring help eating.