Appendix B
Survey Methodology

APPENDIX B

RELIABILITY OF SAMPLE ESTIMATES AND CALCULATION OF GENERALIZED VARIANCES

Reliability of Sample Estimates. Since the estimates of this report are based upon a sample, they will differ from the numbers that could have been obtained had a complete census or enumeration taken place. Of the two sources of error possible in estimates based on a sample survey, sampling and nonsampling errors, it is possible to indicate the magnitude of the sampling error in well designed sample surveys. As discussed briefly below, computed sampling errors will also reflect the effect of compensating nonsampling errors, but not of systematic errors or biases in survey results.

Particular care should be exercised in the analysis of estimates based on a small number of sample cases or on small differences between estimates because they are subject to relatively large sampling errors.

Nonsampling or Measurement Errors. Nonsampling errors can be attributed to many different sources, e.g., nonresponse, interpretation differences in survey questions, definitional problems, errors in reporting by respondents caused by their inability or unwillingness to provide correct information, errors in processing the data such as coding or keypunch errors, and failure to include all registered nurses in the sample frame (undercoverage).

Nonsampling or measurement errors may tend to be of a random character, and more or less compensating from one respondent to another, or may tend to be systematic. Even substantial response or measurement errors, if they are independent and compensating, do not cause biases in simple estimates of aggregates, percentages, or averages. Moreover, the sampling errors estimated from the survey data for such statistics will automatically include the effects of such response errors.

However, these same fortunate results may or may not occur in cross-tabulations of two or more variables, some or all of which are subject to individual response errors. Often (but not necessarily) correlations or relationships in cross-tabulations are decreased by such errors, and sometimes substantially. Thus, errors that tend to be compensated in estimates of simple aggregates or averages may (but not necessarily will) introduce systematic errors or biases in measures of relationships or cross-tabulations. Any such effects on the relationships between two or more variables will not be reduced with increasing sample size.

Systematic measurement errors or biases are not reflected in the computed sampling errors. Some procedures are more prone to lead to systematic errors than others. For example, a poorly-worded question in a questionnaire is likely to lead to errors that are partially compensating but that are prone to improper response, and that result in systematic errors, or biases, <u>on the average</u>.

One illustration of how both random and systematic measurement errors may arise in a survey is if there is a substantial proportion of nonrespondents or noncooperators among those units selected for inclusion in the sample. To the extent that nonrespondents are not importantly different from respondents, errors of nonresponse tend to be random in character, and can be controlled by simply increasing sample size. However, nonrespondents sometimes tend to be different from respondents, on the average, even within the more or less homogeneous subclasses that may be identified and used in attempting to correct or impute for nonrespondents. If such unknown differences are substantial, and if the nonrespondents are a relatively large fraction of the designated sample, a serious bias may be introduced into the survey results. It is for this reason that considerable efforts are made in good survey practice to achieve high response rates, and also to develop as effective methods as feasible for imputing for any nonrespondents. Increasing sample size to offset nonresponse losses, or the substitution of other units for nonrespondents, are procedures sometimes adopted in surveys. These procedures will reduce the random errors but will not necessarily reduce the systematic errors associated with nonresponse, because the implicitly or explicitly substituted cases still represent samples of respondents and will not reflect any average differences in characteristics of nonrespondents.

Biases resulting from more or less systematic measurement errors in survey results sometimes occur in subtle ways, and may be especially difficult to control and to evaluate. Independent sources of information may be available to help in understanding, measuring, and perhaps reducing some of the effects of such sources of error. Measurement errors can be reduced at least in part by well-designed questionnaire and data-collection procedures. Also, motivation of respondents is important. However, these errors are less subject to design control than are sampling errors.

Sampling Variability. Standard errors are measures of sampling variability, that is, the chance fluctuations which occur because a sample of the population was surveyed rather than the whole population. These standard errors do not measure any biases in the data. If the actual standard error is known, the probability is .68 that a statistic from the survey differs from the population parameter by not more than one standard error, and .95 that the statistic differs from the population parameter by not more than 1.96 standard errors. In this study, however, the actual variances are not known. Direct variance estimates obtained from the jackknife procedure are based upon 23 degrees of freedom for these direct estimates, the 95 percent confidence intervals are computed by multiplying the estimated standard error by the corresponding value of the t statistic with 23 degrees of freedom or 2.07. For a 99 percent confidence interval the corresponding value of t with 23 degrees of freedom is 2.81. In situations where the variance estimates are computed through indirect procedures, the appropriate t value is from the normal distribution with ∞ degree of freedom. For the 95 percent confidence interval the estimate of the standard error is multiplied by 1.96 or for a 99 percent confidence interval the standard error is multiplied by 2.58. It should be noted that while there are more degrees of freedom when the indirect procedure is used, the variance estimate is not necessarily more accurate for any single estimate.

The confidence interval where the actual variance is unknown takes the form:

$$\hat{s} \pm t_{(n-1)} \hat{\sigma}_{\hat{s}}$$

where $\hat{s}$ is the estimated statistic and $\hat{\sigma}_{\hat{s}}$ is the the estimated standard error of the statistic.

With respect to sampling variability, the reader should be especially cautious in his interpretation of the data in certain cases in which estimates are based upon quite small samples. The situations are delineated below:

1) The frequencies or estimated totals are based upon an unweighted frequency of less than 25 observations.

2) The denominator of a percentage is based upon an estimated total for which the corresponding unweighted count is less than 25 observations.

3) The numerator of a percentage is based upon an estimated total for which the corresponding unweighted count of the numerator is less than 10 and the denominator is based upon an unweighted count of 25 or more.

All three situations warrant cautious interpretation of the results. It should also be noted that for an observed estimate of zero where these formulas are applied, the sampling error estimated by the formulas given above would be zero. However, the number being estimated and its sampling error may be more than zero. For this case a rough approximation for a confidence interval can be applied using the binomial confidence interval theory.

The use of standard errors already computed from direct procedures. As discussed in the methodology, direct estimates of the standard error for more important variables or characteristics were calculated by a special computer program. Whenever the variability of the estimates of characteristics are discussed, Appendix C should be checked first to determine if the standard errors of the variables under discussion have been directly computed. A standard error calculated through the direct routine ordinarily takes precedence over the generalized variance estimates described in the following sections and it is recommended that the direct variance estimates for statistics always be used when they are available (Appendix C).

<u>Estimating variability of survey statistics for standard errors which have not already been directly computed by the procedures presented in Appendix C.</u> Instead of reporting individual standard errors for each estimate presented where a direct estimate is not available in Appendix C, two short-cut methods for estimating standard errors are provided. One method estimates standard errors of estimated percentages while the second estimates standard errors for estimated numbers of nurses. These methods provide approximations to the standard error of what would have been obtained by direct computation.

Although the techniques appear cumbersome to use, they eliminate another volume devoted entirely to standard errors computed directly, a time consuming and costly process. In most cases, the standard errors provided by these techniques will differ from those computed directly. While there is a discrepancy between the standard errors approximated through the generalized formula versus those calculated through the direct procedures, the difference will not greatly affect the standard errors for the United States or the larger states. However, the standard errors of estimates for very small states, the variability of whose estimates are already affected by reason of the sample design, should be cautiously interpreted.

Variability of estimated percentages for a state or United States. The figures provided in Appendix Table B-1 are used as multipliers to approximate the standard errors for percentages estimated from the sample. The standard error terms are computed using the following formula:

$$(1) \quad \sigma_{\hat{Y}/\hat{X}} \doteq \sqrt{f \cdot \hat{Y}/\hat{X} \cdot (1 - \hat{Y}/\hat{X})/n} \cdot (100)$$

where $\hat{Y}/\hat{X}$ is the ratio estimated and n is the number of sample respondents whose weighted responses were used to estimate $\hat{X}$. The proper factor (f) to use from Appendix Table B-1 depends upon the state of reference of the denominator $\hat{X}$ of the estimated percentage.

Illustration of the use of tables of standard errors for estimated percentages. Table 43 shows that 12,440 of a total estimated 29,410 comprising the Wisconsin registered nurse population, registered nurses were employed full-time in nursing in Wisconsin i.e., $\frac{12,440}{29,410}$ or 42.3 percent of these were employed full-time in nursing. The standard error of the estimated percentage of the Wisconsin nurse population employed full-time in nursing, where the denominator or unweighted base of the estimated ratio .423 is 444, equals

$$(100) \quad (\sqrt{1.1 \cdot .423 \cdot (1 - .423)/444}) = 2.5 \text{ percent.}$$

The chances are 68 out of 100 that the estimated percentage would have been a figure differing from the complete census parameter by less than $\pm$ 2.5 percent. The chances are 95 out of 100 that the estimated percentage would have differed from the complete census parameter by less than $\pm$ 4.9 percent (1.96 times the standard error).

Variability for estimated numbers for state or United States. This method is an approximation technique used to find the magnitude of the standard errors of estimates of numbers of nurses rather than percentages.

The following procedures and formulas are used to approximate the magnitude of the standard errors for estimated numbers. Let $\hat{Y}$ equal the estimated number and $\hat{X}$ equal the population of which $\hat{Y}$ is a sub-population.

First, compute

$$\text{(2a)} \quad V^2_{\hat{Y}} = V^2_{\hat{Y}/\hat{X}} + (C.V._{\hat{X}})^2$$

where $V^2_{\hat{Y}/\hat{X}} = \dfrac{(F) \quad (1 - \hat{Y}/\hat{X})}{n \; (\hat{Y}/\hat{X})}$, F is the design effect for the appropriate state found in Appendix Table B-1, n is the number of respondents to the survey whose responses were weighted to obtain the estimate $\hat{X}$, and $C.V._{\hat{X}}$ is the coefficient of variation found in column four of Appendix Table B-2.

Then, use

$$\text{(2b)} \quad \sigma_{\hat{Y}} \doteq \hat{Y} \cdot \sqrt{V^2_{\hat{Y}}}$$ to approximate the standard error of $\hat{Y}$.

<u>Illustration of the use of tables of standard errors for estimated numbers of nurses.</u> Table 43 of this report shows that the statistic 12,440 nurses ($\hat{Y}$) who are employed full-time in nursing in Wisconsin is a subtotal of the estimated 29,410 nurses ($\hat{X}$) comprising the state nurse population in Wisconsin. The standard error and the coefficient of variation of statistic ($\hat{X}$) are provided in Appendix Table B-2.

$$\text{(2a)} \quad V^2_{\hat{Y}/\hat{X}} = \frac{(1.1)\ (1 - \frac{12,440}{29,410})}{444 \cdot \frac{12,440}{29,410}} + (.0217)^2 = .0039$$

where F= 1.1 from Appendix Table B-1, n = 444 from Table 43, $C.V._{\hat{X}}$ = .0217 from Appendix Table B-2, and

$$\text{(2b)} \quad \sigma_{\hat{Y}} = 12,440 \cdot \sqrt{.0039} = 777$$

The chances are about 68 out of 100 that the estimated 12,440 registered nurses employed full-time in nursing in Wisconsin would have been a figure differing from the complete census or population parameter by less than ± 777.

The chances are about 95 out of 100 that the estimate would have differed from the complete census parameter by less than $\pm$ 1523 (1.96 times the standard errors).

Variability of an estimated percentage for a region or other grouping of states. The standard error of an estimated percentage for a region of the United States depends upon a linear combination of the variances of the same estimated percentages for the states comprising that paricular region. Assume that there are h states within the region (R). The estimated percentage for the region is $\hat{Y}_R/\hat{X}_R$.

$$\text{where} \quad \hat{Y}_R/\hat{X}_R = \frac{\sum_{s=1}^{h} \hat{Y}_s}{\sum_{s=1}^{h} \hat{X}_s},$$

h is the number of states in region (R), and $\hat{Y}_s$ and $\hat{X}_s$ are estimates for a particular state. The formula used to approximate the standard error of an estimated percentage for a region is

$$(3) \quad \sigma_{\hat{Y}_R/\hat{X}_R} = \sqrt{\sum_{s=1}^{h} \left(\hat{X}_s^2 \, \sigma^2_{\hat{Y}_s/\hat{X}_s}\right) / \left(\sum_{s=1}^{h} \hat{X}_s\right)^2} \; (100)$$

where $\sigma_{\hat{Y}_s/\hat{X}_s}$ represents the standard error of the estimated percentage $\hat{Y}_s/\hat{X}_s$ for states which are available from the direct estimates (Appendix C) or from formula (1) if direct estimates are not provided.

Illustration of the computation of the standard error of a percentage for a region or another grouping of states. In Appendix C, the numbers are reported for the estimated percentages of the Middle Atlantic state nurse populations employed in nursing in 1977. The standard errors for these percentages were calculated by the direct procedures and appear in this appendix. It is not necessary to use any special formulas.

In Table 43, the estimated number and percent of registered nurses employed full-time in nursing is provided for each supply state. Direct estimates of the variability are not available for these statistics. For the Middle Atlantic states, it is estimated that 41.5 percent of the nurses included in the New Jersey supply were employed full-time in nursing in that state, 50.5 percent of the nurses included in the New York supply were employed full-time in nursing in New York, and 45.3 percent of the nurses included in the Pennsylvania supply were employed full-time in nursing in Pennsylvania. Thus, as seen in Table 43, for the total Middle Atlantic states, it is estimated that 47.1 percent of the nurses in these supply states are employed full-time in nursing in their supply state.

The standard error of this estimated percentage for the Middle Atlantic states (47.1 percent) is calculated using formula (1) to derive the standard error of each estimated percentage for each state,

Pennsylvania: $\hat{\sigma} = (100)\sqrt{1.1 \cdot (.45327)\ (1 - .45327)/712} = 2.0$ percent

New York: $\hat{\sigma} = (100)\sqrt{1.1 \cdot (.50486)\ (1 - .50486)/721} = 2.0$ percent

New Jersey: $\hat{\sigma} = (100)\sqrt{1.0 \cdot (.41454)\ (1 - .41454)/434} = 2.4$ percent

Applying formula (3), the standard error of the estimated percentage for the Middle Atlantic region is found.

$$\sigma_{\hat{Y}_R/\hat{X}_R} = \sqrt{\frac{(57,063)^2\ (.024)^2 + (147,006)^2\ (.020)^2 + (104,306)^2\ (.020)^2}{(57,063 + 147,006 + 104,306)^2}}\ (100)$$

$$\doteq .013\ (100) = 1.3 \text{ percent}$$

This means that the chances are 68 out of 100 that the estimated 47.1 percent differs from the complete census estimate by less than $\pm$ 1.3 percentage points. The 95 percent confidence interval for this estimate is from 44.6 percent to 49.6 percent, i.e. 47.1 $\pm$ 2.5.

Variability of an estimated number for a region or other grouping of states. The standard error for an estimated number for a region of the United States also depends upon a linear combination of the variances of the same estimated numbers for the states which comprise the region. The formula used is

$$(4) \quad \sigma_{\hat{Y}_R} = \sqrt{\sum_{s=1}^{h} \sigma^2_{\hat{Y}_s}}$$

where the standard error ($\sigma_{\hat{Y}_s}$) of the estimated number $\hat{Y}_s$ is either available from the direct routines or from formula (2b).

Illustration of the computation of the standard error of a number for a region or another grouping of states. Of the 308,375 registered nurses whose supply state was in the Middle Atlantic region in 1977, 145,152 nurses are estimated to be employed full-time in nursing. Applying formula (2b) to each state,

Pennsylvania:	=	2224.2
New York:	=	3270.2
New Jersey:	=	1478.1

and then applying formula (4)

$$\sigma_{\hat{Y}_R} = \sqrt{(2224.2)^2 + (3270.)^2 + (1478.1)^2} \doteq 4222.$$

A 68 percent confidence interval for the number of registered nurses employed full-time in nursing in their supply state in the Middle Atlantic region is from 140,930 to 149,374; a 95 percent confidence interval for the estimated number of registered nurses employed full-time in nursing in their supply state in the Middle Atlantic area is from 136,878 to 153,427.

Standard error of a difference between two comparable estimated statistics (numbers or percentages) from two different states or certain other groups. To estimate the difference between two sample estimates (X and Y), let

$$d_p = \hat{Y}_1/\hat{X}_1 - \hat{Y}_2/\hat{X}_2 \text{ or } d_n = \hat{Y}_1 - \hat{Y}_2$$

where $\hat{Y}_1$ and $\hat{X}_1$ are estimates of registered nurse data from state 1 and $\hat{Y}_2$ and $\hat{X}_2$ are estimates of registered nurse data from state 2. Then

$$(5a) \quad \sigma_{d_p} \doteq \sqrt{\sigma^2_{\hat{Y}_1/\hat{X}_1} + \sigma^2_{\hat{Y}_2/\hat{X}_2}}$$

and

$$(5b) \quad \sigma_{d_n} \doteq \sqrt{\sigma^2_{\hat{Y}_1} + \sigma^2_{\hat{Y}_2}}$$

where the standard error of each statistic is available from the direct procedures (Appendix C) or from formula (1) or formula (2b). This approximation is quite accurate when estimating the difference between two statistics of the same variable in two different geographical areas, or between separate percentages for two groups in the same area such as comparing percentage of males and of females having a specified characteristic.

Illustration of the computation of the standard error of a difference for two comparable characteristics from two different states or certain other groups. Using direct estimates of the standard error in Appendix C, 64.02 percent and 68.58 percent of the September 1977 registered nurse population in the Pacific and Mountain regions respectively were employed in nursing in that year, with standard errors of 1.39 percent and 1.59 percent respectively. The apparent difference (d_p) between the percent of the registered nurse population employed in nursing in the Pacific and Mountain regions is 4.56 percent. Using formula (5a), the standard error of this estimated difference of 4.56 percent is approximately $2.11 = \sqrt{(1.39)^2 + (1.59)^2}$. This statistic means that the chances are 68 out of 100 that the estimated differences derived from the sample estimates would vary from the differences derived using the complete population parameters, (if they were available,) by less than 2.11 percent. The 68 percent confidence interval for the 4.56 percent difference is from 2.45 percent to 6.67 percent. The 95 percent confidence interval is from 0.42 percent to 8.70 percent. It is reasonably conclusive, then, that the difference derived from all possible samples of the same size and design lies within the range 0.42 percent to 8.70 percent for about 95 of each 100 samples drawn. Thus, with a 95 percent confidence level, there is a difference in the percentage in 1977 of the registered nurse population in the Mountain states employed in nursing than in the Pacific states.

Standard error of a difference between two nonoverlapping percentages of total within the same area. The standard error of the difference between two nonoverlapping percentages of a total within the same area, i.e. where each percentage has the same denominator or base is

$$(6a)\quad \sigma_{d_p} = 100\sqrt{F\left(\frac{p_1q_1}{n}+\frac{p_2q_2}{n}+\frac{2p_1p_2}{n}\right)}$$

where $p_1 = \frac{x_1}{n}$, $p_2 = \frac{x_2}{n} \ldots p_i = \frac{x_i}{n}$;

$q_1 = (1-p_1)$, $q_2 = (1-p_2) \ldots q_i = (1-p_i)$;

$x_1 + x_2 + \ldots .x_i = n$; and $d_p = p_1 - p_2$

Illustration of the computation of the estimated standard error of a difference for two nonoverlapping percentages within the same area. Table 43 of this report shows that the unweighted proportion of nurses employed in nursing full-time in Illinois was $\frac{247}{526}$ or .470 while the comparable proportion employed part-time was $\frac{130}{526}$ or .247. The standard error of the difference between the percentage working full-time and the percentage working part-time equals

$$100\sqrt{1.2\left(\frac{.470\times.530}{526}+\frac{.247\times.753}{526}+\frac{2\times.470\times.247}{526}\right)} = 3.90.$$

The chances are 68 out of 100 that the estimated difference would vary from the difference derived using the complete population parameters by less than 3.9 percent. The 68 percent confidence interval for the 22.3 percent difference is from 18.4 to 26.2 percent. The 95 percent confidence interval is from 14.7 to 29.9 percent. As this range does not include zero, it can be said with 95 percent confidence that there was a significant difference between the percent of nurses employed full-time and the percent employed part-time in Illinois.

Standard error of a difference between two estimated numbers from the same state or certain other groups. The following procedures and formulas are used to approximate the magnitude of the standard errors for a difference between two estimated numbers from the same state, region, or other group. Let $\hat{d}_n$ equal the difference between two estimates, $\hat{Y}_1$ and $\hat{Y}_2$, from a particular state or group and $\hat{d}_p$ equals $\left(\hat{Y}_1/\hat{X} - \hat{Y}_2/\hat{X}\right)$ where $\hat{X}$ equals the estimate of the population or group in question.

First, compute

$$\text{(7a)} \quad V^2_{\hat{d}_n} = V^2_{\hat{d}_p} + (\text{C.V.}_{\hat{X}})^2$$

where $V^2_{\hat{d}_p} = \dfrac{\sigma^2_{\hat{d}_p}}{\hat{d}_p^2}$, or the rel-variance of d_p, and C.V.$_{\hat{X}}$ is the coefficient of variation found in column four of Table B-2. Then use

$$\text{(7b)} \quad \sigma_{\hat{d}_n} \doteq \hat{d}_n \cdot \sqrt{V^2_{\hat{d}_n}}$$

to approximate the standard error of $\hat{d}_n$.

Illustration of the computation of the estimated standard error of a difference between two estimated numbers from the same state or group. Table 43 of this report shows that 7,729 nurses ($\hat{Y}_1$) were employed in nursing full-time and 2,049 ($\hat{Y}_2$) were employed part-time from among the 13,151 nurses ($\hat{X}$) in the state of Alabama. Thus,

$$(7a)\quad V^2_{d_n} = \frac{1.1\left(\frac{.588 \times .412}{254} + \frac{.156 \times .844}{254} + \frac{2 \times .588 \times .156}{254}\right)}{\left(\frac{7,729}{13,151} - \frac{2,049}{13,151}\right)^2} + (.0324)^2$$

$$= .0140$$

and

$$(7b)\quad \hat{\sigma}_{d_n} = (7,729 - 2,049) \cdot \sqrt{.0140}$$

$$= 672$$

The chances are about 68 out of 100 that the estimated difference between the 7,729 nurses employed full-time in Alabama and the 2,049 employed part-time in the state (5,680 would have been a figure differing from the complete census by less than ± 672. The chances are about 95 out of 100 that the estimate would have differed from the complete census by less than 1,317.

Table B-1.--Average design effects[1] (F) and factors ($\sqrt{F}$) for percentages estimated from the national survey of registered nurses, by state, 1977

State	Average design effect (F)	Factor ($\sqrt{F}$)
United States ..	2.0	1.41
Alabama	1.1	1.05
Alaska	2.2	1.48
Arizona	1.1	1.05
Arkansas	1.2	1.10
California ...	1.3	1.14
Colorado	1.2	1.10
Connecticut ..	1.3	1.14
Delaware	1.8	1.34
D.C.	1.3	1.14
Florida	1.4	1.18
Georgia	1.0	1.00
Hawaii	2.5	1.58
Idaho	1.3	1.14
Illinois	1.2	1.10
Indiana	1.0	1.00
Iowa	1.0	1.00
Kansas	1.1	1.05
Kentucky	1.2	1.10
Louisiana	1.1	1.05
Maine	1.1	1.05
Maryland	1.2	1.10
Massachusetts.	1.2	1.10
Michigan	1.1	1.05
Minnesota ...	1.3	1.14
Mississippi ..	1.1	1.05
Missouri	1.2	1.10
Montana	1.6	1.26
Nebraska	1.2	1.10
Nevada	1.2	1.10
New Hampshire.	1.3	1.14
New Jersey ...	1.0	1.00
New Mexico ...	1.0	1.00
New York	1.1	1.05
North Carolina	1.1	1.05
North Dakota .	1.3	1.14
Ohio	1.2	1.10
Oklahoma	1.0	1.00
Oregon	1.2	1.10
Pennsylvania .	1.1	1.05
Rhode Island .	1.2	1.10
South Carolina	1.3	1.14
South Dakota .	1.3	1.14
Tennessee	1.0	1.00
Texas	1.5	1.22
Utah	1.2	1.10
Vermont	1.4	1.18

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Table B-1, Cont.--Average design effects[1] (F) and factors ($\sqrt{F}$) for percentages estimated from the national survey of registered nurses, by state, 1977

State	Average design effect (F)	Factor ($\sqrt{F}$)
Virginia	1.2	1.10
Washington	1.1	1.05
West Virginia.	1.1	1.05
Wisconsin	1.1	1.05
Wyoming	2.3	1.52

[1]These design effects represent the approximate average of the ratio of the sampling variance of a percentage estimated from the Registered Nurse survey to the corresponding sampling variance of a simple random sample with the same number of respondents.

Table B-2.--Direct estimates of standard error and rel-variance of the estimated requested nurse population, by state, September 1977

State	Survey respondents (n)	State nurse population (X)	Direct estimate of standard error	C.V. X
United States	16,102	1,401,633	4,969	.0035
Alabama	254	13,151	426	.0324
Alaska	113	2,791	377	.1353
Arizona	271	16,437	622	.0379
Arkansas	169	6,282	299	.0477
California	864	149,285	1,837	.0123
Colorado	328	20,190	932	.0462
Connecticut	342	24,000	883	.0368
Delaware	182	5,772	545	.0945
District of Columbia	145	6,567	413	.0630
Florida	484	52,429	1,792	.0342
Georgia	266	20,860	660	.0317
Hawaii	180	6,261	570	.0911
Idaho	183	5,420	441	.0814
Illinois	526	67,585	1,905	.0282
Indiana	387	29,834	787	.0264
Iowa	293	21,866	434	.0199
Kansas	263	15,449	533	.0345
Kentucky	245	16,085	586	.0364
Louisiana	273	14,713	415	.0282
Maine	223	9,328	385	.0413
Maryland	389	29,635	996	.0336
Massachusetts	498	63,545	1,400	.0220
Michigan	458	56,034	1,066	.0190
Minnesota	473	31,438	717	.0228
Mississippi	192	8,401	245	.0292
Missouri	344	25,588	845	.0331
Montana	201	3,802	382	.1007
Nebraska	231	11,536	528	.0458
Nevada	119	3,293	279	.0850
New Hampshire	218	8,842	549	.0622
New Jersey	434	57,063	1,456	.0255
New Mexico	150	5,924	338	.0571
New York	721	147,006	3,107	.0211
North Carolina	271	25,298	1,012	.0400
North Dakota	209	4,623	158	.0344
Ohio	599	70,268	1,261	.0180
Oklahoma	254	10,867	429	.0396
Oregon	296	16,407	667	.0407
Pennsylvania	712	104,306	1,947	.0187
Rhode Island	195	8,739	543	.0622
South Carolina	265	13,879	744	.0536
South Dakota	200	4,535	229	.0505
Tennessee	310	18,456	547	.0296

Table B-2, Cont.--Direct estimates of standard error and rel-variance of the estimated requested nurse population, by state, September 1977

State	Survey respondents (n)	State nurse population (X)	Direct estimate of standard error	C.V. X
Texas	428	56,418	1,482	.0263
Utah	182	7,090	436	.0615
Vermont	173	5,189	412	.0794
Virginia	417	29,239	829	.0284
Washington	384	28,022	969	.0346
West Virginia	228	9,876	424	.0430
Wisconsin	444	29,410	638	.0217
Wyoming	126	2,595	306	.1130

ble C-1.--Sampling errors (S.E.)[1] of selected statistics (numbers and percentages) for all registered nurses licensed in U.S.,[2] February 1977

Description	Total all licensed nurses: Estimated number	S.E. of estimated number	Estimated percent (N=1,417,665)	S.E. of estimated percent
Basic nursing educational preparation				
Diploma	1,061,387	7,064	74.87	0.46
Associate degree	159,582	5,728	11.26	0.40
Baccalaureate and above	194,010	4,585	13.69	0.32
Not reported	2,607	(3)	0.18	(3)
1976 employment status				
Employed in nursing ...	998,526	7,079	70.43	0.51
Not employed in nursing	418,998	7,666	29.56	0.51
Not reported	141	(3)	0.01	(3)
1977 employment status				
Employed in nursing ...	981,882	5,939	69.26	0.41
Not employed in nursing	435,783	6,217	30.74	0.41
Racial/ethnic background				
Hispanic	19,652	4,136	1.39	0.29
American Indian/Alaskan native	3,296	585	0.23	0.04
Asian/Pacific islander	29,550	6,297	2.08	0.45
Black/Negro	35,554	5,799	2.51	0.41
Caucasian/White	1,309,059	10,432	92.34	0.70
Total minority	88,051	9,387	6.21	0.66
Total nonminority	1,309,059	10,432	92.34	0.70
Not reported	20,555	(3)	1.45	(3)
Sex				
Female	1,390,005	4,397	98.05	0.14
Male	27,257	2,048	1.92	0.14
Not reported	404	(3)	0.03	(3)
1976 marital status				
Married	1,023,133	6,950	72.17	0.47
Widowed	71,563	3,035	5.05	0.21
Divorced	83,406	3,554	5.88	0.24
Separated	14,380	1,634	1.01	0.12
Never married	218,199	6,844	15.39	0.49
Not reported	6,985	(3)	0.49	(3)

[1]Estimated through direct procedure.

[2]Includes only registered nurses with an active United States license, effective date February 1977. Includes nurses living or working outside U.S.

[3]Estimates not available.