

Evaluation and Research Program of the U.S. Censuses of Population and Housing, 1960: Record Check Studies of Population Coverage

HIGHLIGHTS

Introduction

This report is one of a series of reports of evaluation studies providing measures of quality of the 1960 Censuses of Population and Housing. It contains the results of some record check studies designed to measure omissions of persons in the census. Although these studies yield measures of undercoverage only, net error in coverage is estimated by using the estimate of erroneous inclusions (overcoverage) from reenumerative studies. The combined results of these two sets of studies also produce estimates of a "true" population total. Measures of coverage error are provided so that users may be aware of the limitations and reliability of data published by the Bureau of the Census. Also, evaluation of results of census-taking methods is essential to planning and improving future censuses.

In the 1950 census evaluation program, the Bureau measured coverage error chiefly by repetition of census enumeration methods, in more thorough and refined form, on a sample basis. For the 1960 Census, there were also reenumerative studies (to be reported on in other publications of this series), but it was decided to give more emphasis to other ways of studying omissions in enumeration. This decision was made partly because analysis of the results of the 1950 Post-Enumeration Survey (PES)¹ indicated that the reenumerative methods used were only about 50 percent effective in measuring undercoverage in the 1950 Census. In general, it is believed that repeating the census process, even in intensified form, does not eliminate weaknesses inherent in enumeration methods. There is an inclination to miss, in the second enumeration, the same kind of persons (e.g., young adults) missed in the first enumeration.

"Record Check" methods for determining missed persons were therefore given more emphasis in the 1960 census evaluation program. "Record checks" are defined as studies in which samples of persons from independent lists and administrative records are checked for completeness of enumeration in the census. An example of a record check is the determination of whether a child whose name is obtained from a birth registration record was enumerated in the census. The record check method of finding missed enumerations overcomes a weakness of the reenumerative technique by the advance specification of persons in the study sample. However, other problems are associated with the record check method. In particular, matching problems and problems in obtaining current addresses for sample persons prevent close estimation of missed enumerations by record checks.

A summary of the procedures, limitations, and conclusions is given below. The section on methodology presents details of record check study methods and procedures as well as concepts of technical terms used in this report.

Summary of Results

The problems of the record check studies mentioned above do not permit a precise determination of undercoverage in the census. Measures of undercoverage summarized here are presented as a range which is believed to contain the undercoverage rate. When they become available, results from other 1960 coverage evaluation studies can be compared with results shown here and the combined data may permit the range to be narrowed considerably, thus providing better estimates of coverage.

Record check results are based on sample studies of four population groups: persons enumerated in the 1950 census; children born during the intercensal period (after April 1, 1950, and before April 1, 1960); persons missed in the 1950 census but detected by the 1950 PES; and aliens who registered with the Immigration and Naturalization Service in January 1960. Their combined representation is believed to be 98 percent or more of the entire population. The record check study estimates of missed and enumerated persons and the general approach to deriving them are summarized below.

From each of the four population groups, a sample of persons was selected, on a probability basis, and an effort was made to determine whether each person was enumerated in the 1960 census. Population records and lists of persons who were believed to present difficult enumeration problems were sampled at a relatively high rate. For example, although births registered in the intercensal decade represented only one-fifth of the total sampled population, they comprised three-fifths of the combined study sample because of past evidence of undercounts of children in censuses.

The four population samples totalled 7,612 persons of whom 425 were found to be "out of scope" (persons deceased, outside the United States, or erroneously included in the sample), resulting in a working sample of 7,187. Definite information about enumeration status was available for 6,003 sample persons; of these, 1.3 percent were identified as having been missed in the 1960 census (table 1). Major limitations in the ability to arrive at precise estimates of omission arise from a failure to account for 16.5 percent of the working sample because of "non-interviews," mostly caused by inability to obtain 1960 addresses for 932 sample persons, and because of a "probably missed" group for whom a precise determination about inclusion in the 1960 census could not be made.

Because noninterview and probably missed cases were believed to involve more underenumeration than the 6,003 cases for whom definite enumeration information was ob-

¹U.S. Bureau of the Census, *The Post-Enumeration Survey: 1950*. Bureau of the Census, Technical Paper No. 4, Washington D.C., 1950.

tained, it did not appear reasonable to apply to the problem group the 1.3 percent missed rate established for the 6,003 sample persons of known enumeration status. Hence, various assumptions (table B) were made about the enumeration status of the problem group for six alternative estimates of missed persons.

The major findings of the record check studies can best be summarized as ranges of estimates (table 2) lying between upper and lower estimates arising from rather extreme assumptions about the enumeration status of "noninterviews" and "probably missed" cases. The number of persons estimated to have been erroneously omitted from the 1960 census ranges from 4.7 million to 8.5 million, or 2.6 percent to 4.7 percent of the 1960 published population total of 179,323,000. Using the estimate of persons erroneously enumerated according to the reenumerative studies, undercoverage is partially offset by an overcoverage rate of 1.3 percent of 179,323,000, resulting in undercount estimates of 1.3 percent to 3.4 percent, the range of estimated net coverage error in the 1960 census. Corresponding estimates of "true" population at the time of the 1960 census ranges from 181.7 million to 185.5 million persons.

Rates of missed persons appear to be highest in the south and lowest in the north-central region with the other two regions, the northeast and the west, in between. However, the range of possible values within each region was too great to detect differences among the regions (table 4).

Rates of missed persons for each of the four population sample groups were also compared. Although persons enumerated in the 1950 census comprised about three-fourths of the population represented in the record check studies, they accounted for only two-thirds of the record check study estimate of persons missed in 1960. On the other hand, one-fourth of the missed persons were accounted for through the intercensal birth records study which comprised only one-fifth of the total population represented in the record check studies. The 1950 PES group and the alien registration group also accounted for more than their population share of missed persons (tables 3 and 5).

METHODOLOGY

Concept of a "Missed Person"

The usual meaning of the term "missed person" relative to census coverage is a person who should have been counted in the census but who was not counted even if computer imputation was made to account for him. In census evaluation studies, however, the term also applies to persons enumerated in an enumeration district (ED) other than the correct ED.

For the most part, the record check studies follow the usual principles as other evaluation studies in classifying a person as missed. However, record check study procedures tended not to be as rigorous in classifying as missed a few persons found to be enumerated in an ED other than where they should have been enumerated.

Population Groups Sampled for Record Checks

The record checks are based on samples from four population groups whose combined representation almost equals the total 1960 United States population. No single list could be found to serve as that universe, but a com-

bination of the four sources listed below approximated that total:

1. Persons enumerated in the 1950 Census of Population in the United States (including Hawaii and Alaska).
2. Children born after April 1, 1950 and before April 1, 1960, registered with the Bureau of Vital Statistics of the 50 states and 4 large cities.
3. Persons missed by the 1950 census enumeration but detected in the 1950 Post-Enumeration Survey (PES).
4. Aliens residing in the United States in January 1960, and registered with the Immigration and Naturalization Service of the Department of Justice under the Alien Registration Act.

The population included in items 1 and 2, that is, the population enumerated in 1950, and children born and whose births were registered during the intercensal period, comprised about 95 percent of the persons eligible for enumeration in 1960. When supplemented by the population groups indicated in items 3 and 4, it is believed that almost the entire population is then represented in the record check studies. A number of differences can be identified between the actual population of the United States as of April 1, 1960, and the combined representation of the four samples, as follows.

First, the following groups were a part of the total United States population, but are *not* represented in the four samples:

1. Persons missed by the 1950 census and not accounted for in the 1950 PES estimate of missed persons.
2. Persons missed by the 1950 census in Alaska and Hawaii (the 1950 Post Enumeration Survey excluded both Alaska and Hawaii).
3. Citizens outside conterminous United States at the time of the 1950 census but residing inside conterminous United States in April 1960 (most of this group consists of Puerto Ricans).
4. Unregistered births after April 1, 1950, and before April 1, 1960.
5. Aliens who entered the United States after April 1, 1950, and became citizens before February 1, 1960.
6. Aliens who entered the United States between February 1, 1960, to April 1, 1960.
7. Aliens in the United States in January 1960 who failed to register with the Immigration and Naturalization Service under the Alien Registration Act.

Secondly, there are at least two groups of persons in the 1960 population represented *twice* by the four samples:

1. Persons missed in 1950 at their usual place of residence and erroneously enumerated at another address (represented both as missed persons by the 1950 PES and as enumerated in the 1950 census).
2. Aliens registered in 1960 and enumerated in the United States in 1950 (represented both by the 1950 census sample and the sample of registered aliens).

Sampling Methods

The methods used in sampling from each of the four sets of records are described below.

Persons enumerated in the 1950 Census of Population. The sample from the 1950 census was selected in three stages: (a) a sample of counties, (b) a sample of census enumeration districts (EDs) within counties, and (c) a sample of persons within EDs.

For the sample of counties, the 333-area Current Population Survey design² used in 1960 was adopted. With minor exceptions, each area in that design was either a single county or a group of two or more counties. The exceptions occurred in New England where some areas were not whole counties but rather groups of towns.

Within the 333 CPS sample areas, 1,067 of the EDs used in the 1950 census were selected. (In urban areas, an ED is typically a small group of adjacent blocks. In rural areas, where population is more sparse, the average ED covers a much larger land area.)

A systematic sample of about 2,600 persons was selected from the 1,067 sample EDs so that, typically, either 2 or 3 sample persons were selected from each ED. The methods used in selection yielded a sampling rate of one person for each 60,000 persons enumerated in the 1950 census. The sample persons, for the most part, were selected with a uniform sampling rate. However, a few of the sample persons required assignment of differential weights.

Registered births after April 1, 1950, and before April 1, 1960. The sample of registered births was selected in two stages: (a) a sample of counties, and (b) a sample of births registered in the counties selected.

For the county sample, the same 333 areas used for the sample of the 1950 census were used. About 4,500 birth registrations were selected systematically from files of births in the sample counties.

The sample taken from the birth registration files was at a rate of one child for each 8,700 births registered after April 1, 1950, and before April 1, 1960. As in the sample from the 1950 census enumerated persons, differential weight assignments were required for a few of the persons in this sample.

Persons detected as missed in the 1950 Census of Population by the 1950 Post-Enumeration Survey. The third group consisted of a sample of 273 persons, missed in the 1950 census, but found in the 1950 PES. Since a subsample of the persons detected in the 1950 PES was used, the sample design was, in effect, the same as for the 1950 PES, which was a multistage sample design.³ The selection was at a rate of one person for each 11,400 persons estimated as missed in the 1950 Census of Population.

Aliens residing in the United States in January 1960 and registered with the Immigration and Naturalization Service under the Alien Registration Act. Eighty percent of all registered aliens resided in 11 States in 1960. For this group, a systematic sample of individuals was taken. The remaining 20 percent of registered aliens were scattered among 39 States and the District of Columbia. For this latter group, a sample of 5 States was drawn and within these States a systematic sample of aliens was selected. The combined sample from both groups totalled 209 aliens selected with a sampling rate of one for each 14,000 registered aliens.

²U.S. Bureau of the Census. *The Current Population Survey—A Report of Methodology*. Technical Paper No. 7, U.S. Government Printing Office, Washington, D.C., 1963.

³Ibid, page 1.

Methods for Determining Whether Sample Persons Were Enumerated in 1960 Census

Once the sample persons were identified by name and address from the source records, the following steps were taken to obtain current addresses and to determine whether the sample persons were enumerated in the 1960 census.

1. Determine the sample person's address as of April 1960. For the samples from the 1950 census, from the 1950 PES, and from 1950-60 births, the addresses originally obtained could have been outdated by as much as 10 years. In fact, in the majority of cases, the address obtained from the sample list or record was found to be different from the 1960 census address. Since the census file is arranged geographically, the April 1960 address for each sample person had to be ascertained to determine his enumeration status. The following measures were taken to determine the April 1960 addresses.

a. The original address was checked by mail with the local post office. There were four possible outcomes: (i) mail for the sample person was deliverable at the original address; (ii) a forwarding address was given, and this address was checked in turn, changing the result to one of the other outcomes; (iii) the person was unknown or a forwarding address was unavailable; or (iv) the post office reported that the sample person was deceased.

b. When the post office check provided a usable address a questionnaire was sent to that address. The questionnaire attempted to verify the identity of the sample person, establish his April 1960 address, and get other information about him and his household to help in the match with census enumeration records. (Record check questionnaires are shown in the report entitled "Evaluation and Research Program of the U. S. Censuses of Population and Housing, 1960: Background, Procedures, and Forms," Series ER60, No. 1.)

c. When the post office check failed to provide a usable address or the sample person did not reply either to the questionnaire or the mailed followup, an interviewer was sent to try to locate the sample person and to obtain essentially the information asked for on the questionnaire. At times, the job of locating the sample person required investigating many sources and an imaginative follow-up of scant clues. Detailed suggestions were given to the interviewer about sources to check.

For the sample of aliens, this step was skipped as unnecessary because it was assumed that the alien's address at the time of registration (January 1960) was his address as of April 1960. In a small minority of cases the assumption was mistaken, but this error was corrected in the process of carrying out step 3 below.

Some of the persons were deceased, were outside the United States at the time of the 1960 census, or were erroneously included in the study sample. Those persons were classified as out of scope of this study.

2. Search of 1960 Census enumeration records. For sample persons who responded to the mailed questionnaire or the mailed followup, or who were located by the interviewer, and for all persons in the alien sample, the search for evidence of 1960 census enumeration was undertaken in accordance with procedures described below. The sample person's address was spotted, either precisely or approximately, on a map, and the map location in turn identified the ED. Ordinarily, any specific address could be quickly located in the enumeration records of the given ED, and the presence or absence of the sample person's

name noted. If not found at the specific address, a search was made throughout the entire ED or, in certain problem situations, the search was extended to other EDs in the same general area. The address was always the focal point of search.

Results of the census search were classified in one of four categories:

- a. The sample person was found to be enumerated.
- b. The sample person was not enumerated at the given address. That is, the ED or EDs to which the address could have belonged had been found and searched without discovering any possible matches.
- c. A possible or probable listing of the sample person was found in the enumeration, but discrepancies in address, sample person characteristics, or characteristics of other household members made the match questionable.
- d. The sample person was not found in the search, but an incomplete or apparently nonexistent address left doubt as to whether the right ED had been included in the search.

No further work was required for the definitely enumerated sample persons, but persons in the other three categories were carried on to the next step.

For sample persons not responding to the mailed questionnaire or the mailed followup, and not located by the interviewer, addresses obtained from the record source were sometimes used successfully to determine that persons were enumerated. All other persons in this group were classified as "noninterview--failure to locate."

3. Reconciliation of inconsistent information. When the enumeration status of a sample person had not been uniquely determined by the steps described above because of inconsistencies in information, efforts were made to reconcile the differences by correspondence or by personal interview. It was uncertain whether persons in the third and fourth categories had actually been enumerated and the second category was also considered to require clarifying information. For example, steps were taken to verify that a sample alien's registration address in January 1960 was actually the same as his address in April 1960. For other sample persons, an April 1960 address had been obtained by the procedures in step 1, but it was possible that the address was not the "usual residence" according to census rules. For example, a student might report himself or be reported as living at his father's home, when in April he was in college and should have been enumerated at his college address.

Each person in the second category was informed that he had not been found enumerated in 1960 at a specified address, and that the Census Bureau wanted to determine whether he was missed in the enumeration. He was informed, in general, of census rules for determining the correct enumeration address, and then was asked "Where do you think you SHOULD have been counted in the 1960 census?"

For each sample person in the third category it was necessary to determine whether the census listing found was actually for him and, if not, whether there was another address where he should have been enumerated.

For a person in the fourth category, there were two remaining questions about first, the adequacy of the address search already made, and secondly, the possible existence of another address that should have been searched. These questions were handled by trying to get

a geographic description of the inadequate address, or to obtain additional addresses for further investigation.

These efforts to reconcile differences sometimes produced additional addresses and other information that helped to determine whether the sample person was enumerated. At the end of the reconciliation phase, a classification decision was made for all persons not previously classified as enumerated, out-of-scope, or noninterview--failure to locate. Whenever the evidence was clear-cut, the sample person was classified "enumerated" or "missed," as appropriate. When facts indicated a missed person, but the evidence did not appear certain, the sample person was classified "probably missed." All the sample persons in the third category were classified as enumerated, missed, or probably missed. When neither a mail return nor a personal interview was obtained for a person in the second or fourth categories, the sample person was classified "noninterview--failure to reconcile." (Note that this category is distinguished from "noninterview--failure to locate" by the fact that in the latter case, no initial contact was made.)

Effectiveness of Location Procedures for Sample Persons

Table 1 shows the way in which sample persons for each of the record checks was accounted for. A summary of the success of the location operations is given in table A below.

Table A.--RESULTS OF LOCATION OPERATIONS FOR SAMPLE PERSONS, BY LIST OR RECORD SOURCE

List or record source	Number in sample			Percent of sample located
	Total	Located	Not located	
Total.....	7,612	6,680	932	87.8
1950 census.....	2,605	2,371	234	91.0
Birth registration records.....	4,525	3,873	652	85.6
1950 PES.....	273	227	46	83.2
Alien registration records.....	209	209	0	100.0

The word "located" is not intended to carry the implication of enumeration. A sample person noted as "located," in the sense used here, means a person who has been found or identified in some way in addition to the basic source record. A sample person identified as enumerated, as missed in enumeration, as having died or as having left the country, or identified as a living person in 1960 whose enumeration is uncertain, are examples of sample units regarded "located." Where no trace of a person, beyond the basic record source, is found, then the person is, for present purposes, regarded "not located."

This dichotomy of sample persons into located and not located is an oversimplification perhaps, but it is meant only to indicate an approximate success rate for this part of the study operation. When the studies were in the planning stage, there was an intention to pursue the location of sample persons until a minimum of 90 percent were located, or until a definite conclusion had been reached that further efforts would be too costly for possible gains in study results.

The 90 percent standard was almost, although not quite, achieved on an overall basis, since some information was obtained for 6,680 or 87.8 percent, of the designated total of 7,612 sample persons. With a greater expenditure of funds and further work this percentage of located persons might have been increased. However, in some instances, a conservative policy was probably responsible for a lower success rate than could have been achieved with fewer restraints. For example, in trying to trace children whose intercensal birth records were selected, the policy was to locate the mother and to list the persons in the household of which the mother was then a member. The location of the child was determined, at this point, only if he appeared in the listing of household members. For children not located by this method, inquiry was made of the State vital statistics agency about whether the child was still living, and, if so, whether census field workers could inquire about the location of the child in any way suggested by the circumstances. In some instances, permission was denied, and the trace procedure was dropped. This restriction was thought to be partially responsible for the low percentage, 85.6 percent, of children located.

The low found rate, 83.2 percent, for the 1950 PES sample was possibly attributable to the fact that since these persons might have been difficult to find and enumerate in the 1950 census, the same characteristics could have had the same effect in 1960. Since 91.0 percent of the sample persons drawn from the enumerated population in the 1950 census were found, as compared with the 83.2 percent rate for the PES group, the supposition about the PES sample seems reasonable. The 100 percent success rate for the alien registration sample was assumed, without further address searching, because of the recency of the address given in the basic records.

Estimation Procedures

Estimates of missed persons from the record check sample data were derived using a ratio estimator for the three samples where the sample size was a variable, and a simple unbiased estimator for the fixed sample of aliens. The general form of that estimator is:

$$x' = \frac{N}{n} \left(\sum_{i=1}^n x_i \right) \quad \text{where } x_i = 1 \text{ when the } i\text{th sample person was missed}$$

$$x_i = 0 \text{ otherwise}$$

Here N is the total in a population group and is given in line 1 of table 1; n is the sample size and is given as line 2 in table 1. For sample persons classified as missed, the value of x was "1." For sample persons classified as enumerated (or definitely not missed) and for out-of-scope persons, the value of x is clearly "0." Persons whose enumeration status was not clearly determined constitute the problem group since there is reason to believe that at least some of them (persons classified as probably missed and as noninterview) were missed and some were enumerated. The problem arises from the necessity of making some assumptions about the enumeration status of this problem group so that values of "1" or "0" may be assigned, in reasonable proportions, for the problem group.

One method of overcoming the estimation problem is to make extreme assumptions about the problem group: First, derive an estimate by classifying all as missed; and, secondly, derive an estimate by classifying all as enumerated. The first estimate yields an upper bound

for the rate of missed persons, and the second estimate gives a lower bound for this rate. However, rates resulting from these assumptions are unrealistic: Applying the first assumption yields a rate of about 17 percent missed; applying the second assumption yields a rate of about 1 percent missed. Also the population estimate corresponding to the second assumption implies that the record check samples represented more than 100 percent of the population. Therefore, the assumptions were modified to produce more realistic estimates.

Varying assumptions were then made about allocation of the problem group to the missed and enumerated classifications. In general, the assumptions were guided by the following considerations.

1. The "probably missed" sample persons should have a high probability of actually being missed.
2. The "unlocated" noninterview sample persons should have a high probability of actually being enumerated. (Even assuming unusual enumeration difficulties for this noninterview group, it is reasonable to suppose that most of them were enumerated.)
3. The rate of actually being missed for the "noninterview-failure to reconcile" sample persons should lie between the rates for the "probably missed" and the "noninterview-failure to locate" sample persons.
4. The population represented by these four record checks is undoubtedly smaller than the total United States population in 1960. (Comparison of rough estimates for the population groups not represented or represented twice as noted previously on page 2, indicates a net underrepresentation by the four record checks.) Corresponding to each estimate of undercoverage from the record checks is a complementary estimate of correct enumerations. The sum of the estimates of correctly enumerated persons and missed persons is constant. If a record check estimate of correctly enumerated population is greater than the estimate obtained by subtracting from the census total the estimate of erroneously enumerated persons, there is an implication of more than 100 percent population representation by the combined record check studies. The corresponding assumptions were modified to allow for an upper limit of 100 percent.

Table B summarizes six sets of assumptions used in allocating problem group sample persons to the enumerated and missed classifications. The resulting six alternative estimates are examined in the text that follows.

Estimates No. 1 and No. 2 provide an upper and a lower estimate of the missed rate corresponding to extreme assumptions (all missed and then the maximum enumerated) about enumeration of the "probably missed" persons while assuming, in both cases, that all "noninterview" persons were enumerated. In order to keep estimate No. 2 from implying that the record check samples represent more than 100 percent of the population, only 2/9 of the "probably missed" persons could be allocated to the enumerated classification.

Estimates No. 3 and No. 4 provide an upper and a lower estimate of the missed rate as a result of making extreme assumptions about the enumeration of the "probably missed" sample persons and assuming, in both cases, that the "noninterview" sample persons were missed at the same rate as the rest of the sample. As in estimate No. 2, a maximum value existed for the allocation of "probably missed" persons to the enumerated classification.

Table B.--ASSUMPTIONS ABOUT SAMPLE GROUPS OF UNKNOWN ENUMERATION STATUS USED FOR SIX ALTERNATIVE ESTIMATES OF MISSED PERSONS

Sample groups of unknown enumeration status	Assumptions used for six alternative estimates of missed persons					
	Estimate No. 1	Estimate No. 2	Estimate No. 3	Estimate No. 4	Estimate No. 5	Estimate No. 6
Not interviewed: Failure to locate...	All enumerated	All enumerated	Missed at same rate as rest of sample	Missed at same rate as rest of sample	All enumerated	Missed at same rate as rate of sample
Failure to reconcile	All enumerated	All enumerated	Missed at same rate as rest of sample	Missed at same rate as rest of sample	All missed	All missed
"Probably missed".....	All missed	7/9 missed 2/9 enumerated ¹	All missed	4/7 missed 3/7 enumerated ¹	All missed	All missed
	Estimates of population not represented in record checks					
	0.6%	0	1.0%	0	1.5%	2.0%

¹These are the maximum rates of enumeration that can be assumed for the "probably missed," since larger figures would produce estimates of the total enumerated population in excess of the number actually enumerated in the 1960 census.

Estimates No. 5 and No. 6 provide additional upper estimates of the missed rate as a result of varying the assumptions in estimates No. 1 and No. 3 about allocations to the missed classification of noninterview persons. The assumptions made in estimates No. 5 and No. 6 recognize a difference in the missed rates between "non-interview--failure to locate" and "noninterview--failure to reconcile" sample persons. No corresponding lower estimates are provided for estimates No. 5 and No. 6 because lower estimates would have to be adjusted to imply a maximum of 100 percent representation of the population. Therefore, lower estimates of the missed rate as provided by estimates No. 2 and No. 4 are used.

No allocation of the problem group was made to the out-of-scope classification although some of the noninterview--failure to locate persons may have been persons who had died or left the country. In fact, comparison of estimates of deceased persons from the record check sample results with data from the National Office of Vital Statistics indicates the estimates from the study results were low. Nevertheless, the adjustment of the estimates for these implied differences led to negligible effects, and consequently, allocations of problem group sample persons to the out-of-scope category were ignored.

For four of the six alternative estimates, there is a residual group of persons implied as not represented by the four record check samples. An allocation of this group had to be made to the enumerated and missed estimates of persons. This was accomplished by using the same percentages of enumerated and missed persons as the record check results in the corresponding estimate.

Results of the estimation procedure described here are presented in tables 2 through 5.

Related References

For a description of how the censuses were conducted see Bureau of the Census Working Paper No. 16, *Procedural Report on the 1960 Censuses of Population and Housing*.

Census published data being evaluated by the record check studies and other population coverage studies is published in the population volumes of the 1960 census;

principally, U. S. Bureau of the Census, *U.S. Census of Population: 1960, Number of Inhabitants, United States Summary*, Final report PC(1)-1A.

Some preliminary evaluation of the 1960 censuses have been presented by Conrad Taeuber and Morris H. Hansen in a paper entitled "A Preliminary Evaluation of the 1960 Censuses of Population and Housing" (September 1963).

The results of the studies in the Evaluation and Research Program of the 1960 Censuses of Population and Housing are being presented in a series of reports numbered ER 60. The first report in that series entitled "Background, Procedures, and Forms" presents the principal forms used in the record check studies reported on here. It is planned that the evaluation of the census will be presented in a special analytical report combining the content and coverage data from all the evaluation studies.

The Post-Enumeration Survey (PES) was used to evaluate the 1950 censuses. Results of the PES are available in Bureau of the Census Technical Paper No. 4, *The Post-Enumeration Survey: 1950*, as well as in unpublished papers.

The Canadian Census Bureau used a record check approach as a part of their evaluation program in connection with the 1961 Canadian Census. Some results of that study have been presented in a paper entitled "First Report on Project III of the Quality Analyses of the 1961 Census."

An earlier attempt to match records from independent sources to census records was reported on by Lillian Guralnick and Charles B. Nam, in an article entitled "Census-NOVS Study of Death Certificates Matched to Census Records," printed in the Milbank Memorial Fund Quarterly, April 1959, Vol. XXXVII, No. 2, pp. 144-153.

In connection with the 1950 evaluation program, a record check approach was used to evaluate the completeness of coverage of children born in the first three months of 1950. Results are available in Bureau of the Census Procedural Studies of the 1950 Censuses, No. 1, *Infant Enumeration Study: 1950*.

Table 1.—RESULTS OF LOCATION AND MATCHING PROCEDURES BY POPULATION GROUP SAMPLED, FOR RECORD CHECK STUDIES

(Percentages may not add to totals because of independent rounding)

Results of location and matching procedures	Persons enumerated in 1950 census				Birth registrations from April 1, 1950, to April 1, 1960			
	Number	Percent			Number	Percent		
Total persons in population group ¹	151,325,798	...	...	...	40,360,246	...	...	...
Total persons in sample.....	2,605	100.0	...	...	4,525	100.0	...	...
Out of scope of record checks.....	252	9.7	...	...	147	3.2	...	...
Deceased.....	229	8.8	...	...	103	2.3	...	...
Outside U.S.....	23	0.9	...	...	32	0.7	...	...
Other.....	...	...	...	...	12	0.3	...	...
In scope of record checks.....	2,353	90.3	100.0	...	4,378	96.8	100.0	...
Record check not completed.....	255	9.8	10.8	...	682	15.1	15.6	...
Failure to locate.....	234	9.0	9.9	...	652	14.4	14.9	...
Failure to reconcile.....	21	0.8	0.9	...	30	0.7	0.7	...
Record check completed.....	2,098	80.5	89.2	100.0	3,696	81.7	84.4	100.0
Enumerated in census.....	2,032	78.0	86.4	96.9	3,532	78.1	80.7	95.6
Missed.....	26	1.0	1.1	1.2	40	0.9	0.9	1.1
Probably missed.....	40	1.5	1.7	1.9	124	2.7	2.8	3.4
Results of location and matching procedures	Persons estimated as missed in 1950 census by PES ³				Aliens registered in January 1960			
	Number	Percent			Number	Percent		
Total persons in population group ²	3,400,000	...	...	...	2,931,937	...	...	...
Total persons in sample.....	273	100.0	...	...	209	100.0	...	...
Out of scope of record checks.....	24	8.8	...	...	2	1.0	...	...
Deceased.....	20	7.3	...	...	1	0.5	...	...
Outside U.S.....	4	1.5	...	...	...	...	...	...
Other.....	...	...	...	...	1	0.5	...	...
In scope of record checks.....	249	91.2	100.0	...	207	99.0	100.0	...
Record check not completed.....	49	17.9	19.7	...	9	4.3	4.3	...
Failure to locate.....	46	16.8	18.5	...	...	...	...	...
Failure to reconcile.....	3	1.1	1.2	...	9	4.3	4.3	...
Record check completed.....	200	73.3	80.3	100.0	198	94.7	95.7	100.0
Enumerated in census.....	184	67.4	73.9	92.0	179	85.6	86.5	90.4
Missed.....	4	1.5	1.6	2.0	6	2.9	2.9	3.0
Probably missed.....	12	4.4	4.8	6.0	13	6.2	6.3	6.6

¹Sources: Published population count, 1950 Census. National Office of Vital Statistics, "Vital Statistics of the United States," selected volumes.²Sources: U.S. Bureau of the Census, The Post-Enumeration Survey: 1950, Technical Paper No. 4. Annual report of the Immigration and Naturalization Service, 1960.³Post-Enumeration Survey: 1950.

Table 2.—SIX ALTERNATIVE ESTIMATES FROM RECORD CHECK STUDIES OF MISSED PERSONS AND OF 1960 TRUE TOTAL POPULATION, IN DESCENDING ORDER

(In thousands. See table B in text for bases for alternative estimates. Details may not add to totals because of independent rounding)

Components of estimates of 1960 true total population	Estimate No. 6		Estimate No. 5		Estimate No. 3		Estimate No. 1		Estimate No. 2		Estimate No. 4	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1. Published population count, 1960 census.....	179,323	...	179,323	...	179,323	...	179,323	...	179,323	...	179,323	...
2. Estimates of persons erroneously included, according to reenumerative studies.....	2,325	1.3	2,325	1.3	2,325	1.3	2,325	1.3	2,325	1.3	2,325	1.3
3. Estimates of persons missed, according to record check studies ¹	8,501	4.7	7,527	4.2	6,633	3.7	5,801	3.2	4,737	2.6	4,737	2.6
4. Estimated net undercoverage (item 3 minus item 2)....	6,176	3.4	5,202	2.9	4,308	2.4	3,476	1.9	2,412	1.3	2,412	1.3
5. Estimated 1960 true total population (item 1 plus item 4).....	185,499	...	184,525	...	183,631	...	182,800	...	181,735	...	181,735	...

¹Including estimates for population not represented in record checks.

Table 3.—SIX ALTERNATIVE ESTIMATES FROM RECORD CHECK STUDIES OF MISSED PERSONS, IN DESCENDING ORDER, AND OF CORRECTLY ENUMERATED PERSONS, BY POPULATION GROUPS SAMPLED

(In thousands. See table B in text for bases for alternative estimates. Details may not add to totals because of independent rounding)

Population groups sampled by missed and correctly enumerated classifications	Estimate No. 6		Estimate No. 5		Estimate No. 3		Estimate No. 1		Estimate No. 2		Estimate No. 4	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total missed.....	8,501	100.0	7,527	100.0	6,633	100.0	5,801	100.0	4,737	100.0	4,737	100.0
Persons enumerated in 1950 census.....	5,612	66.0	5,054	67.1	4,309	65.0	3,842	66.2	3,202	67.6	3,193	67.4
Birth registrations from April 1, 1950 to April 1, 1960..	2,035	23.9	1,732	23.0	1,734	26.1	1,464	25.2	1,163	24.6	1,180	24.9
Persons estimated as missed in 1950 census by PES ¹	295	3.5	241	3.2	244	3.7	195	3.4	156	3.3	167	3.5
Aliens registered in January 1960.....	386	4.5	386	5.1	278	4.2	266	4.6	216	4.6	197	4.2
Other ²	173	2.0	114	1.5	68	1.0	34	0.6	...	...	...	...
Total correctly enumerated.....	176,998	100.0	176,998	100.0	176,998	100.0	176,998	100.0	176,998	100.0	176,998	100.0
Persons enumerated in 1950 census.....	131,075	74.1	131,633	74.4	132,378	74.8	132,845	75.1	133,485	75.4	133,494	75.4
Birth registrations from April 1, 1950 to April 1, 1960..	37,014	20.9	37,317	21.1	37,315	21.1	37,585	21.2	37,886	21.4	37,869	21.4
Persons estimated as missed in 1950 census by PES ¹	2,806	1.6	2,860	1.6	2,857	1.6	2,906	1.6	2,945	1.7	2,934	1.7
Aliens registered in January 1960.....	2,512	1.4	2,512	1.4	2,620	1.5	2,632	1.5	2,682	1.5	2,701	1.5
Other ²	3,591	2.0	2,676	1.5	1,828	1.0	1,030	0.6	....	...	...	...

¹Post-Enumeration Survey: 1950²"Other" represents a residual population group not accounted for in the record check studies.

Table 4.—SIX ALTERNATIVE ESTIMATES FROM RECORD CHECK STUDIES OF MISSED PERSONS, IN DESCENDING ORDER, BY REGION

(In thousands. Excluding estimates for population not covered by record check studies. See table B in text for bases for alternative estimates. Details may not add to totals because of independent rounding)

Alternative estimates	United States		Northeast		North Central		South		West	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Published population count, 1960 census.....	179,323	...	44,678	...	51,619	...	54,973	...	28,053	...
Estimate No. 6.....	8,329	4.6	1,889	4.2	1,994	3.9	3,094	5.6	1,352	4.8
Estimate No. 5.....	7,413	4.1	1,661	3.7	1,731	3.4	2,813	5.1	1,208	4.3
Estimate No. 3.....	6,565	3.7	1,474	3.3	1,516	2.9	2,493	4.5	1,082	3.9
Estimate No. 1.....	5,768	3.2	1,276	2.9	1,287	2.5	2,248	4.1	957	3.4
Estimate No. 2.....	4,737	2.6	1,084	2.4	1,034	2.0	1,806	3.3	812	2.9
Estimate No. 4.....	4,737	2.6	1,104	2.5	1,020	2.0	1,781	3.2	833	3.0

Table 5.—SIX ALTERNATIVE ESTIMATES FROM RECORD CHECK STUDIES, IN ORDER OF SIZE, OF ENUMERATED PERSONS AND OF MISSED PERSONS WITH CORRESPONDING STANDARD ERROR, BY POPULATION GROUPS SAMPLED

(In thousands. Excluding estimates for population not covered by record check studies. See table B in text for bases for alternative estimates. Details may not add to totals because of independent rounding)

Alternative estimates for enumerated and missed persons, and standard error	Population groups sampled				
	Total, four record check studies	Persons enumerated in 1950 census	Birth registrations from April 1, 1950 to April 1, 1960	Persons estimated as missed in 1950 census by PES ¹	Aliens registered in January 1960
Estimate No. 6					
Enumerated persons, 1960.....	173,407	131,075	37,014	2,806	2,512
Missed persons, 1960.....	8,329	5,612	2,035	295	386
Standard error.....	816	691	185	69	79
Missed persons, rate per 100 enumerated persons..	4.8	4.3	5.5	10.5	15.4
Standard error.....	0.5	0.5	0.5	2.5	3.1
Estimate No. 5					
Enumerated persons, 1960.....	174,322	131,633	37,317	2,860	2,512
Missed persons, 1960.....	7,413	5,054	1,732	241	386
Standard error.....	778	660	170	62	79
Missed persons, rate per 100 enumerated persons..	4.3	3.8	4.6	8.4	15.4
Standard error.....	0.4	0.5	0.5	2.2	3.1
Estimate No. 3					
Enumerated persons, 1960.....	175,170	132,378	37,315	2,857	2,620
Missed persons, 1960.....	6,565	4,309	1,734	244	278
Standard error.....	739	614	170	63	67
Missed persons, rate per 100 enumerated persons..	3.7	3.3	4.6	8.5	10.6
Standard error.....	0.4	0.5	0.5	2.2	2.6
Estimate No. 1					
Enumerated persons, 1960.....	175,968	132,845	37,585	2,906	2,632
Missed persons, 1960.....	5,768	3,842	1,464	195	266
Standard error.....	699	583	156	56	66
Missed persons, rate per 100 enumerated persons..	3.3	2.9	3.9	6.7	10.1
Standard error.....	0.4	0.4	0.4	1.9	2.5
Estimate No. 2					
Enumerated persons, 1960.....	176,998	133,485	37,886	2,945	2,682
Missed persons, 1960.....	4,737	3,202	1,163	156	216
Standard error.....	641	536	139	50	59
Missed persons, rate per 100 enumerated persons..	2.7	2.4	3.1	5.3	8.1
Standard error.....	0.4	0.4	0.4	1.7	2.2
Estimate No. 4					
Enumerated persons, 1960.....	176,998	133,494	37,869	2,934	2,701
Missed persons, 1960.....	4,737	3,193	1,180	167	197
Standard error.....	641	535	140	52	56
Missed persons, rate per 100 enumerated persons..	2.7	2.4	3.1	5.7	7.3
Standard error.....	0.4	0.4	0.4	1.8	2.1

¹ P. 4. Survey: 1950.