

RESULTS FROM THE 1995 INTEGRATED COVERAGE MEASUREMENT EVALUATION INTERVIEW

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I. Introduction

The objective of this evaluation is to measure and evaluate the quality of the Integrated Coverage Measurement (ICM) Person Interview data. The evaluation focuses on errors that are relevant to the study of census coverage estimator bias and the CensusPlus estimator. The data for the evaluation are obtained from the 1995 ICM Evaluation Interview.

Different types of nonsampling errors might be introduced in the data during collection and processing. Data collection errors can be caused by the instrument design, the enumerators or the respondents. In the ICM Person Interview, examples of possible data collection error include respondent recall error on household membership or misunderstanding of Census Bureau residence rules due to question wording. Possible errors caused by an enumerator include falsifying part of a roster or entering erroneous information to reconcile roster differences. Finally, data processing errors might be introduced when census and ICM Person Interview data are linked and residence status is established. To determine the overall accuracy of the Person Interview results, a reinterview was conducted on a sample of the ICM households. This reinterview was designed to obtain the "best" residency status classifications for all sample persons.

II. Background

The ICM Person Interview was a computer assisted personal interview (CAPI). The purpose of the interview was to obtain an independent roster of names and demographic information for each person living at a sample address on Census Day. After collecting the independent roster and confirming it with the respondent, the interviewer was permitted access to the census roster. The census roster was collected either by a respondent completed mail return, a Be Counted form, a reverse computer assisted telephone interview (CATI) or an enumerator return. This information had been keyed and loaded into the instrument before the interview.

The census roster and the independent roster were compared, first by computer software using an exact match on age and sex, and second by the enumerator visually examining the data. Persons that appeared on both rosters were linked. For the persons not linked on the independent roster (ICM nonmatch persons) the respondents were guided through a separate instrument path. On this path, information was gathered on the reasons why these persons were listed on the independent roster, but not on the census roster. Data were obtained on the living situation of these persons on Census Day.

Similarly, for the persons not linked on the census roster (census nonmatch persons) the respondents were guided through a path to obtain information on the reasons why these persons were listed on the census roster, but not on the independent roster. Data were obtained on the living situation of these persons on Census Day.

The Evaluation Interview was identical to the ICM Person Interview, but the preloaded input roster was different. The Evaluation Interview input roster was the union of persons from the initial census roster and any ICM nonmatched persons.

Similar to the ICM Person Interview data process, Evaluation Interview cases with unresolved residence status and/or enumerator notes attached were sent to a clerical review operation in the processing office. The purpose of this review was to determine the correct residence status of these cases.

For a detailed discussion of the computer and the clerical residence status coding specifications see Pausche (1995a and 1995b).

III. Methodology

A. Sampling

The Evaluation Interview was conducted in Oakland, California. In this site, the ICM Person Interview sample consisted of two subsamples with approximately 5,000 households in each. The Evaluation Interview sample was selected from the subsample that would not be receiving a followup

visit for Dual System Estimation. The ICM Person Interview field work began on June 5, 1995. The sample selection for the Evaluation Interview was based on data collected in the ICM Person Interview by July 17, 1995. The cutoff date was required to have the input roster loaded into the instrument and have the interviewer assignments ready before the start of the reinterview on August 7, 1995. Only cases with outcome codes of completed and partially completed were eligible for sampling. Thus, the sampling universe was reduced to about 3,400 housing units, or 68 percent of the subsample. Approximately 1,000 housing units were selected from this universe. A number of cases that had previously received a quality control reinterview were eliminated from the sample, leaving a total of 947 housing units to be interviewed.

The sample design called for a stratified cluster sample. The housing units were stratified by number of census and independent roster nonmatches and by ICM Person Interview outcome codes. The strata definitions and the strata sample sizes (n=number of housing units) are presented below:

Stratum 1: Whole household match. All census and independent roster persons match (n=116)

Stratum 2: At least one person match between the census and the independent roster, at least one census roster nonmatch and no independent roster nonmatches (n=153)

Stratum 3: At least one person match between the census and the independent rosters, at least one independent roster nonmatch and no census roster nonmatches (n=195)

Stratum 4: At least one person match between the census and the independent rosters, at least one census nonmatch and at least one independent roster nonmatch (n=83)

Stratum 5.1: Whole household nonmatch with zero persons on the census roster (n=238)

Stratum 5.2: Whole household nonmatch with at least one person on the census roster (n=162)

Since most rostering errors are expected to come from strata 2, 3, 4, and 5.2, i.e., the unit variability in these strata is expected to be greater than in strata 1 and 5.1, the former strata were oversampled to reduce the variance of an estimator based on the number of

errors. For a detailed account of the sampling design see Griffiths (1995).

B. Statistical Methodology

ICM methodology is concerned with estimating the coverage error associated with the initial census responses. ICM is used to produce an estimate of the missed or erroneously included persons in the initial census. As the Evaluation Interview attempts to provide a picture of the accuracy of the ICM data collection and processing, it subsequently produces a method for examining factors related to the bias of the ICM coverage estimator.

Coverage estimation involves both data collection and data processing steps. It involves obtaining a roster of names for each housing unit in the sample, determining residence status on Census Day for the roster, and then determining whether the roster corresponds to the census roster. For any nonmatch person on the census roster, a determination must be made about residence status. In this evaluation, the ICM Person Interview is conceptualized as a single implementation of the entire ICM process and an error in the ICM Person Interview is any decision that causes a person to be missed (not listed), to be erroneously excluded from the roster or to be erroneously included on the roster.

Assuming that the Evaluation Interview roster is correct, the outcome of the Evaluation Interview can be compared to the outcome of the ICM Person Interview, and estimates of the following error parameters can be derived: 1) missed Census Day resident, 2) unresolved Census Day resident, 3) unlisted Census Day resident, 4) erroneous ICM enumeration, and 5) unresolved nonresident. A detailed description of the methodology and the analysis plan is provided in Biemer (1995).

IV. Assumptions

The discussion of the error parameters is based on several assumptions. First, we assume that the universe for the study of ICM error is the set of roster elements (i.e., real persons, fictitious persons, nonresidents, etc.) that would be generated by implementing the ICM and Evaluation Interview processes for the entire residential population. We do not assume that the Evaluation Interview process is capable of listing all persons in the residential population. Rather, we assume that it contains the largest subset of the total residential population that

can be rostered by an interview process. In this sense, the Evaluation Interview provides an assessment of how well the ICM Person Interview performed relative to the best interview procedure.

We also assume: a) the Evaluation Interview process classification of residents is always correct, b) the Evaluation Interview process classification of nonresidents is always correct, c) every person in the Census Day roster is "rosterable" by the Evaluation Interview process listing, and d) the Evaluation Interview process produces the "best" set of unresolved cases.

Assumption d means that every unresolved roster listing is correctly classified as "unresolved" as determined by the "best" procedures for this classification, the Evaluation Interview procedures. This assumption allows us to use the Evaluation Interview classification as the standard by which to evaluate the ICM classifications.

We believe this assumption is plausible because the Evaluation Interview enumerators were the most qualified and the best that could be obtained to complete this survey and similarly, that the best staff in the processing office in Jeffersonville, Indiana completed the residence status coding associated with the Evaluation Interview.

It is important to note that the roster of Census Day residents does not contain all Census Day residents in the entire population. Census Day residents who would not be captured by an interview process, not even the "best" one, are not included in this roster. These are persons in hiding, persons not living in housing units, and other persons who for whatever reason can never be rostered. If CensusPlus was the coverage estimation methodology employed in ICM, it would require a different strategy to identify such persons.

V. Limitations

The assumption that the Evaluation Interview process accurately classifies the roster elements may not be satisfied in practice. If the Evaluation Interview error rate is nonnegligible, the analysis presented in this paper could be equally erroneous. For example, if a substantial number of misclassified persons in the Person Interview are misclassified in the same way in the Evaluation Interview, then the estimated ICM error rate will be understated. On the other hand, the ICM error rate could be overstated if errors in the

Evaluation Interview are uncorrelated with those in the Person Interview. More research is needed to assess the validity of these assumptions.

Given the assumptions listed above, the results from this study should not be regarded as providing estimates of the total error associated with the ICM Person Interview.

Concerns about linking errors (interviewer and computer), persons added through the ICM methodology and the quality of the work performed for the ICM Person Interview by the clerical staff in the processing office are not addressed in this study.

Finally, due to limited resources, the evaluation is based on data from only one of the three test sites.

VI. Results

The Evaluation Interview had a 3.9 percent noninterview rate. Fifteen units or 1.6 percent of the housing units in the sample were determined to have been vacant or not a housing unit on Census Day.

The Evaluation Interview identified 238 new cases. Of these, 147 or about 2/3 were determined to be residents. The residents represent 84 different households. They were not concentrated in any specific race or ethnic origin group. Neither were they of a specific sex or age. Some of the residents were relatives and some were nonrelatives living in the household.

Table 1 presents a comparison of residence status codes for the Evaluation Interview and the ICM Person Interview. The data in the table are weighted to the Evaluation Interview sampling universe. When weighted, 96 percent of the resident data remained classified as residents, 26 percent of the nonresidents remained nonresidents and 13 percent of the unresolved cases remained unresolved. Sixty-two percent of the nonresidents in the ICM Person Interview and 78 percent of the unresolved cases were determined to be residents in the Evaluation Interview. The results for weighted and unweighted data were similar.

The data presented in Table 1 are used to calculate the estimates of ICM error parameters. These estimates are presented in Table 2.

The probability that the ICM Person Interview misclassified a person who was truly a resident as a

Table 1. ICM Person Interview Results Compared to the Evaluation Interview Results (Weighted Frequencies and Percent Distributions¹)²

Eval. Interview	ICM Person Interview				
	Resident	Nonresident	Unresolved	Not on roster	Total
Resident (cell) (row) (column)	7287 (82.7) (90.0) (95.6)	136 (1.5) (1.7) (61.5)	256 (2.9) (3.2) (78.3)	416 (4.7) (5.1) (65.5)	8095 (91.9)
Nonresident	71 (0.8) (28.7) (0.9)	58 (0.7) (23.5) (26.2)	30 (0.3) (12.1) (9.2)	88 (1.0) (35.6) (13.9)	247 (2.8)
Unresolved	266 (3.0) (57.2) (3.5)	27 (0.3) (5.8) (12.3)	41 (0.5) (8.8) (12.5)	131 (1.5) (28.2) (20.6)	465 (5.3)
Total	7624 (86.6)	221 (2.5)	327 (3.7)	635 (7.2)	8807 (100)

¹ Cell totals, cell percents, row percents, column percents. The frequencies are rounded to integers

² Cases that were identified as living in another housing unit in the sample block and cases that were listed as "unknown" were given the code of nonresident at the sample address. Cases that were identified as duplicates were omitted from the analysis.

Table 2. ICM Error Parameters

Parameter	Estimate	Standard Error
Missed Census Day resident	.0168	.0037
Unresolved Census Day resident	.0316	.0053
Unlisted Census Day resident	.0514	.0047
Erroneous ICM enumeration	.2881	.0398
Unresolved nonresident	.1205	.0171

nonresident, and thereby missed that person, is .0168. Similarly, the probability that the ICM Person Interview misclassified a person who was truly a resident as an unresolved case is .0316. The probability of failing to list a Census Day resident is .0514. Combining the probability of misclassifying a resident as a nonresident with this probability results in an overall probability of .0682 of missing a Census Day resident. The probability of making an erroneous enumeration, i.e., of classifying a person as a resident when the person really is a nonresident, is .2881. Finally, the probability of classifying a nonresident as an unresolved case is .1205. (All parameters were calculated with unrounded numbers.)

Inspection of the data by sampling strata suggests that the largest number of omission errors come from the strata representing whole household nonmatch situations. More than half of the new persons were added from these strata (unweighted data). Erroneous enumerations, on the other hand, are evenly spread over all sampling strata.

It should be noted that the probabilities stated above are the conditional probabilities that errors were made in the ICM Person Interview in the classification of persons as residents, nonresidents or unresolved, based on the Evaluation Interview data. These probabilities should not be confused with estimates of coverage error (undercount and overcount estimates) obtained from the CensusPlus or the Dual System Estimation methodologies. Neither should they be translated into estimates of net coverage error.

VII. Conclusion and Discussion

The Evaluation Interview was conducted to assess the accuracy of the ICM Person Interview data. A sample of ICM Person Interview cases was reinterviewed. These cases had been completed during the first six weeks of the interviewing period and classified with an interview outcome code of complete or partial complete. The sample was selected to represent households where the census and the ICM Person data matched as well as households where there were inconsistencies in the rosters and households where the rosters had shown no agreement. The "best" enumerators from the ICM Person Interview were invited to become involved in the Evaluation Interview. They were briefed on the purpose of the interview, and they received special instructions on reinterview situations.

Overall, the respondents cooperated with the

enumerators and the noninterview rates were low. In a debriefing session at the end of the field operation, the enumerators attributed their success in gaining access to the respondents to their interviewing experience, their familiarity with the CAPI machine and the ICM instrument and their understanding of the operation and its purpose.

The "best" staff in the processing office completed the residence status coding associated with the Evaluation Interview. They also reviewed the matching of rosters between the ICM and Evaluation Interviews. Before the start of the operation, the ICM analysts were briefed on the nature of the data collection. They were instructed to follow the production rules for coding. In addition to the experience gained during the ICM production, these analysts had worked on previous census coverage measurement activities.

The results from the reinterview and the clerical operation indicate that some persons were erroneously left off the ICM Person Interview roster. Furthermore, for some persons new information was collected that enabled the instrument, the enumerators or the clerical review to determine that some persons who had been classified as nonresidents or unresolved should have been listed as Census Day residents at a sample address. For other persons the additional or new information suggested that they were not Census Day residents at a given address.

Error parameters were estimated from the Evaluation Interview data. The probability of failing to list a resident is estimated to be .0514 (s.e.=.0047). The probability of misclassifying a resident as a nonresident is .0168 (s.e.=.0037), and the probability of misclassifying a nonresident as a resident is .2881 (s.e.=.0398).

These findings suggest that there is uncertainty about establishing who should be included on the household roster as residing at a given address on Census Day, and the tendency is to include someone who should not have been included. However, since the number of true residents is many times greater than the number of nonresidents encountered in the sample, the false negative probability (.0168) represents many more people than the false positive probability (.2881).

As shown, some persons were omitted entirely from the roster. Inspection of the data by sampling stratum suggests that the largest number of omission errors

come from the strata representing whole household nonmatch situations. More than half of the new persons were added from these strata (unweighted data). Many of the households in these strata did not mail back a census questionnaire and therefore they became part of the census nonresponse operation. Some census rosters obtained in that operation were not available to be loaded into the instrument before the ICM Person Interview. It cannot be determined from this evaluation if the residents added by the Evaluation Interview were also added in the nonresponse operation. What can be determined is that the ICM Person Interview and the Evaluation Interview results are in disagreement about the correct Census Day roster for this type of household.

The use of the Evaluation Interview data as a standard against which to judge the accuracy of the ICM Person Interview rests on the assumption that the best procedures, the best enumerators and the best clerks were available for the Evaluation Interview. Only limited data are available to examine this issue. The data we do have come from debriefings of the enumerators and evaluations of the clerical operation in the ICM production process. Both sources suggest that the staffs were well trained.

The debriefing at the conclusion of the Evaluation Interview field activities suggests that the enumerators were comfortable with the computers and the instrument. They had a good understanding of the objective of the Evaluation Interview. The enumerators understood why this evaluation was different from a quality control operation, why they were repeating the ICM Person Interview and why they were given different assignment areas (Treat, 1995).

A separate evaluation focused on the quality of the work performed by the clerical staff for the ICM Person Interview. It was the conclusion of the report that the clerks performed well in that operation (Childers, 1996).

The high incidence of unresolved cases in the Evaluation Interview (cases for which insufficient data had been collected to determine a person's residence status on Census Day) suggests that both the respondents and the ICM enumerators had difficulty with the residence rules. It is recommended that modifications and improvements to the instrument and different rostering techniques be explored to ensure that an accurate Census Day roster is achieved.

In the future, it would be desirable to have more information regarding the quality of the Evaluation Interview data. Insight about the error components in the reinterview might be obtained from for example a latent class model estimation study.

VIII. References

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