Census 2000 Topic Report No. 13

Census 2000 Testing, Experimentation, and Evaluation Program

Issued March 2004

TR-13

Data Collection in Census 2000

U S C E N S U S B U R E A U

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United States Census 2000

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DATA COLLECTION IN CENSUS 2000

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Foreword

The Census 2000 Testing, Experimentation, and Evaluation Program provides measures of effectiveness for the Census 2000 design, operations, systems, and processes and provides information on the value of new or different methodologies. By providing measures of how well Census 2000 was conducted, this program fully supports the Census Bureau's strategy to integrate the 2010 planning process with ongoing Master Address File/TIGER enhancements and the American Community Survey. The purpose of the report that follows is to integrate findings and provide context and background for interpretation of related Census 2000 evaluations, experiments, and other assessments to make recommendations for planning the 2010 Census. Census 2000 Testing, Experimentation, and Evaluation reports are available on the Census Bureau's Internet site at: *www.census.gov/pred/www/*.

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1. Introduction[1]

With the goal to obtain a complet ed questionnaire for every housing unit in Census 2000, the United States Census Bureau used three basic data collection methods and other special strategies to ensure delivery of questionnaires to every housing unit. The basic methods included "door-to- door" canvass ing, a variation of which has been done since the first census in 1790, the use of the postal service to both deliver questionnaires and receive questionnaire responses (mailout/mailback), which was ini tiated in the 1970 census, and the personal delivery of census ques tionnaires to the respondents with instructions for them to mail the completed questionnaires back to the Census Bureau (update/leave). This report, *Data Collection in Census 2000*, synthesizes results from evaluations and assessments that pertain to these data collec tion methods. This includes, in varying degrees, operations such as Nonresponse Followup, Update/Leave, Urban Update/ Leave, Update/Enumerate, List/Enumerate, Coverage Improvement Followup, and Field Verification. The report highlights the major challenges and success es of data collection operations, cites results from the evaluations and assessments, and includes rec ommendations for planning and designing future data collection operations.

Background

Census-taking efforts were initiat ed shortly after our first President, George Washington, was inaugurat ed in 1790. In accordance with Article I, section 2, of the United States Constitution, the first enu meration of the inhabitants of the United States began on the first Monday of August in that same year.

From 1790 to 1960, the basic method of collecting census infor mation from the population remained the same. It is referred to as "door-to-door" enumeration. Throughout this period, however, the census schedules, field proce dures, training, and questionnaires were continually improved from the previous experience. Changes or improvements related to data collection are highlighted below.

Up to 1840, the household, rather than the individual, remained the unit of enumeration in the popula tion census. The U.S. marshals responsible for collecting data entered only the names of the "household heads" on the census schedules.

From 1850 through 1870, the act that governed the taking of the Seventh, Eighth, and Ninth Decennial Censuses initiated changes in the census data collec tion process. The marshals were required, for the first time, to sub-divide their districts into "known civil divisions" such as counties, townships, or wards and they were also responsible for checking the completed census work to ensure that the returns of their assistants were properly completed.

Three important changes were ini tiated for the 1880 census. Specially appointed agents (experts assigned to collect technical data) along with supervisors and enu merators replaced marshals and their assistants. Enumerators were forbidden to disclose census infor mation. In prior censuses, census schedules were posted publicly. Third, enumerators were given detailed maps to follow so that they could account for every street or road, and not stray beyond their assigned boundaries.

The 1890 census utilized, for the first time in history, a separate schedule for each family. The 1900 census featured the first U.S. censuses conducted outside of the continental states and territories. The 1910 census had several notable features. Most importantly from a data collection perspective, this was the first time that prospective census employees were required to take open com petitive examinations that were administered throughout the coun try. Previously, starting in 1880, appointees had been given non-competitive tests prior to working as census enumerators.

[1] Sources for this section include: (a) *Census 2000 Operational Plan*; (b) *200 Years of Census Taking: Population and Housing Questions, 1790 – 1990*; (c) *Twenty Censuses–Population and Housing Questions*; (d) *Measuring America: The Decennial Censuses From 1790–2000*; (e) *Two Hundred Years and Counting: The 1990 Census*; (f) *1990 Census of Population and Housing History* (Parts A and D); (g) *1980 Census of Population and Housing–History*; (h) *1970 Census of Population and Housing–Procedural History*; (i) *Procedural History of the 1960 Censuses of Population and Housing*; (j) *The 1950 Censuses–How They Were Taken, Procedural Studies of the 1950 Censuses*; and (k) *Procedural History of the 1940 Census of Population and Housing.*

There were minor changes in the scope and the data collection methods of the 1920 and 1930 censuses. However, a profound change was introduced with the census of 1940. Sampling in the 1940 census allowed for the addi tion of several questions for just five percent of the households enu merated without unduly increasing the overall burden on respondents or on the data processing require ments. It was also the first to include a census of housing which obtained a variety of facts on the general condition of the Nation's housing inventory.

The 1950 population and housing census was conducted following the conventional method of door-to-door enumeration. However, a census test conducted in October of 1948 indicated that self-enumer ation appeared feasible for use in the census of agriculture in 1950. Prior to the actual decennial cen sus in April 1950, an experiment was conducted in six district offices and indicated that a general 20 percent sampling pattern would be feasible during the census. This sampling pattern was institut ed during the 1950 census.

As in all previous censuses, the 1960 census still relied on door-to-door enumeration. However, it was the first time that the United States Postal Service (USPS) was used extensively to deliver census self-administered questionnaires. Prior to the door-to-door enumera tor canvassing operation, the USPS delivered a questionnaire contain ing the 100 percent questions to every occupied housing unit. Householders were asked to com plete the questionnaire and hold it until the census enumerator came to pick it up. This was regarded as the first stage in the 1960 census. The second stage pertained to the sample questions, which were on a separate questionnaire. In the urban areas of the country (which contained about 80 percent of the population), the enumerators car ried the sample questionnaires with them while canvassing and left one at every fourth household asking the occupants to complete the sample questionnaire and mail it back to the Census Bureau.[2]

The 1970 census introduced the first data collection method that did not require a 100 percent door-to-door canvassing. As in 1960, the USPS delivered self-adminis tered questionnaires to house-holds, but in 1970 the household respondent was instructed to mail return their responses back to the Census Bureau. This method is referred to as mailout/mailback. Approximately 60 percent of the population (essentially in large metropolitan areas) received and were asked to return their census questionnaires via the mail. In these areas, enumerators contact ed only those households that did not return questionnaires or that had given incomplete answers to the questions (a nonresponse fol lowup operation). For the remain ing 40 percent of the population, predominately located in rural areas, the mail carriers delivered a questionnaire to the households and the householders were asked to complete and hold them for pickup by a census enumerator. The enumerators were responsible for obtaining missing or incom-

[2] The first stage of the 1960 process was designed to concentrate primarily on coverage, with the goal of providing improved counts of people and housing units. During the second stage of the 1960 enumeration, the census enumerators con centrated primarily on collecting acceptable sample information on the various subjects covered by the censuses. The separation of the enumeration into two stages was intend ed to simplify the job of the enumerators and it was hoped that if the enumerators for each stage had fewer tasks to perform, they would master them better.

plete information. Three hundred and ninety-three district offices were established in the 50 states and the District of Columbia. In addition, six temporary district offices and one area office were established for the census of Puerto Rico. In 181 of the district offices, the census was taken in the conventional (traditional) man ner; that is, an enumerator visited each house to collect the informa tion. In 167 of the district offices, the census was taken by the decentralized mail method. The decentralized mail method involved listing, by enumerators, the street addresses of every hous ing unit and the addressing, by clerks, of mailing pieces (question naire packages) to be mailed to every housing unit. In the remain ing 45 district offices, where com mercial mailing lists were available for purchase by the Census Bureau, the centralized (mailout/mailback) method was used to collect the census information.

The 1980 census basically involved the same methods used in 1970. The mailout/mailback method was used in areas of the country con taining 95.5 percent of the popula tion and the conventional method (going door to door) was used for the remainder of the country. The USPS delivered addressed census questionnaires to over 80 million housing units at the end of March, 1980. In addition, by Census Day, all of the mail district offices had telephone lines installed for the purpose of helping respondents complete their questionnaires. All district offices provided the same service for respondents who appeared in person through the use of walk-in assistance centers.

The Census Bureau conducted the 1990 Census using the three basic census methodologies: "mailout/ mailback, enumerator delivery/

mailback, and mailout with a door-to-door canvass," (U.S. Department of Commerce 1993). Ninety-five percent of the population was counted by mail census proce dures. Notably, the 1990 Census was the first national census that used computers at the local district office level to check-in, monitor, and check-out census question naires. Field data collection opera tions were structured, monitored, and evaluated through the use of computer programs available at the local district office level, the 13 regional census centers, and the national Census Bureau Headquarters. Applicant, employ ee, and payroll data were also maintained on files at each of the 449 temporary local district offices established to conduct the field data collection procedures. The 1990 Census involved the mailing or delivery of over 96 million ques tionnaires to housing units across the United States.

Census 2000 marks the culmina tion of 210 years of census-taking. Every effort was made to ensure that the field data collection processes employed were the most thorough and efficient possible. For more than 80 percent of the households in the country, the United States Postal Service deliv ered the census questionnaires. At the vast majority of the remaining housing units, census enumera tors personally delivered question naires while updating the list of addresses for their assigned areas. In the remaining sparsely settled or remote areas, census enumerators created an address list and, while doing so, enumerated the residents of each listed household. Refinements in the use of comput er technology designed to aug ment the field data collection efforts were instituted and new innovations such as the use of the Internet to broaden response options were available.

More detailed background informa tion on the specific data collection methodologies employed in both the 1990 Census and Census 2000 are presented in Section 4 of this report.

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2. Scope

This report includes information on enumerator recruiting and enumerator pay rates, and discusses data quality in terms of the actual wording of questions and the actual reference date. Additionally, the following research questions are addressed:

- .How well did field operations work?
- .What operational problems occurred and how were they addressed?
- .Were field operations completed on time?
- .How did field data collection schedules and procedures affect data quality (rate of proxy response, "unclassified", and partial interviews)?
- .How was the planning database used, and was it helpful in targeting locations for tool kit applications?
- .How can the planning database be improved for future use?
- .How effective was training for the Nonresponse Followup Operation?
- .How well did nonresponse enumerators administer the instrument?
- .Did nonresponse enumerators adhere to Census Day as the reference date?

With the relatively large number of source documents used to compile this topic report, the background, study methodologies, limitations, results, and recommendations for each source are presented separately in Section 4 of the report. The major recommendations are presented in Section 5. Source documents include one topic report, twelve formal evaluations, and two assessment reports. They are listed below. (Note that this report does not integrate results from the Accuracy and Coverage Evaluation data collection operations.)

- .*Coverage Improvement in Census 2000 Enumeration* topic report
- .Evaluation of the Update/Leave Operation (F.10)
- Urban Update/Leave (F.11)
- Update/Enumerate (F.12)
- List/Enumerate (F.13)
- .Census 2000 Staffing Programs, Pay Component (part of G.1)
- .Census 2000 Staffing Programs, Recruiting Component (part of G.1)
- .Operational Analysis of Field Verification Operation for Non-ID Questionnaires (H.2)
- .Questionnaire Assistance Centers for Census 2000 (H.4)
- .Nonresponse Followup for Census 2000 (H.5)
- .Study of Nonresponse Followup (NRFU) Enumerator Training (H.7)
- .Operational Analysis of Enumeration of Puerto Rico (H.8)
- .Date of Reference for Respondents of Census 2000 (H.10)
- .Assessment Report for Nonresponse Followup
- .Assessment of Non-Type of Enumeration Area (TEA) Tool Kit Methods

Other Census 2000 topic reports that complement and/or coincide with the information contained in this report are described below.

- .The topic report on *Coverage Improvement in Census 2000 Enumeration* provides information about field operations that were intended to improve coverage of both housing units (HUs) and persons in the census. It complements information in this report and provides further insight into the effectiveness of the data collection effort.
- .The topic report on *Puerto Rico* provides a synthesis of information about Census 2000 in Puerto Rico, including field data collection. Given this, this document on *Data Collection in Census 2000* provides a comparison of data collection methods between 1990 and 2000, but does not cover evaluation results.
- .The topic report on *Special Place/Group Quarters Enumeration* provides a synthesis of information about Special Place/Group Quarters (SP/GQ) including the development of the SP/GQ inventory, the enumeration of GQs, and

processing activities related to GQ enumeration. Although SP/GQs were enumerated apart from regular HUs, SP/GQ operations were a major part of the overall field data collection effort conducted by the Local Census Offices (LCOs).

- .The topic report on *Address List Development in Census 2000* provides a wide array of information pertaining to field activities whose primary purpose was to build address files and related geographic databases. While the majority of these field operations were conducted to collect information for Master Address File building purposes, operations such as Update/Leave, Update/Enumerate and List/Enumerate served a dual purpose: to create/update address lists and to collect HU and person information for the census. Please see the Limits section.

3. Limits

A synthesis of the field collection methods used in Census 2000 is limited to only a few operations. Although there are formal evaluations specific to Update/Enumerate, List/Enumerate, Update/Leave, and Urban Update/Leave, they focus on address list development and not on operational aspects. For these collection methods, this document on *Data Collection in Census 2000* provides a comparison to what was done in 1990 and only covers the timing of the operations in Census 2000.

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4. Findings

This section discusses the background, methods, limits, results, and recommendations from each of the individual evaluations, assessments, and auxiliary reports.

4.1 Recruiting, pay rates, and frontloading[3]

For the 1990 Census, source infor: mation comes from U.S. Department of Commerce (1996), and for Census 2000, from Jacobson, Petta and Yudd (2002) and Jacobson and Petta (2002).

4.1.1 Recruiting

- 1990 Census

Recruiting for decennial censuses has always been a monumental undertaking. For the 1990 Census, staffing requirements dictated that the Census Bureau recruit and test about 2 million applicants for approximately 500,000 temporary positions. Overall, the 1990 Census recruiting program was very successful. There were areas of the country that experienced shortages of job applicants, espe: cially where the cost of living was high and the unemployment num: bers were low. For these areas, the Census Bureau made upward adjustments to its pay scale during the census to encourage applicants to apply for a census position. This action proved successful in bolster: ing the recruitment of job appli: cants in these areas.

Table 1.
Recruiting Performance Groups

Performance group	Performance measure (as of February 2000)	Number of LCOs within each performance group
1	Exceeded recruiting goal by 60 percent or more	27
2	Exceeded recruiting goals by 25 percent to 59 percent	43
3	Exceeded recruiting goals by <25 percent	137
4	Recruiting averaged 80 percent of goal	258
5	Recruiting averaged 50 percent of goal	54
	Total:	519[6]

Source: (Jacobson, Petta, and Yudd 2002)

- Census 2000

The Census 2000 recruiting pro- gram was also comprehensive, far- reaching, and highly successful. At the Census Bureau's request, Westat (Jacobson, Petta, and Yudd 2002) reviewed and analyzed the factors affecting Census 2000 recruiting efforts in 519 of the 520 LCOs during Census 2000.[4]

Westat examined the effects of sev: eral different factors on recruiting including:

- ;Census pay relative to the local: ly prevailing pay rate.
- ;Recruiting goals established by Census Headquarters (HQ).
- ;Expected Nonresponse Followup (NRFU) workloads.
- Management turnover.
- ;Area characteristics such as population density, private firm employment, and per capita income.

4.1.2 Recruiting study methodology

Westat's analysis of factors affect: ing Census 2000 recruiting per: formance was modeled on their similar analysis of enumeration performance during the 1990 decennial census. The methodolo: gy included developing a bench- mark for comparing recruiting per: formance across LCOs[5] and placing each into one of five performance groups based on the extent to which the LCO's performance devi: ated from average. Table 1 shows the number of LCOs in each per: formance group. The methodology then compared the characteristics of the LCOs in each performance group to obtain a preliminary review of which factors had strong effects on performance and which had weak effects. The effects of

[3] Frontloading is, "the Census Bureau's practice of hiring and training approximately twice as many enumerators as needed for decennial field operations to compensate for no-shows, dropouts, and expected turnover." (Gore 2002).

[4] The Window Rock, Arizona LCO was omitted from the study due to incomplete data.

[5] To assess the variability in recruiting performance across all LCOs and the impor: tance of various factors affecting recruiting performance, Westat used the ratio of LCO applicants to recruiting goals during February 2000 (when recruiting goals were met for the nation as a whole) as a measure of individual LCO differences to meeting recruiting goals.

[6] See footnote 4.

various factors were examined using multiple regression analysis.

4.1.3 Recruiting study results

Analysis of the study data yielded numerous results. This report highlights some of the key find: ings.

There was considerable variation in recruiting performance across the LCOs. Notably, by April 2000, about 82 percent of LCOs substan: tially exceeded their recruiting goals. Of the LCOs that ultimately did not meet their recruiting goals, only five fell well below 70 percent of their goals. Importantly, *every* LCO recruited at least three appli: cants for each enumerator position to be filled.

Enumerator pay, relative to the locally prevailing rate, was a key determinant of recruiting perform: ance. The correlation between high census pay (relative to pre: vailing pay) and above average recruiting performance was much stronger than Westat initially expected.

An LCO's expected NRFU workload strongly influenced its recruiting efforts. An increase in workload of 24,000 cases, about one standard deviation, was associated with a 13 percent increase in qualified applicants. There was a strong correlation between recruiting per: formance and enumeration per: formance. This finding suggests that high pay, effective manage: ment, and other factors discussed in the Westat report strongly affect: ed both recruiting and the NRFU enumeration.

One of the more interesting find: ings pertained to applicant test scores. Westat observed that one standard deviation in test scores, an increase from 85.6 to 88.4, was associated with a decrease in the number of applicants of almost 11 percent. This suggests that recruiting may have been more dif: ficult in areas where many people were apt to do well on the census test (even holding relative wages and per capita income constant). If Westat's speculation is correct, the effect is large enough that vari: ation in test scores should be taken into account when setting pay rates, and Local Census Office Managers (LCOMs) should antici: pate the need for alternate meth: ods to boost recruiting in areas with high test scores.

Westat stated in their findings that they did not have the data needed to statistically link cross-regional differences in recruiting perform: ance to specific management dif: ferences, nor could they entirely eliminate the possibility that the differences in recruiting perform: ance may be overstated because of some important exogenous factors that were omitted from their data- base. Nevertheless, Westat had lit: tle doubt that regional manage: ment differences were the source of much of the variation in recruit: ing performance.

Westat held this view because their statistical results are consistent with more subjective evidence developed during their site visits and the direct observations of the U.S. Census Bureau headquarters staff interviewed. In addition, they tested the effect of a broad range of variables, and regression-adjust: ing the results made a significant difference. For example, Los Angeles' unadjusted performance was about as good as the region with the best performance, but its adjusted performance was in the average range.

It is Westat's view that the influ: ence of regional management is so great that it would be very worth- while to determine precisely what managerial elements led to above- average recruiting performance. Based on their site visits, they identified the following six key fac: tors associated with superior recruiting performance:

- ;Encouraging LCOs to develop plans that will lead to meeting or exceeding the key goals laid out by headquarters, including detailed implementation plans for dealing with unanticipated challenges;
- ;Providing accurate and timely feedback to the LCOMs about the strengths and weaknesses of recruiting in each area of each LCO;
- ;Helping LCOMs develop effec: tive strategies to deal with prob: lems as soon as they develop;
- ;Providing timely direct assis: tance through use of regional technicians;
- ;Avoiding micro-management by giving broad discretion to the LCOMs to meet agreed-upon goals and resolve problems in keeping with general guidelines established by the region; and
- ;Rapidly replacing LCOMs and Assistant Managers for Recruiting who are unable to effectively identify and resolve problems.

Finally, Westat reported that resig: nations, terminations for cause, or departures for any other reason by LCO management staff during the recruiting period were associated with a reduction in the number of applicants by approximately 12 percent. This finding suggests that LCOMs played a key role in determining recruiting success and that managers needed to be on board for a substantial period in order to be highly effective.

4.1.4 Recruiting recommendations for the 2010 Census

Westat identified several key factors associated with superior recruiting performance. These factors included:

- ;Encourage LCOs to develop plans that will meet or exceed goals established by Census HQ, including detailed imple: mentation plans for dealing with unanticipated challenges.
- ;Avoid micro-management by giving broad discretion to the LCOMs to meet agreed-upon goals and resolve problems in keeping with general guidelines established by the region.
- ;Rapidly replacing LCOMs and Assistant Managers for Recruiting who are unable to effectively identify and resolve problems.

4.1.5 Census Pay and Frontloading

- 1990 Census

The pay program for the 1990 Census included separate payroll operations for four distinct groups of employees. District office inter: mittent employees, by far the largest group, included enumera: tors, crew leaders, field operations supervisors, office operations supervisors, and office clerks. Even before the start of the 1990 Census, the Census Bureau raised the pay rates for district office employees because of difficulties recruiting sufficient numbers of workers in many parts of the coun: try during the 1988 Dress Rehearsal and the national address listing operation.

The overall design of the 1990 pay program included seven pay levels. To determine which pay level to apply to a particular district office, the Census Bureau considered its degree of enumeration difficulty, ability to recruit job applicants, and competitive local wage rates. Pay rates for rural areas tended to be in the low range, whereas pay rates for large metropolitan hard-to-enumerate areas/upper wage scale areas, like Hawaii and Alaska, were at the high end.

The Census Bureau again revised pay rates during June 1990 for field staff in certain district offices where shortages of field enumera: tion staff existed and recruiting enough qualified personnel contin: ued to be a problem.

For the 1990 Census, the Census Bureau also administered a nation-wide supplemental pay program. In addition to hourly wages, field employees could earn additional monies for quality performance during both the L/E and NRFU operations. The supplemental pay program was used as an incentive to motivate and retain workers and to stimulate production and quali: ty. The amount of supplemental pay was based upon the total num: ber of questionnaires completed during the operation. Enumerators had to meet certain quality and time requirements to be eligible for supplemental pay.

Because of continuing problems with employee turnover and short-ages of staff, the Census Bureau extended the duration of the sup: plemental award program to encourage employees to remain on the job. Additionally, a piece-rate plan was implemented during June 1990. This plan paid enumerators $1.50, crew leaders $0.20 and field operations supervisors $0.05 for each completed case in addi: tion to their regular hourly rates.

- Census 2000

For Census 2000, the Census Bureau significantly increased the hourly pay rates of its intermittent work force relative to the 1990 Census (adjusted for inflation). As a result, Census 2000 experienced dramatic improvements in LCO recruiting performance, enumera: tor retention, and NRFU completion time when compared to the 1990 Census.

At the Census Bureau's request, Westat (Jacobson and Petta 2003) also examined the effects of pay and frontloading on how quickly NRFU was completed in Census 2000. The primary focus of Westat's work was on whether increasing enumerator wages and frontloading had the desired effect of allowing the Census Bureau to quickly complete NRFU. Of sec: ondary interest, the Census Bureau also wanted to know whether there were systematic differences in NRFU performance that could be linked to the characteristics of enu: merators, the areas in which they worked, their pay, or the way in which they were managed. If so, these variables would be important when planning the 2010 Census.

4.1.6 Pay and frontloading study methodology

Westat's analysis of factors affect: ing Census 2000 NRFU pay rates was modeled on their earlier work done in 1977. To assess NRFU per: formance, Westat used published reports plus tabulations developed from administrative data to make comparisons between 1990 Census and Census 2000 NRFU performance, administrative data-bases coupled with published sta: tistics describing area characteris: tics to compare performance across 510[7] Census 2000 LCOs, and five Westat-executed surveys to compare enumerator perform: ance across 27 LCOs.

[7] The Window Rock, Arizona LCO and nine LCOs in Puerto Rico were omitted due to insufficient administrative data.

4.1.7 Pay and frontloading study limitations

Westat's methodology had two limi: tations. First, a lack of data on the number, timing, and refusal rate of applicants to accept positions, and on the intentions of census man: agers, prohibited Westat from definitively sorting out the relative importance of alternate explana: tions for why some LCOMs did not meet frontloading goals. Additionally, with respect to identi: fying an optimal NRFU schedule for the 2010 Census, Westat's analysis examined only Census 2000 NRFU completion speed. It did not address the effects of speed on accuracy and cost.

4.1.8 Pay and frontloading study results

Westat (Jacobson and Petta 2002) reported numerous findings regarding pay and frontloading. This report highlights only some of the major findings.

Westat found that setting pay com: petitively was essential to recruit: ing sufficient numbers of well-qual: ified applicants and to retain enumerators as long as they were needed. For Census 2000, hourly pay was increased by 37.8 percent on average relative to the 1990 Census (adjusted for inflation) and enumerator retention was increased by 22.6 percent. The increase in retention coupled with frontloading permitted the average LCO to complete NRFU in 7.19 weeks compared to 9.72 weeks in the 1990 Census. Significantly, the slowest performing LCOs complet: ed their work about 1.5 weeks faster than the fastest performing LCO in 1990.

Based on the results of Westat's study, we believe that when basic pay, recruiting, and frontloading plans were followed, LCOs suc: ceeded in securing and retaining a sufficient number of applicants to staff NRFU with highly competent enumerators who also were strong: ly motivated to work as long as needed. The degree to which LCOs exceeded operational sched: ules was largely a function of the amount of frontloading that was achieved by a particular LCO. About 80 percent of the LCOs met or exceeded their frontloading goals.

4.1.9 Pay and frontloading recommendations for the 2010 Census

- ;Consider reassessing how test scores and the availability to work many hours are used as hiring screens. Westat's analysis suggests that the capacity to complete NRFU would have been enhanced had test scores of about 82 percent been used as the first selecting criteria (unless applicants had a special language skill) and the order of contacting applicants had been based on the hours of availabili: ty (at least 20 hours per week) as reported on their job applica: tions.[8]
- ;Further expand upon Westat's findings to establish the NRFU schedule and degree of front: loading for the 2010 Census that would substantially reduce costs without reducing the likeli: hood of meeting the operational schedule.
- ;Implement a plan that uses the full six weeks to reach the 95 percent level if the Census 2000 goal of completing 95 percent of the NRFU cases in the first six weeks is retained for the 2010 Census. Westat opined that increasing NRFU speed is costly because the less time that is allocated, the more staff are needed and this reduces the flexibility crew leaders have in assigning work to the most pro: ductive enumerators. Increasing enumerator staffing is also cost: ly because about one-third of all compensation is spent on train: ing and supervision. Not allo: cating work to the most produc: tive enumerators is also costly because, within any given LCO, above average enumerators complete about twice as many cases per hour as below average enumerators. Thus, Westat believes that using a full six: week period to reach the 95 percent completion goal would have a positive effect on NRFU costs.

4.2 Field verification

For the 1990 Census and Census 2000, source information comes from Tenebaum (2001a).

- 1990 Census

For the 1990 Census, the Census Bureau relied on a series of clerical processes and the United States Postal Service (USPS) to confirm that an address was valid before adding it to the census files. Forms generated from the Were You Counted campaign and Whole Household Usual Residence Elsewhere were processed through a clerical search/match procedure after first being geocoded to a cen: sus block. When addresses could be geocoded and were not on the Census Bureau's Address Control File (ACF), they were sent to the

[8] Within the applicant groupings on selection certificates (preference and non-preference candidates), applicants were pri: oritized in test score order with the highest test score applicants appearing at the top of each grouping of candidates. Unless a lan: guage or other special skill was needed, the LCOs hired applicants using test score as the primary selecting criteria. Westat's analysis indicates that applicants with test scores above 82 completed NRFU no sooner than applicants with a test score of 82.

USPS for verification that the address was complete and deliverable. About 35,000 HUs were added to the ACF as a result of the search/match operations.

- Census 2000

For Census 2000, the Census Bureau had enumerators conduct a field verification rather than relying on the USPS to verify the status of potentially missed addresses. This decision was based on the fact that the Census Bureau had already used the USPS's Delivery Sequence File to help build the Census 2000 MAF.

Field Verification was one compo: nent of a multi-faceted operation for handling non-ID questionnaires in Census 2000.[9] During Be Counted/Telephone Questionnaire Assistance (BC/TQA) Field Verification, enumerators visited the location of units without an assigned census identification number to verify their existence prior to including their addresses in Census 2000.

Potential cases for BC/TQA Field Verification included those from the Be Counted program, Telephone Questionnaire Assistance, Service-Based Enumeration, Group Quarters Enumeration, Military/Maritime Crews of Vessels Enumeration, Military Unit Enumeration, and In: Movers/Whole Households programs.

In addition, units that were deleted in two or more previous operations (double deletes), but for which the Census Bureau received a mail return, also were included in BC/TQA Field Verification. The Field Verification workload consist: ed of 884,896 addresses. Tables 2 and 3, respectively, show the workload by type of case and the distribution of the workload by type of enumeration area (TEA).

Table 2.
Field Verification Workload

Type of case	Number	Percent
Be Counted (Non-ID)	195,812	22.13
Telephone Questionnaire Assistance (Non-ID)	155,148	17.53
Individual Census Report (Non-ID)	101,458	11.47
Military Census Report (Non-ID)	16,131	1.82
Double-Deletes	416,347	47.05
Total	884,896	100.00

Source: (Tenebaum 2001a)

Table 3.
Field Verification Workload by TEA

TEA	Cases sent to field verification	
	Number	Percent
Mailout/Mailback	759,187	85.79
Update/Leave	111,467	12.60
List/Enumerate	2,973	0.34
Remote Alaska	33	0.00
Rural Update/Enumerate	3,328	0.38
Military in Update/Leave	2,209	0.25
Urban Update/Leave	2,111	0.24
Urban Update/Enumerate	279	0.03
Update/Leave Converted From MO/MB	3,309	0.37
Total	884,896	100.00

Source: (Tenebaum 2001a)

4.2.1 Field verification study methodology

To assess the effectiveness of BC/TQA Field Verification, the Census Bureau used data from var: ious files. These files identified such information as the types of cases that were sent to BC/TQA Field Verification, summary tallies of the results of automated and clerical geocoding, Operations Control System (OCS) workloads, and characteristics of addresses included in the census and are documented in (Tenebaum 2001a).

4.2.2 Field verification study limitations

The non-ID questionnaire process for Census 2000 was complex and consisted of several components including automated matching and clerical geocoding. However, this evaluation was limited only to the verification of geocoded addresses which did not match the MAF. Thus, the data cannot be used to draw conclusions about any other components of the non-ID ques: tionnaire process. Further, the study is unable to state any con: clusions about how accurately enu: merators identified duplicate addresses because insufficient information was captured for the addresses to properly link the duplicate addresses. Lastly, although quality assurance con: ducted on enumerators' work sug: gests that the work was of an acceptable level, there was no

[9] The discussion of field verification is limited to the Be Counted/Telephone Questionnaire Assistance Field Verification (BC/TQA) operation and does not include any pre-census field verification activities such as the Local Update of Census Addresses (LUCA) Field Verification program.

independent validation of the process to confirm that the field work improved the census files.

4.2.3 Field verification study results

Results of the Census Bureau's assessment of the BC/TQA Field Verification indicate that the opera: tion was conducted on schedule and within budget, and that the operation improved the accuracy of the MAF. The study results also show that there were no quality or operational problems associated with the BC/TQA Field Verification program.

More than 50 percent of the assigned addresses were coded as valid living quarters. In addition, about 14 percent of the assigned addresses were coded as dupli: cates of another address while nearly 35 percent of the assigned addresses were coded as deletes. (The deletes included 1,113 cases that enumerators returned with status unknown.) Of the 416,347 double delete cases included in BC/TQA Field Verification, about 53 percent were determined to be valid HUs.

4.2.4 Field verification recommen: dations for the 2010 Census

- ;Capture information on dupli: cate addresses for use during quality assurance and for future research into the causes of duplicate addresses.
- ;Consider ways to independently validate the results of the Field Verification operation to deter: mine whether the process improves the census files.
- ;Assess the impact of additional response options for the 2010 Census on the Field Verification workload.

4.3 Update/leave and urban update/leave (stateside)

4.3.1Update/leave

For the 1990 Census, source infor: mation comes from U.S. Department of Commerce (1993) and, for Census 2000, from Pennington (2003).

- 1990 Census

The 1990 Census Update/Leave (U/L) methodology employed a combination of a dependent can: vass for coverage, questionnaire delivery by enumerators, and self-enumeration and mailback census-taking. Despite some significant delays in completing the 1990 Census U/L field work, U/L enu: merators added almost 400,000 valid addresses to the Census Bureau's address control file while delivering questionnaires to 10.4 million HUs.

- Census 2000

The Census 2000 U/L operation was conducted in areas where the addresses used for mail delivery were predominately noncity-style (e.g., PO Box or Rural Route). These areas typically lacked mail: ing addresses that identified their exact geographic location. The locations of HUs and SP/GQs in the U/L universe were captured during the Address Listing operation. Address Listing and U/L were included in TEA 2. All of Puerto Rico, including military bases, was also included in TEA 2.

For Census 2000, TEAs reflected not only the type of enumeration, but also the method used to com: pile the census address list that controlled the enumeration process. The addresses used for U/L were derived from information collected during Address Listing and updated during the Local Update of Census Addresses (LUCA) 1999 Recanvassing opera: tion. The Geography and Field (FLD) divisions identified some blocks in TEA 1 (city-style address: es) that contained a significant number of living quarters with noncity-style addresses. These blocks were removed from TEA 1, assigned a TEA code of 9, and included in U/L. This, coupled with the conversion of some for: mer List/Enumerate areas to Update/Leave areas, significantly increased the U/L universe during Census 2000.

U/L was conducted during the peri: od March 3 to March 30, 2000. Three hundred and sixty-three of the 520 LCOs had U/L work assignments. By the conclusion of the field work, U/L enumerators had updated their assignment maps and address binders and dropped off questionnaires at approximately 23.5 million occu: pied and vacant HUs. Increase from the 1990 U/L workload (10.4 million HUs) is due to changes in the criteria for defining TEAs. The 1990 TEA for prelist mailout/mail: back was eliminated and some HUs were converted to U/L.

4.3.2 Urban update/leave

For the 1990 Census and Census 2000, source information comes from Rosenthal (2002b).

- 1990 Census

The Urban Update/Leave (UU/L) methodology was used in selected inner-city district offices to enu: merate census blocks that con: tained mostly public housing developments. One of the major features of the UU/L was the promotion activity that preceded the enumeration. These promotion programs publicized the census and were designed to foster the understanding that census

information was confidential. Enumerators were hired from among the residents from the tar: geted housing projects. These enumerators were specially trained to hang posters in area buildings, distribute census pamphlets to respondents, and attend various community functions and tenant association meetings.

- Census 2000

The UU/L operation was conducted in targeted urban areas where the Census Bureau was not confident that the USPS would deliver census questionnaires to the correct HUs. The areas included known multi-unit apartment buildings where tenants received mail at a common drop point, locations that did not have house number/street name addresses used for mail delivery, and HUs whose occupants received mail at a post office box.

The locations of HUs and SP/GQs in blocks covered by the UU/L TEA were identified during the Block Canvassing operation and a field re-canvass of targeted blocks from the LUCA operation. UU/L was included in TEA 7. Puerto Rico had no UU/L workload. For Census 2000, TEAs reflected not only the type of enumeration, but also the method used to compile the cen: sus address list that controlled the enumeration process. As these residences had city-style address: es, there was no need for enumer: ators to assign map spots to assist enumerators in locating these units during subsequent census opera: tions.

The scope of UU/L was relatively limited with a national workload of 310,114 HUs that was broken down into slightly less than 13,000 assignment areas (AAs). The UU/L operation was conducted from March 3 to March 31, 2000. Using their census maps, UU/L enumerators canvassed their assigned area, one block at a time, and identified each HU. Enumerators then verified or updated the location of each HU, obtained the name of the house-hold at each address, and left a census questionnaire. Census questionnaires were left at both occupied and vacant HUs.

4.4 Update/leave in Puerto Rico

For the 1990 Census, source infor: mation comes from U.S. Department of Commerce (1996) and, for Census 2000, from McNally (2003).

- 1990 Census

The 1990 Census represented the first time that the Topologically Integrated Geographic Encoding and Referencing (TIGER) system was used to produce products to control the enumeration and tabu: lation process. Questionnaires generally followed the stateside versions; however, given socioeco: nomic, cultural, and climatic differ: ences between Puerto Rico and the States, the Census Bureau tailored questionnaire content to fulfill the specific data needs of the Commonwealth. Data were collect: ed using the L/E methodology.

- Census 2000

Census 2000 marked the first time in the history of census-taking in Puerto Rico that a conventional (List/Enumerate) methodology was not employed. Following the 1990 Census, the Census Bureau recog: nized that a growing part of Puerto Rico was becoming urbanized enough to use a mail census methodology to enumerate its resi: dents. Unfortunately, the lack of a comprehensive and accurate address mailing list for these urban areas negated any possibili: ty of using a mailout/mailback methodology in Puerto Rico for Census 2000.

In 1996, the Census Bureau decid: ed to use a modified U/L method: ology for the entire island of Puerto Rico. Although this deci: sion would require that a precen: sus address listing operation be conducted for all of Puerto Rico, three important benefits would result: (1) a single enumeration methodology could be used which presumably would be less expen: sive than using multiple method: ologies, (2) residents would, for the first time, assume responsibili: ty for returning their census form by mail, and (3) the mailing list resulting from the precensus address listing operation could be used as the basis for using a mailout/mailback methodology in urban areas for the 2010 Census. It could also be used as a basis for U/L without address listing in 2010 as well.

During U/L, enumerators can: vassed their assigned areas and updated their address lists and census maps. They also added addresses of HUs that were found on the ground but not included on their address lists and deleted addresses for units that did not qualify to be included in the cen: sus, e.g., units that were demol: ished, condemned, converted to a business, and so forth. The U/L operation was conducted during the period March 3 to 31, 2000. The LCO was able to recruit and hire qualified field staff the majori: ty of the time.

4.5 Update/enumerate and list/enumerate

4.5.1 Update/enumerate

For the 1990 Census and Census 2000, source information comes from Rosenthal (2002a).

- 1990 Census

For the 1990 Census, an urban Update/Enumerate (UU/E) methodology was used in New York and Detroit to enumerate whole preidentified census blocks of boarded-up buildings. UU/E questionnaires followed the same processing route as regular questionnaires, except that the UU/E questionnaires were excluded from telephone followup, NRFU, and the vacant/delete check portion of the Field Followup operation. Data are not available to draw any conclusions about the effectiveness of the 1990 UU/E operation.

- Census 2000

The targeted UU/E methodology used for boarded up buildings in selected cities during the 1990 Census was dropped for Census 2000. In its place, the Census Bureau employed an Update/Enumerate (U/E) methodology for targeted areas with special enumeration needs, in areas where most HUs may not have had house number and street name mailing addresses, and where it was not likely that respondents would mail back their census questionnaires.

U/E areas included resort areas with high concentrations of seasonally vacant HUs, selected American Indian reservations and the colonias. The colonias are usually small towns near the border with Mexico. Many of these small towns do not have mail delivery. U/E was the preferred method of enumeration in these areas because of concerns about the possibility of low response rates and poor address integrity.

U/E was conducted during the period March 13 to June 5, 2000 in 35 states which included all Regional Census Center (RCC) areas except Detroit. Similar to U/L, U/E enumerators updated address listings and census maps, adding and deleting addresses as appropriate. However, rather than dropping off a census questionnaire for the residents to complete and return by mail, U/E enumerators conducted interviews and completed questionnaires for the household living at the units.

4.5.2 List/enumerate

For the 1990 Census, source information comes from U.S. Department of Commerce (1993) and, for Census 2000, from Zajac (2002).

- 1990 Census

For the 1990 Census, List/Enumerate (L/E) was conducted in all 70 type 3 census district offices. These 70 district offices, with about 215,000 HUs each, were in sparsely settled parts of the West and North, where the primary data collection methods varied from mailout/mailback to L/E. The national L/E workload for the 1990 Census was 5.5 million HUs.

Several days prior to the start of the L/E operation, USPS letter carriers delivered Advance Census Reports (ACRs) to all known residential addresses in sparsely populated rural areas. All ACRs were unaddressed, short-form questionnaires. A member of the household was asked to complete the questionnaire and hold it for pick up by an enumerator. L/E enumerators canvassed their assigned area, listed the address of each HU, marked the location of each unit on a census block map, and entered a map spot number for the unit on the map and on the corresponding line on the address register page. L/E enumerators picked up the respondent-completed questionnaire or completed a questionnaire when the respondent did not have a completed form ready for pick up. For households that were designated on the address listing page to receive a long-form questionnaire, L/E enumerators collected the completed ACR and transcribed the information onto a long-form enumerator questionnaire. They then conducted an interview to obtain the remaining long-form information.

- Census 2000

For Census 2000, the L/E methodology was again used in sparsely populated areas; however, the Census Bureau decided to use the Update/Enumerate (U/E) methodology rather than L/E for most of the 1990 L/E areas. Thus, the national L/E workload dropped from 5.5 million HUs in 1990 to 392,368 HUs during Census 2000.

The use of ACRs was discontinued because L/E areas had been delineated at the block level. Additionally, USPS carrier routes did not necessarily fall into entire ZIP codes so it was not possible to tell the post office where to deliver the ACRs.

Procedurally, L/E enumerators listed addresses within their assignment area in an address binder, spotted the location of HUs on census maps, assigned each unit a unique map spot number, and conducted an interview to collect census information for each address. L/E, which included reinterview and field followup components, was conducted from mid-March through the beginning of July 2000.

The L/E operation was followed by L/E Field Followup (FFU). L/E FFU was a quality assurance operation that was conducted to recheck the status of units that were classified as vacant during L/E, to re-enumer: ate HUs whose original question: naires were not data captured, and to convert short-form question: naire interviews at designated HUs to long-form questionnaires.

4.6 Nonresponse followup (and tool kit methods)

For the 1990 Census, source infor: mation comes from U.S. Department of Commerce (1993) and, for Census 2000, from Moul (2002) and Monaco (2002). With the exception of certain cost infor: mation from Monaco (2002), the statistical data related to NRFU were obtained from Moul (2002).

- 1990 Census

NRFU was the largest field data collection activity conducted dur: ing the 1990 Census and it took place in all district offices except for two entirely L/E offices (Window Rock, Arizona and Hyannis, Massachusetts). The NRFU universe consisted of HUs for which mail-return questionnaires were not checked in by April 22, 1990. These HUs originated from the initial mailout, as well as late adds from other precensus opera: tions.

All type 1 district offices (large, central-city and metropolitan areas) were scheduled to start NRFU on April 26, 1990. The remaining dis: trict offices were supposed to begin NRFU on May 3, 1990. All district offices were to finish NRFU by June 6, 1990. The NRFU opera: tion was not completed as planned. As of June 4, 1990, only 70 percent of the workload was completed. By this date, only 33 percent of the district offices had begun closeout procedures and only two district offices had actual: ly completed NRFU.

Most delays were attributed to larger-than-expected workloads,[10] staffing difficulties, employee turnover, and more part-time work: ers than anticipated. In response to these problems, the Census Bureau initiated a pay rate increase in June of 1990 in an effort to attract additional workers by com: peting more favorably with other employers in these areas and to motivate existing staff to increase hours and production. Additionally, the Census Bureau extended its supplemental pay pro- gram and implemented a piece-rate program for each completed ques: tionnaire. (See section 4.1.5). By July 19, 1990, 98 percent of all district offices had finished NRFU, with the remaining 2 percent by July 30. Approximately 200,000 persons worked on the NRFU oper: ation, which enumerated more than 34 million HUs.

- Census 2000

The objective of Census 2000 NRFU was to obtain a completed questionnaire from households in mailback areas that did not respond to the Census. The poten: tial universe for NRFU included 119,090,016 HUs in mailback areas (including Puerto Rico). Of this total, almost 45 million HUs (37.7 percent) were identified as NRFU cases.

The NRFU addresses were identi: fied on a flow basis and distrib: uted to the LCOs.[11] Although the NRFU operation was scheduled to be conducted during the period April 27 through July 7, 2000, the operation began as planned, but ended ten days ahead of schedule on June 26, 2000.[12]

Table 4 shows the weekly check-in rates of NRFU enumerator ques: tionnaires by form type. The ques: tionnaire check-in activity shown in the table was taken from the DMAF.

Although the official start and fin: ish dates for NRFU were April 27 and June 26, two discrepancies were noted. According to OCS2000[13] data, the LCOs started NRFU as early as April 21 and fin: ished as late as September 7. The start and end dates were defined as the date the first and last NRFU questionnaires were checked into the OCS2000. Also, according to OCS2000 data, the range of start dates for NRFU was from April 21 to May 5, and the range of NRFU end dates was from May 5 to September 7.

Approximately 1.6 percent of the NRFU workload (677,967 cases) was checked in after June 26, 2000 - the official end of the NRFU oper: ation. These were primarily NRFU

[10] NRFU operational plans were based on a 70 percent mail-response rate. When the 1990 Census mail- response rate turned out to be 63 percent, the workload was notably increased and more field staff were needed.

[11] A late mail return (LMR) operation subsequently identified about 2.5 million HUs that were checked in after the initial NRFU universe was identified. These specif: ic addresses were manually removed from the NRFU workload at the appropriate LCOs. As a result of the LMR operation, the nation: al NRFU workload was reduced to 42.3 mil- lion HUs or 35.6 percent of the eligible uni: verse.

[12] More than 98 percent of NRFU enu: merator questionnaires were checked-in sometime during the official NRFU start and end dates. About 1.6 percent of the NRFU workload was checked-in after the end of NRFU. These were primarily population unknown (code 99) cases or lost question: naires that were recontacted during the Residual NRFU operation.

[13] The Operations Control System (OCS) was an automated database that resided at each LCO. It's primary use was to make ini: tial enumerator work assignments, control and monitor the flow of work between the LCO and the field staff, capture limited data from completed questionnaires, and prepare shipping documents/tracking numbers for materials shipped from the LCOs.

cases with unknown population counts (POP99s) or lost NRFU enumerator returns that were con: tacted in the Residual Nonresponse Followup operation. According to the DMAF data, however, there were no check-in actions for NRFU questionnaires after August 25.

4.6.1 NRFU study methodology

To assess the effectiveness of the Census 2000 NRFU operation, the Census Bureau used the DMAF to identify the NRFU eligible universe, the initial NRFU universe, the late mail return (LMR) universe, the final NRFU universe, and the March 2001 MAF extract. They were used to identify addresses added during NRFU and to classify them into one of the following five cate: gories: complete city-style, com: plete rural route, complete P.O. box, incomplete address, and no address information.

The Decennial Response File : Stage 2 (DRF2), which represents the capture of questionnaire data from Census 2000, was used as the source for NRFU enumerator questionnaire responses.

The Hundred Percent Census Edited File with the Reinstated HUs (HCEF_D'), which contained the edited and imputed 100 percent data from census HUs and group quarters, was used as the source for the demographics for the NRFU and self-enumerated HUs and households.

The Technologies Management Office's Decennial Data Warehouse, which is a repository for data from OCS2000 and the Pre-Appointment Management System/Automated Decennial Administrative Management System (PAMS/ADAMS), was used to obtain NRFU start and end dates for the LCOs.

4.6.2 NRFU study limitations

There was no official cut-off day for the initial NRFU universe. The Census Bureau's processing divi: sion, the Decennial Systems and Contracts Management Office (DSCMO), used a range of dates, covering just over a week, to per- form the NRFU selection process on a state/LCO basis. Prior to beginning the NRFU selection process for a state, DSCMO ran a DMAF update based on all current: ly available checked-in question: naires. These updates reflected questionnaires checked in as of the previous day. Since the initial

Table 4.
Distribution of NRFU Questionnaires Checked-in by Week and by Form Type*

Week[14]	Date	Total forms		Form type			
				Short forms		Long forms	
		Number	Percent	Number	Percent	Number	Percent
	Total	42,365,816	100.0	33,050,538	100.0	9,315,278	100.0
1	Apr 21 - Apr 29	119,685	0.3	104,218	0.3	15,467	0.2
2	Apr 30 - May 06	5,132,662	12.1	4,228,079	12.8	904,583	9.7
3	May 07 - May 13	8,924,593	21.1	7,131,363	21.6	1,793,230	19.3
4	May 14 - May 20	8,927,344	21.1	7,046,837	21.3	1,880,507	20.2
5	May 21 - May 27	8,054,555	19.0	6,264,203	19	1,790,352	19.2
6	May 28 - Jun 03	5,196,605	12.3	3,941,718	11.9	1,254,887	13.5
7	Jun 04 - Jun 10	3,586,604	8.5	2,616,687	7.9	969,917	10.4
8	Jun 11 - Jun 17	1,442,652	3.4	1,020,808	3.1	421,844	4.5
9	Jun 18 - Jun 24	261,289	0.6	183,151	0.6	78,138	0.8
10	Jun 25 - Jul 01	11,958	0.0	9,057	0.0	2,901	0.0
11	Jul 02 - Jul 08	2,061	0.0	1,693	0.0	368	0.0
12	Jul 09 - Jul 15	1,375	0.0	1,077	0.0	298	0.0
13	Jul 16 - Jul 22	58,512	0.1	41,421	0.1	17,091	0.2
14	Jul 23 - Jul 29	426,098	1.0	300,118	0.9	125,980	1.4
15	Jul 30 - Aug 05	155,946	0.4	112,051	0.3	43,895	0.5
16	Aug 06 - Aug 12	38,922	0.1	28,733	0.1	10,189	0.1
17	Aug 13 - Aug 19	20,008	0.0	15,547	0.0	4,461	0.0
18	Aug 20 - Aug 25	4,947	0.0	3,777	0.0	1,170	0.0

* Table includes data for Puerto Rico but excludes data for Hialeah, FL (LCO 2928).

Source: (Moul 2002)

[14] Weeks 2 through 18 are seven day weeks - Sunday through Saturday. To be consistent with the other weeks, Week 1 should have started April 23. Since there were only 37 NRFU questionnaires checked in on April 21 and no questionnaires checked in on April 22, these days were included with Week 1.

NRFU universe was created on a flow basis, data users should be aware of the possibility of noise in the data with respect to the initial universe and the LMR universe.

The meaningfulness of data analysis that relies on the interview summary section on the enumerator questionnaire is limited due to enumerator errors in completing these items.

As a result of enumeration problems in the Hialeah, Florida LCO, enumeration data for this LCO were removed from all tabulations.

4.6.3 Overview of NRFU procedures

Enumerators visited each address designated for NRFU to determine the Census Day status of the HU. Census Day, or April 1, 2000, was the fixed reference date for the collection of census information. Determining the Census Day status of followup addresses not only determined which sections and/or questions on the questionnaire to complete, but it also served as a reminder that the information collected would be as of April 1, 2000.

All NRFU addresses had one of the following statuses as of April 1, 2000.

- Occupied[15]
- Vacant[16]
- Nonexistent[17]

Although NRFU enumerators were expected to obtain complete interviews, in some instances, partial interviews were accepted. When enumerators could not contact a household member at a followup address after making at least three personal visits and three telephone attempts, enumerators attempted to obtain the required census information by contacting a knowledgeable nonhousehold (proxy) respondent.

When 95 percent of the NRFU workload was completed in a crew leader district (CLD), final attempt procedures were implemented in that CLD. Final attempt was an intense effort, conducted in a short period of time, to obtain a completed questionnaire for each unresolved case.

During this phase of NRFU, enumerators made one final visit to each remaining NRFU address to obtain a complete interview or, at a minimum, the unit status and population count for the unit.

Completed NRFU cases were returned to the LCO on a flow basis where assignment control clerks reviewed the incoming forms to ensure that critical questionnaire items were completed. Clerks returned questionnaires that failed the review to the field for correction. Questionnaires that passed the review were forwarded to OCS2000 check-in. During the check-in process, OCS2000 automatically selected certain questionnaires for the NRFU Reinterview program. These questionnaires were temporarily routed to another section within the LCO where clerks transcribed questionnaire data onto reinterview forms. Upon completion of the transcription process, the original questionnaires were returned to the flow of forms for OCS2000 check-in. All questionnaires were eventually assigned a check-out status and shipped to the appropriate Data Capture Center (DCC).

4.6.4 NRFU study results

The key NRFU results from Moul (2002) are summarized here.

Regarding the NRFU universe, the evaluation found that approximately 78 percent of the 42.4 million forms comprising the NRFU workload were short-form questionnaires while 22 percent were long-form questionnaires (see Table 5). The majority (62.3 percent) of the enumerated units were occupied and the occupancy rate for long-form households was greater than for households who received a short form. About 470,000 NRFU questionnaires (1.2 percent) were completed in Spanish.

Of the 26.4 million occupied units, 117,730 (0.4 percent) were classified by enumerators as Code 99 - Pop Unknown. This classification indicates that the enumerator was unable to determine the population count of the household. Approximately 6 million HUs (14.3 percent) of the NRFU universe were classified by enumerators as nonexistent.

With respect to the characteristics of NRFU questionnaires by form type,[18] the NRFU evaluation

[15] This status included addresses that were occupied on Census Day by the same household living there at the time of the enumerator's visit and those that were occupied by a different household on Census Day. Once enumerators determined the correct household for which to complete the questionnaire, the mechanics of completing the questionnaire was the same for all occupied units.

[16] This status included both regular vacants such as for sale, for rent, etc., and vacant - usual home elsewhere (UHE) situations. A vacant UHE occurs when the NRFU unit is occupied on Census Day, but the household reports having a UHE.

[17] Also known as deletes, these are NRFU addresses that are removed from the enumeration process because the address no longer qualifies to be included in the inventory of residential addresses for the census. Examples of nonexistent units include units that have been demolished or burned down, duplicates of other addresses, nonresidential addresses, and vacant units that have been condemned.

[18] The DRF2 was used to obtain data from the Respondent Information and Interview Summary sections of the enumerator questionnaire.

Table 5.
NRFU HU Status by Form Type

NRFU status	Total forms		Form type			
			Short forms		Long forms	
	Number	Percent	Number	Percent	Number	Percent
Total	42,372,965	100.0	33,056,635	78.00	9,316,330	22.00
Occupied	26,418,357	62.35	20,397,349	61.70	6,021,008	64.63
Vacant	9,893,046	23.35	7,799,783	23.60	2,093,263	22.47
Delete	6,054,399	14.29	4,853,394	14.68	1,201,005	12.89
Undetermined	7,163	0.02	6,109	0.02	1,054	0.01

Note: Table includes data for Puerto Rico and excludes data for Hialeah, FL (LCO 2928).
Source: (Moul 2002); Data Source: DMAF.

Table 6.
Characteristics of NRFU Enumerator Questionnaires by Form Type[20]

Return responses	Total forms		Form type			
			Short forms		Long forms	
	Number	Percent[21]	Number	Percent	Number	Percent
Total returns	38,636,451	100.0	29,987,599	77.6	8,648,852	22.4
Proxy Interviews	14,474,361	100.0	11,401,120	78.8	3,073,241	21.2
Final Attempt	1,042,715	100.0	703,605	67.5	339,110	32.5
Partial Interviews	2,061,930	100.0	1,064,696	51.6	997,234	48.4
Refusals	771,002	100.0	433,448	56.2	337,554	43.8
Spanish	470,184	100.0	366,399	77.9	103,785	22.1
Replacement	705,936	100.0	507,570	71.9	198,366	28.1

Source: (Moul 2002).

findings indicate that almost 14.5 million of the 38.6 million[19] questionnaires in the DRF2 were conducted with proxy respondents. This represented about 37.5 percent of all questionnaires. About 31.1 percent (4.5 million) of the proxy interviews were for occupied HUs. Approximately 63.8 percent (9.2 million) of the 14.5 million proxies were for vacant units.

Approximately 771,000 (2.0 percent) of the NRFU questionnaires were classified as respondent refusals. About 56.2 percent of the total NRFU refusals were for short-form questionnaires; 43.8 percent were for long-form questionnaires. The 43.8 percent rate of refusals that were long forms is substantially higher than the percent of total forms that were long forms (22.4 percent). This suggests poorer long-form quality.

The NRFU evaluation also examined the distribution of respondent type for long-form and short- form NRFU questionnaires (see Table 7). Question R3, on the back cover of the questionnaire, identifies the type of respondent who provided census information to NRFU enumerators. Question R3 identified respondents who lived at the unit on April 1, 2000, moved into the unit after April 1, 2000, or who were a neighbor or other non-household member.

A respondent who lived at the followup unit on April 1 was considered a household member. Respondents who moved into the followup unit after April 1 were classified as in-movers. Neighbors and others who provided information about the followup unit and its occupants were classified as

[19] The DRF2 consisted of 38.6 million NRFU enumerator questionnaires which represented 37.4 million unique HUs. The difference in the preceding two numbers is the result of multiple questionnaire receipts from about 1.2 million units. While there were 42.4 million HUs in the NRFU universe following the removal of Late Mail Returns, the difference between the 42.4 million field NRFU workload and the 38.6 million records in the DRF2 is the result of the DRF2 creation process which linked forms and implemented the primary selection algorithm.

[20] The DRF2 was used to obtain data from the Respondent Information and Interview Summary sections of the enumerator questionnaire. The table includes data for Puerto Rico and excludes data for the Hialeah, LCO.

[21] Note that the percentage of occurrences for each category in the table is not totaled under the Total Forms column. This is because the categories are not mutually exclusive. For example, an enumerator-filled questionnaire could be a partial interview completed in Spanish, or a proxy interview that was completed during the Final Attempt phase of NRFU.

Table 7.
Distribution of Respondent Type by Form Type

Respondent type	Total forms		Form type			
			Short forms		Long forms	
	Number	Percent	Number	Percent	Number	Percent
Total	38,636,451	100.0	29,987,599	100.0	8,648,852	100.0
HH member	22,078,073	57.1	17,045,202	56.8	5,032,871	58.2
Proxy	14,474,361	37.5	11,401,120	38.0	3,073,241	35.5
In-mover	837,728	2.2	666,760	2.2	170,968	2.0
Neighbor/Other	13,636,633	35.3	10,734,360	35.8	2,902,273	33.6
No Response	2,084,017	5.4	1,541,277	5.1	542,740	6.3

Note: Table includes data for Puerto Rico and excludes data for Hialeah, FL (LCO 2928).
Source: (Moul 2002); Data Source: DRF2.

Table 8.
Distribution of Respondent Type by HU Status for Partial Interviews

HU status	Total	Respondent type		
		Proxy	HH member	No response
Total partial interviews	2,061,930	1,105.365	873,257	83,308
Percent	(100.0 %)	(100.0 %)	(100.0%)	(100.0%)
Occupied	1,927,647	986,908	866,806	73,933
Percent	(93.5%)	(89.3%)	(99.3%)	(88.7 %)
Vacant	123,043	111,537	3,621	7,885
Percent	(6.0%)	(10.1%)	(0.4%)	(9.5%)
Delete	11,172	6,902	2,811	1,459
Percent	(0.5%)	(0.6%)	(0.3%)	(1.8 %)
Undetermined	68	18	19	31
Percent	(0.0 %)	(0.0%)	(0.0%)	(0.0%)
Total returns for respondent type*	38,636,451	14,474,361	22,078,073	2,084,017

*From Table 7.
Note: Table includes data for Puerto Rico and excludes the data for Hialeah, FL (LCO 2928)
Source: (Moul 2002); Data Source: DRF2.

nonhousehold members. For pur: poses of the study, in-movers, neighbors, and others were consid: ered proxy respondents.

The study findings reveal that about 57 percent of all NRFU respondents were household mem: bers. Long-form questionnaires had a slightly higher percentage (1.4 percentage points) of house- hold member respondents than short-form questionnaires.

Almost 14.5 million (37.5 percent) of the 38.6 million NRFU question: naires were completed using proxy respondents. The category *is a Neighbor or Other* accounted for about 94 percent of the proxy respondents for both short and long-form questionnaires. About 4.5 million of the 14.5 million proxy interviews were for occupied units while 63.8 percent (9.2 mil- lion) of the total proxy interviews were for vacant units.[22]

The study also compared the com: pleteness of interviews obtained from household respondents with proxy respondents by examining the proportion of each that were partial interviews. A partial inter- view is one in which an enumera: tor collects less than the minimum amount of information for a com: plete interview, but at least Unit Status and HU Population (POP) Count. Table 8 provides counts of respondent types (proxy, a house- hold member, no response) by HU status (occupied, vacant, delete, undetermined) for the partial inter- views.

The study results indicate a dispro: portionate number of partial inter- views for the proxy respondents compared to household respon: dents. Specifically, the data reveal that of the 14.5 million interviews completed with proxy respondents, about 1.1 million (7.6 percent) were classified as a partial inter- view. This is contrasted to the 22 million interviews completed with household respondents of which about 873,000 (4.0 percent) were classified as a partial inter- view. With respect to the use of continuation questionnaires for

[22] Refer to Moul (2002) for detailed breakdowns of respondent type information by form type for occupied and vacant units.

Table 9.
Total Cost for Field and Office Operations

	Workload	Cost per case	Total cost	Percent of total cost
Total field and office operations	**44,897,971**[27]	**$27.09**	**$1,261,707,341**	**100.00%**
Total field operations	44,897,971	$26.09	$1,171,205,039	96.27%
NRFU and POP 99s	42,269,216	$26.58	$1,123,563,961	89.05%
R-NRFU	120,919	$28.39	$3,433,211	0.27%
Reinterview	2,507,836	$17.63	$44,207,867	3.50%
Total office operations	**44,897,971**	**$1.01**	**$45,251,151**	**3.73%**
Assignment preparation	44,897,971	$0.56	$25,356,645	2.01%
Assignment control	44,897,971	$0.44	$19,894,506	1.65%

Source: (Monaco 2002).

households containing more than five persons, the study data show that almost 1.3 million continua: tion questionnaires were used dur: ing NRFU. This represents about 3.2 percent of the total NRFU returns (38,636,451). As expect: ed, about 93.6 percent of continua: tion questionnaire usage involved one continuation form.

4.6.5 Effects of added and deleted units on the DMAF

The NRFU evaluation also exam: ined the distribution of added and deleted addresses in NRFU by TEA.[23] The majority of added and deleted addresses were in mailout/mailback areas. Of the 688,944 added units in TEAs where NRFU occurred,[24] all address: es met the criteria to be included on the DMAF. Slightly more than 6 million addresses were deleted during NRFU.

The distribution of deleted addresses was similar to the work- load distribution across the TEAs, but there was a disproportionate number of added units in U/L areas (31.9 percent) compared to the percentage of the NRFU work- load (21.7) in U/L areas.[25]

Table 10.
Summary of Field Operation Cost for NRFU (including POP99s)

Cost component	Dollars	Percent
Total	$1,123,563,961	100.0
Production salary cost	757,756,402	67.4
Training salary cost	182,201,464	16.2
Mileage cost	107,500,627	9.6
Other objects cost	76,105,468	6.8

Data Source: U.S. Bureau of the Census, 2001c.

Source: (Monaco 2002).

4.6.6 NRFU costs

Source information on costs comes from Monaco (2002).

NRFU field operations were com: pleted within 7.23 percent of the $1.1 billion budget. The total cost of NRFU field and office operations was derived from PAMS/ADAMS - the payroll and administrative sys: tem used to support Census 2000 (see Table 9). The almost $1.2 bil: lion cost of NRFU field operations included the following compo: nents: NRFU, POP99, Residual NRFU (R- NRFU), and Reinterview.[26]

The POP99 operation was conduct: ed to obtain population counts for occupied units that were classified as population unknown during NRFU. Residual NRFU was con: ducted for questionnaires that had been checked in, but could not be processed such as for blank, lost, or damaged questionnaires.

The cost component of the $1.12 billion expense for conducting NRFU and POP99 are shown in Table 10. POP99 costs are includ: ed with NRFU because both opera: tions used the same task code. The mileage cost includes produc: tion work and travel to and from training sessions. The other objects cost includes civilian per: sonnel benefits, telecommunication services, and other costs.

[23] Refer to Moul (2002) for additional data pertaining to the distributions of added and deleted addresses by type of address and unit type.

[24] NRFU occurred in TEA 1 (mailout/ mailback), TEA 2 (Update/Leave), TEA 6 (mili: tary in Update/Leave), TEA 7 (Urban Update/Leave), and TEA 9 (Update/Leave converted from mailout/mailback).

[25] HUs added during U/L (March 2000) were not processed in time to update the NRFU address registers. Consequently, NRFU enumerators may have added the same addresses again and thus inflated the per: centage of added addresses in TEAs 2 and 9.

[26] The field operations expense does not include Census HQ, regional infrastruc: ture costs, or Puerto Rico and it excludes any re-worked cases.

[27] These data, which were obtained from Monaco (2002), include NRFU, POP99, Residual NRFU, and Reinterview cases. They do not contain any re-worked cases.

Table 11.
Percent of Variance
(NRFU, R-NRFU, POP 99s, Reinterview)

	Variance	Percent Variance of budget	Percent of total variance
Total	**$78,946,983**	**–7.23%**	**100.00%**
NRFU, POP 99s, R-NRFU	($64,649,666)	–6.56%	81.89%
Enumerators & Crew Leader Assistants	($2,934,975)	–0.36%	4.54%
Crew Leaders	**($56,043,487)**	**–44.05%**	**86.69%**
Field Operations Supervisor, Office Operations Supervisor, Special Place Operations Supervisor	$1,137,892	3.32%	–1.76%
Clerks & Recruiting Assist.	($6,753,196)	N/A	10.45%
Other Employees	($55,900)	N/A	0.09%
Reinterview	**($19,543,013)**	**–79.23%**	**24.75%**
Miscellaneous	($5,245,696)	6.43%	–6.64%

Source: (Monaco 2002)

The final NRFU costs showed some variance between actual spending and budgeted amounts (see Table 11). Three areas of overspending for Census 2000 resulted from higher staffing (especially crew leader) costs, lower production rates, and larger Reinterview workloads.

The largest overspending (86.69 percent) or $56 million was for crew leader expenditures. Crew leader expenditures exceeded the budget for all LCO types, but especially for Type C offices ($42,364,336).[28] The large deficit in crew leader costs is attributed to the fact that crew leaders were modeled at 33,401 positions (which includes a 50 percent replacement training rate), but a total of 49,694 crew leaders were actually hired. Although crew leaders were not the largest percentage of hirees, they worked more production days and hours at a higher pay rate than other staff and exceeded the frontloading limit.

When actual costs for NRFU and POP99 were compared to the Census 2000 allocation model dated March 30, 2000,[29] the analysis indicated that the actual production rate of NRFU enumerators was 1.04 cases per hour compared to the allocation model production rate of 1.35 cases per hour.

The Decennial Management Division (DMD) suggests that the lower production rate may have been in part due to enumerators not being on the job long enough to develop strategies that could result in production efficiencies which characterize longer term employees (Monaco 2002).

The NRFU Reinterview was difficult to analyze. According to DMD's analysis, the NRFU Reinterview workload appeared to be 121 percent larger than planned, and the cost was greater by 79.23 percent. The budget, which modeled only for personal visit followup, assumed a Reinterview workload of 1.1 million cases, but the OCS2000 actual workload of 2.5 million Reinterview cases included both personal visit and telephone followup. The PAMS/ADAMS data are for both personal visit and telephone followup, but separate task codes were not assigned; therefore, the costs for personal visit and telephone could not be distinguished.

4.6.7 Operational Challenges

Although NRFU was completed ahead of schedule, some operational challenges were encountered. Errors in the software used to create the initial NRFU files resulted in some address listings being omitted for responding households. The address register listings should have contained the addresses of HUs for both responding and nonresponding households.[30]

Additionally, the surnames of responding households in mailout/mailback areas were erroneously omitted in the initial production of NRFU files. In U/L areas, surname information was incorrectly taken from an incorrect file field.[31] The address listings also had an incorrect starting address. The address listings

[28] This was not the final Census 2000 model used for budget formulation. The allocation model contained a contingency reserve held by the Decennial Management Division to support variable pay rates and variability in workload size for LCOs.

[29] This was not the final Census 2000 model used for budget formulation. The allocation model contained a contingency reserve held by the Decennial Management Division to support variable pay rates and variability in workload size for LCOs.

[30] The DSCMO redelivered corrected NRFU files without causing any delay in the NRFU operations schedule.

[31] NRFU enumerators were given supplementary DSCMO-produced address listings containing surname data. The enumerators received additional training on how to best use these listings in the field.

started with the address of the first NRFU case in each block and omitted the addresses of any responding HUs that should have appeared prior to the first listing designated for NRFU.

The NRFU evaluation reported numerous other operational chal: lenges including HUs added during U/L not being reflected on the NRFU listings, major enumeration problems in the Hialeah, Florida LCO, delays in the identification of the NRFU universe, slow implemen: tation and poor management of NRFU Reinterview, inconsistent cost and progress data, multiple enumerations, and failure by enu: merators to obtain a population count.[32]

4.6.8 Factors contributing to the early completion of NRFU

There were three factors that con: tributed to the early completion of NRFU. Locally competitive pay rates allowed the regions to attract, recruit, and retain staff in its LCOs. Early, aggressive front-loading of field staff coupled with timely replacement training ensured sufficient staff levels to begin the operation with a full compliment of workers and to replenish it as needed. (See Section 4.1 for additional details regarding the effects of frontload: ing and pay on the completion of NRFU.) Improved information tech: nology such as the OCS2000, Master Activity Schedule, and map printing capability in the LCOs also played an important role in the success of NRFU.

4.6.9 NRFU recommendations for the 2010 Census[33]

- ;Continue to offer locally com: petitive pay rates to allow regions to attract, recruit, and retain both office and field staff in their LCOs.
- ;Continue the practice of front-loading field staff and combine it with replacement training to ensure sufficient staff levels throughout the operation.
- ;Identify and remove Late Mail Returns periodically from the NRFU workload to reduce the workload and the number of HUs with multiple data captures.

  Because of the planned intro: duction of mobile computing devices[34] in the 2010 Census, enumerators will be able to transmit data directly to head-quarters for processing and receive daily-updated field assignments (Decennial Management Division 2003). This potentially will improve the accuracy of the NRFU universe listings and reduce multiple enu: merations.
- ;Provide field offices with DMAF maintenance capabilities and real time, up-to-the minute access.
- ;Make NRFU Reinterview an inde: pendent operation managed by someone other than the Assistant Manager for Field Operations.
- ;Include Residual NRFU and POP99 operations in the census design and plan.
- Rethink the assignment area structure and delineation process to make use of new technology and an integrated system design.
- Develop and implement an inte: grated tracking database system for planning, tracking, property management, procurement, kit pro: duction, shipping and receiving.

4.6.10 Use of tool kit methods

Evaluation source information comes from Tenebaum (2001b).

The *Census 2000 Operational Plan* (U.S. Department of Commerce 2000) provided for the use of tar: geted special enumeration meth: ods to improve the count of popu: lation groups and geographic areas which historically have a dispro: portionate share of people missed in the census. The plan included the implementation of a limited number of special tool kit strate: gies to overcome barriers to suc: cessful enumeration and to address concerns about the per: sonal safety of enumerators, improve respondent cooperation, gain access, and improve cover-age.

The three tool kit strategies used successfully during Census 2000 NRFU field operations were blitz enumeration, paired enumeration, and local facilitators.

During blitz enumeration, a crew of enumerators conducted enumer: ation activities in a very com: pressed time schedule (generally two or three days) under the close personal supervision of a crew leader. The crew leader remained on site to resolve problems and to assist with respondents who were reluctant to participate in the cen: sus. Blitz enumeration proved to be successful in areas with com: plex households, low levels of cooperation, multi-unit buildings, a larger number of renters, and/or

[32] Of the 26.4 million occupied HUs, 117,730 (0.4 percent) had no population count in OCS2000. For the entire Census 2000, there were 193,753 HUs that required total imputation.

[33] Included are recommendations from Moul (2002) and Monaco (2002).

[34] "An MCD [mobile computing device] is a small electronic device that has self-con: tained processing units, contains wireless telecommunications capabilities, and is easi: ly transportable. These devices also are referred to as personal digital assistants, palm tops, and hand-held computers." (Gore 2002).

low enumerator productivity.

Paired enumeration was used mostly to provide support in areas where there were concerns about the safety of enumerators. One enumerator conducted the actual interview while the other enumera: tor, keeping an eye on the sur: rounding environment, provided support functions as needed. Paired enumeration was used also in rural areas containing hard-to-locate HUs. In this situation, one member of the team served as a navigator while the other person drove the car.

Local facilitators, also known as cultural facilitators, were generally well known residents of the partic: ular area being enumerated. They were sworn to protect the confi: dentiality of census information and provided assistance such as introducing enumerators to respondents, providing translation services, convincing residents to cooperate, and helping enumera: tors to find hidden living quarters. Local facilitators were paid on a contract basis at the rate of an enumerator's hourly pay.

4.6.11 Tool kit methods assessment findings

While Tenebaum (2001b) notes numerous limitations to assessing the effectiveness of the tool kit methods employed during NRFU, the report does provide some insight into the use of the special enumeration procedures and their impact on the level of refusals, partial interviews, final attempts, and enumerator questionnaires without a population count. The report also cites some anecdotal feedback from enumerators regarding the use of the tool kit methods.

The findings reveal that about 1.7 million (4 percent) NRFU cases were enumerated using one of the special tool kit enumeration meth: ods. The completeness of data for census tracts in which special tool kit enumeration methods were employed was comparable to non-targeted areas. Overall, 6.64 per: cent of tool kit enumerated addresses were something other than complete interviews com: pared to 5.93 percent for the regu: larly enumerated addresses. This may suggest that the special enu: meration methods were effective because the expectation was that targeted areas would have less complete data since they were identified as difficult-to-enumerate areas.

Additional findings shows that blitzed units had a higher rate of refusals, partial interviews, final attempts, and population unknown cases than the regularly enumerat: ed units. Blitzed units also had a higher rate of refusals, partial interviews, final attempts, and population unknown cases than did units which received paired or locally facilitated enumeration.

Paired enumeration had lower refusals, partial interviews, and final attempts, but slightly higher rates of population unknown cases than addresses enumerated with regular procedures. Locally facili: tated enumeration had lower refusal rates, partial interviews, and population unknown rates, but much higher final attempt rates than regularly enumerated units.

Although the report by Tenebaum (2001b) did not collect detailed feedback from enumerators and crew leaders who implemented tool kit enumeration methods dur: ing NRFU, enough information was gathered from routine debriefing questionnaires and anecdotal infor: mation to report that most enu: merators who conducted blitz enu: meration thought it was very bene: ficial and that it improved the overall enumeration in the targeted areas. Similarly, most enumerators who conducted paired enumeration reported increased feelings of per: sonal safety and other benefits of doing the enumeration in pairs.

4.6.12 Tool kit methods recommendations for the 2010 Census

- ;Continue to target difficult-to-enumerate areas for special enu: meration methods in the 2010 Census.
- ;Design controlled experiments for use in census pretests to measure the effectiveness of using special enumeration meth: ods on data content and cover: age.
- ;Continue to refine the targeting algorithms using the planning database.
- ;Obtain detailed feedback on enumerator productivity and retention as a result of imple: menting special enumeration methods.

4.7 Nonresponse followup enumerator training and administering the question naire

Evaluation source information for the subsections of 4.7 comes from Burt and Mangaroo (2003).

4.7.1 Description of NRFU enumerator training

NRFU enumerator training began nationally on April 24, 2000. All initial NRFU classroom training ses: sions were frontloaded. Frontloading an operation quickly got the operation off to a fast start. It reduced the effects of staff attrition on production and somewhat lessened the urgency for the training of replacement

enumerators. As needed, enumerator replacement training sessions were conducted to keep crew leader districts, to the maximum extent possible, at their full front-loaded staffing levels. At least one enumerator replacement training session was mandated.

Upon arrival at the training session, trainees received a trainee kit containing an enumerator's manual, a classroom workbook, several job aids, and a supply of needed forms and materials. Although the NRFU enumerator manual provided detailed job instructions on all facets of the enumerator's duties and responsibilities, the job aids served as quick references to specific procedures while enumerators were working in the field. Additionally, the NRFU enumerators were given flashcards to show to respondents when asking specific questions during the interview.

NRFU training sessions were generally conducted by a crew leader who would later serve as the trainee's first line supervisor during the field data collection effort. Crew leaders, like their enumerator trainees, generally were recent hires and had little or no previous knowledge of census operations and procedures. Their effectiveness as trainers was varied and those who excelled as trainers clearly had acquired the requisite skills, abilities, and knowledge from prior work experience.

To help ensure uniformity and consistency in the presentation of information, the NRFU training used verbatim lectures and standardized videos. Paired-practice interviewing and roleplay situations were incorporated throughout the training. The paired-practice interviews and roleplay scenarios focused largely on the importance for trainees to use established interviewing techniques while administering the questionnaire.

An important component of the NRFU training was "live" practice interviewing. The trainer gave each of the trainees an actual work assignment. For approximately a four-hour period, the trainees were sent out into the community to conduct live interviews. When the trainees returned to the training session, they discussed their field experiences and sought guidance from the trainer as needed. At the conclusion of training, the trainees completed a multiple choice test to assess their understanding of the procedures and job responsibilities. The answers to the test were then discussed, and the trainees were graded on their performance. Following training, the NRFU enumerators were immediately sent out to collect census data from approximately 42 million nonresponding households.

4.7.2 Building an effective NRFU training program

The Census Bureau has long recognized that a successful NRFU operation initially depends upon recruiting sufficient numbers of candidates in each LCO area and implementing a training program that adequately teaches the trainees to perform the duties of a NRFU enumerator.

In preparation for the Census 2000 Dress Rehearsal, the Census Bureau invested extensive resources to design and implement a quality NRFU enumerator training program. Additionally, the Census Bureau hired an outside contractor to review, assess, and evaluate the effectiveness of the Census 2000 Dress Rehearsal NRFU training program. Although the findings of the evaluation indicated that the Dress Rehearsal NRFU enumerators were successfully and effectively trained, the study results did note several areas for improvements in composition and delivery that would help ensure a highly successful enumeration effort during Census 2000.

4.7.3 Evaluating the effectiveness of NRFU enumerator training

The effectiveness of the Census 2000 NRFU enumerator training program was evaluated using the Kirkpatrick model of training evaluation. The Kirkpatrick model assesses employee training programs on four levels: reaction to training, learning, application (on-the-job performance), and organizational performance.[35]

The purpose of the evaluation was twofold: (1) to examine the quality of the Census 2000 NRFU enumerator training program, and (2) to assess how well prepared the trainees were, following training, to perform the NRFU enumeration.

4.7.4 NRFU training study methodology

A major component of the Census 2000 evaluation methodology included an analysis and thorough review of the Census 2000 training materials in conjunction with the Census 2000 Dress Rehearsal evaluation report recommendations by Broadnax (1999).

The four evaluation levels of the Kirkpatrick Evaluation Model for assessing training effectiveness are shown in Table 12 (Burt and Mangaroo 2003).

The Census Bureau developed multiple observation guides for use by staff who observed the classroom

[35] By design, the impact of training effectiveness on organization performance (level four) was not included in the evaluation.

Table 12.
Evaluation Levels of Kirkpatrick Model

KIRKPATRICK EVALUATION LEVEL	WHAT DO WE WANT TO KNOW?	MEASURES	DATA SOURCE
REACTION	Did trainees find the training effective, useful, and enjoyable?	- attitude about the job - reactions to the trainer - reactions to the training materials - reactions to the training - satisfaction with knowledge gained	enumerator debriefings post-employment telephone survey crew leader debriefings classroom training observations
LEARNING	Did the trainees gain the knowledge intended? Were training objectives met?	- knowledge of Census concepts - knowledge of Census procedures - attitudes toward a job - knowledge of effective interviewing skills	classroom training observations enumeration observations enumerator debriefings crew leader debriefings tests
APPLICATION/ ON-THE-JOB BEHAVIOR	Can the trainees effectively do the job after completing training?	- productivity - on-the-job performance - operation completion rates	enumeration observations enumerator debriefings crew leader debriefings employee performance records
ORGANIZATIONAL PERFORMANCE	What impact has the training had on the agency's overall performance	N/A	N/A

Source: (Burt and Mangaroo 2003).

training and/or field enumeration activities. Observers used the training observation protocol to report their perceptions of trainer effectiveness, training delivery, and training materials. Observers used the enumeration protocol to record their perceptions of enumerators' on-the-job performance, attitudes toward their work, and feelings about how well the training prepared them to perform their job.[36] Using the collected observation data, the Census Bureau produced measures of adequacy of the training content and format, measures of enumerators' knowledge of Census 2000 concepts and procedures, and enumerator performance statistics.

In addition to the formal Census 2000 Evaluation Program examination into NRFU enumerator training, additional data on reactions to the training were obtained from enumerator and crew leader debriefing questionnaires and focus groups.

Finally, the Census Bureau supplemented observation and debriefing data through the use of a post-employment telephone interview of NRFU enumerators and crew leaders and reviewed performance data for a sample of NRFU enumerators.

4.7.5 NRFU training study limitations

The methodology used to evaluate Census 2000 NRFU enumerator training was limited in several ways.

Despite the use of structured observation guides, the final assessments of the quality of enumerator training and on-the-job performance were based on the subjective judgments of individual observers. The reliability and validity of these judgments are highly correlated with the accuracy and consistency of the observers' skills as observers, and also, to some extent, on their knowledge of the NRFU operation (Burt and Mangaroo 2003).

The observations were not based on a scientifically selected sample. Because the training classes and individual enumerators observed were informal rather than predefined statistically representative samples, the ability to generalize evaluation results is limited.

Additionally, it is likely that enumerators were on their best behavior while being observed.[37] Thus, it is possible that the observation process influenced the enumerators' performance which might impact the overall reliability of the results.

[36] Both protocols were developed by staff from the Center for Survey Methods Research (CSMR), Field Training and Career Development Office (FTCDO), and FLD based on input from the decennial areas regarding which work behaviors would have the greatest impact on census data quality.

[37] Observers told enumerators they were being observed as part of an evaluation of NRFU training and that the results would not be used to evaluate their performance. Additionally, enumerators observed by HQ staff and external contractors were told that the observation results would not be shared with their crew leader or other LCO staff.

4.7.6 Measures of NRFU enumerator training effectiveness

The best measure of the effective: ness of employee training programs is the degree to which the skills taught in training are demon: strated on the job. Burt and Mangaroo (2003) indicate that the Census 2000 NRFU enumerator training program adequately prepared trainees to effectively perform the tasks of the NRFU enu: merator position. Additionally, about three fourths of the NRFU enumerators who participated in a survey of training satisfaction reported that they were satisfied with the training they received.

Evaluation results reveal that almost all of the enumerators properly identified themselves at the followup address, showed their ID card, stated the purpose of their visit, and determined the HU's Census Day status. Additionally, most enumerators verified that they were at the correct address and provided respondents with a Privacy Act Notice. While the majority of enumerators recorded responses accurately and legibly, a significant number of enumerators did not always read questionnaire items as written and often did not use the flashcards provided. In particular, enumerators seemed less likely to follow the procedures taught in training when asking the Hispanic origin and race questions. About half of the recommendations from the Census 2000 Dress Rehearsal evaluation were incorpo: rated, either completely or partial: ly, into the Census 2000 NRFU enu: merator training program. The incorporated recommendations contributed to an improved train: ing program.

4.7.7 NRFU training recommendations for the 2010 Census

Although the results of Burt and Mangaroo (2003) indicate that the Census 2000 NRFU enumerator training program was viewed favorably by the trainees and did produce enumerators who could effectively obtain census data from nonresponding households, the results also suggest some areas the Census Bureau should focus on when developing NRFU enumerator training for the 2010 Census. Some key recommendations include:

- ;Continue to provide an opportu: nity for the field work compo: nent of NRFU training and enforce inclusion of field work in all training sessions.
- ;Continue to place emphasis on reading all of the questions exactly as worded, adding addi: tional explanations on why read: ing questions verbatim is so important to data quality. Consider the use of a video that focuses on the importance of reading the Hispanic origin and race questions exactly as worded.
- ;Increase the use of role playing, varying the situations to include reluctant respondents and refusals.

4.7.8 Administering the enumerator questionnaire

The purpose of the NRFU operation was to collect census information at specific addresses for which a census questionnaire was not returned to the Census Bureau. Before conducting an interview for the household at the followup address, enumerators were required to introduce themselves by stating their name, show their census ID, explain the purpose for their visit and the approximate length of time required to com: plete the interview, and hand the respondent a Privacy Act Notice, D-31.

Once these introductory activities were complete, NRFU enumerators were required to answer two key questions before conducting the interview to collect census infor: mation for the household members and the HU.

4.7.9 Interviewing at the correct address

A crucial job task was for NRFU enumerators to ensure that they were at the specific address desig: nated for a followup interview. Typically, enumerators confirmed this by reading the address on the questionnaire label to the respon: dent and asking if they were at the correct address. Of a total of 474 enumerator observations,[38] Burt and Mangaroo (2003) reveal that enumerators confirmed that they were at the correct address 92.5 percent of the time. In only seven percent of the observed interviews did enumerators fail to consistent: ly verify that they were at the des: ignated followup address. Administering enumerator ques: tionnaires at addresses not desig: nated for followup could affect the overall quality of census data.

4.7.10 Determining the Census Day status of the followup unit

One of the most critical responsi: bilities of NRFU enumerators was to determine the Census Day sta: tus of the HU at the followup address. Census Day, or April 1, 2000, was the fixed reference date for the collection of census infor: mation. Determining the Census

[38] The references to observations in Sections 4.7.9 through 4.7.15 pertain to field observers who used observation proto: cols developed by the Center for Survey Methods Research (CSMR), Field Training and Career Development Office (FTCDO), and FLD to observe and record the performance of NRFU enumerators.

Day status of followup addresses not only determined which sec: tions and/or questions on the instrument to complete, but it also served as a reminder that the information collected would be as of April 1, 2000. All NRFU addresses had one of the following statuses as of April 1, 2000 - occu: pied, vacant, or nonexistent.

Evaluation results indicate in about 97 percent of the observed inter: views enumerators correctly asked question S2, "Did you or anyone in this household live here on Saturday, April 1, 2000?"

Additionally, in almost 91 percent of the observed interviews, enu: merators asked followup screening questions, as appropriate, to deter: mine the unit's Census Day status. For units that were determined to have been occupied on Census Day, study results reveal that in about 94 percent of the observed interviews, enumerators properly asked the question in order to record a Census Day population count for the unit in question S5.

4.7.11 Asking about relationships to the reference person

Question 2 on the enumerator questionnaire asks for the relation: ship of each household member to the reference person. The refer: ence person is defined as the household member who owns or rents the HU and who, according to procedure, is listed as Person 1 on the household roster in ques: tion 1. Failure to list the owner/renter as Person 1 and/or incorrectly asking about the refer: ence person's relationship to the other household members rather than asking for the relationship of each household member to the ref: erence person, would result in faulty data collection.

Evaluation results show that enu: merators correctly asked the rela: tionship question in about 81 per: cent of the observed interviews, but seldom used the relationship flashcard. Several observers noted that the enumerators who did not show the relationship flashcard to respondents appeared to have dif: ficulty recording the relationship of a common-law spouse and/or a live-in boyfriend or girlfriend. When respondents reported that the relationship of a household member to Person 1 was a son/daughter/child, enumerators were supposed to probe for a more precise relationship such as natural born, adopted, or foster. Observation data reveal that enu: merators probed for more specific relationship information for chil: dren in about 74 percent of the observed interviews.

4.7.12 Asking about Hispanic origin

During NRFU enumerator training, considerable emphasis was placed on the proper procedure for asking the Hispanic origin question. This was accomplished through a com: bination of verbatim training, paired-practice interviews, and an interviewer skills video. The trainees were repeatedly told not to make assumptions about a per: son's origin and never to complete the question by observation.

Rather, enumerators were to show respondents the Hispanic origin flashcard, which listed all of the response categories on the ques: tionnaire, and ask: "Are any of the persons that I have listed Mexican, Puerto Rican, Cuban, or of another Hispanic or Latino group?"

Evaluation results indicate that enumerators showed the Hispanic origin flashcard to respondents in about 42 percent of the observed interviews.

Enumerators were supposed to mark a response box for each household member to indicate whether or not the household member was of Spanish, Hispanic, or Latino origin. If the household member was of Spanish, Hispanic, or Latino origin, enumerators were to mark the specific group to which the household member belonged.

Despite the emphasis placed on how to ask this question, NRFU enumerators read the Hispanic ori: gin question exactly as worded in only about 75 percent of the observed interviews. In about 84 percent of the observed interviews, enumerators inquired about Hispanic origin for each household member, but did not necessarily read the question exactly as word: ed.

4.7.13 Asking about race

As with the Hispanic origin ques: tion, the NRFU enumerator training placed considerable emphasis on the proper procedure for asking the race question. Trainees were told that race was based on self-identification and that observation should never be used to complete the race question. Additionally, trainees were instructed to show the race flashcard to respondents and ask: "Now choose one or more races for each person." Census 2000 was the first time that respondents could identify the race of each household member by choosing more than one response category. Thus, it was essential for enumerators to read the race question exactly as worded so respondents would clearly under: stand that one or more races could be chosen for a household mem: ber, if applicable.

When respondents reported American Indian or Alaska Native as a household member's race,

enumerators were trained to ask for and write in the name of the person's enrolled or principal tribe. Similarly, when respondents chose other Asian, other Pacific Islander, or some other race as the household member's race, enumerators were trained to probe for and write in the specific name of the race.

Observation reports of the NRFU enumerator training reveal that many trainees had difficulty asking about race. Thus, it was not surprising that data from enumerator field observations indicate that enumerators were less likely to follow correct procedures when asking about race than any other census question. Study results indicate that enumerators showed respondents the race flashcard in about 46 percent of the observed interviews and read the race question exactly as worded in 63 percent of the observed interviews. In about 41 percent of the observed interviews, enumerators read all of the race categories to the respondent.

When enumerators were required to probe for the name of an enrolled or principal tribe for the American Indian and Alaska Native race categories, they did so in 70 percent of the observed interviews. Similarly, when enumerators needed to probe for the name of a specific race for the *other Asian, other Pacific Islander*, and some other race categories, they asked for the race in 81 percent of the observed interviews.

4.7.14 Checking household coverage

Another important enumerator responsibility was to verify the completeness and accuracy of the household roster in question 1. Question 1 was supposed to list all household members at the followup address as of Census Day.

Coverage question C1 asked: "I need to make sure I have counted everyone who lived or stayed here on April 1, 2000. Did I miss – any children, including foster children? — anyone away on business or vacation? – any roomers or housemates? – anyone else who had no other home? "

Coverage question C2 asked: "The Census Bureau has already counted certain people so I don't want to count them again here. On April 1, 2000, were any of the people you told me about –away at college? –away in the armed forces, – in a nursing home, – in correctional facility?"

Asking both coverage questions was important to Census coverage and the failure by enumerators to always ask these questions could affect within household coverage measurements.

Evaluation results indicate that enumerators asked if they had missed anyone who should have been included on the household roster in 85 percent of the observed interviews. The results also show that, in 82 percent of the observed interviews, enumerators asked if anyone who had been included on the household roster should not have been included.

4.7.15 Obtaining other household data

The field observation protocol also provided data about the collection of household member names, their ages and dates of birth, and the use of household or proxy respondents. Information about these data items was not only important to the maintenance of data quality, but it provided additional insight into how effectively enumerators administered the instrument.

Study results indicate that enumerators asked respondents for the names of all household members living at the followup unit in about 94 percent of the observed interviews. Additionally, the data show that enumerators were observed to have asked the age/date of birth question for each household member in about 91 percent of the interviews.

4.8 Questionnaire assistance centers

For the 1990 Census, source information comes from U.S. Department of Commerce (1993) and, for Census 2000, from Jones and Barrett (2003).

- 1990 Census

The 1990 Census had two types of questionnaire assistance - telephone assistance and walk-in assistance. Telephone assistance was provided in all district offices, except type 1 offices (large, central-city and metropolitan areas) which had walk-in assistance centers. Telephone assistance in type 1 district offices was provided by the servicing processing office based on the caller's originating area code and exchange.

Questionnaire assistance was available in English as well as Cambodian, Chinese, Korean, Laotian, Spanish, Thai, and Vietnamese where appropriate. The walk-in centers were staffed by unaffiliated, bilingual (when appropriate) volunteer personnel who answered respondents' questions concerning the census and/or the completion of their questionnaires.

The program suffered staffing problems from the start and never realized its goal of rendering assistance in all type 1 district offices, although the walk-in centers that were staffed provided valuable information to the public.

- Census 2000

More than 14,000 questionnaire; assistance centers were staffed during Census 2000 to provide: 1) general help to respondents who had questions or difficulty completing their census questionnaire; 2) language assistance guides for respondents who had language barriers to completing their questionnaire; and 3) *Be Counted* forms to respondents who believed they did not receive a questionnaire or were not included on the question: naire for their household. For each respondent contact at a question: naire assistance center, census clerks or volunteers, as appropri: ate, completed a D-399, Record of Contact, to document the reason(s) for the visit.

Table 13 provides the number of QACs established, the number of QACs that had Record of Contact questionnaires keyed, and the number and type of census tracts that the keyed data represents.

There were a total of 23,556 QACs, nationwide. Data was keyed from 14,222 (60.4 percent) of these QACs. The 14,222 QACs were established in 8,952 census tracts. Flagged census tracts are defined to be those tracts known to be dif: ficult to enumerate, those that are heavily populated by racial and ethnic groups, or those that are lin: guistically isolated. About 97.5 percent of the census tracts from which we have QAC data were flagged. The remaining 2.5 percent of census tracts from which we have QAC data were not flagged. Non-flagged tracts are defined to be those difficult to enumerate tracts that did not meet the flagged criteria.

4.8.1 Questionnaire assistance center study methodology

Table 13.
Number of Census 2000 Questionnaire Assistance Centers and Types of Census Tracts with Questionnaire Assistance Centers

	Number	Percent
Total number of Census Tracts in 2000	61,258	
Number of Questionnaire Assistance Centers	23,556	100.0
Number of Questionnaire Assistance Centers (from keyed data)	14,222	60.4
Number of Census Tracts with QACs (from keyed data)	8,952*	100.0
Number of Flagged Census Tracts with QACs	8,725	97.5
Number of Non Flagged Census Tracts with QACs	227	2.5

*D-399 keyed data is available from QACs in these tracts. The actual number of tracts with QACs is unknown.

Source: (Jones and Barrett 2003).

To assess the scope of the ques: tionnaire assistance operation and to determine the type of assistance requested, the Census Bureau relied exclusively on the data con: tained on the D-399, Record of Contact.

4.8.2 Questionnaire assistance center study limitations

Since most D-399s, *Record of Contact*, were filled out by volun: teers rather than paid Census Bureau clerks, there may be a potential for reduced data quality. Also, errors in keying data from the D-399s affect the accuracy of the results.

4.8.3 Questionnaire assistance center study results

A total of 559,027 respondents visited questionnaire assistance centers for some type of help com: pleting their Census 2000 ques: tionnaire. As expected, the majori: ty of respondents requested assistance with completing the short-form English-language ques: tionnaire.

Of the 94,639 respondents who asked for a language assistance guide, 53 percent (50,158) requested a Spanish-language guide. Language assistance guides in Russian (5.2 percent) and Chinese (5.1) were the next two most requested guides after Spanish.

Almost 40 percent of respondents visiting questionnaire assistance centers were given a *Be Counted* form because they did not receive a questionnaire or thought they were missed in the census. *Be Counted* forms were available in six languages (English, Spanish, Chinese, Korean, Vietnamese, and Tagalog). Of the 220,489 people who requested *Be Counted* forms at the Questionnaire Assistance Centers, most requested them in English (69.8 percent) or Spanish (24.4 percent).

4.8.4 Questionnaire assistance center recommendations for the 2010 Census

Two important recommendations for future questionnaire assistance center operations were:

- ;Assess the number of languages in which we print the *Be Counted* form for the 2010 Census in light of the Census 2000 evaluation results and the potential cost of providing addi: tional languages. The authors of the Questionnaire Assistance Centers evaluation (Jones and Barrett 2003) recommended that we increase the number of

languages in which we provide the *Be Counted* form for the 2010 Census. They based this recommendation on data that respondents requested more that 1,000 Language Assistance Guides in each of six languages for which the *Be Counted* form was not available. However, according to the evaluation of the Be Count Campaign (Carter 2002a), overall only 4.9 percent of the *Be Counted* forms that were printed were returned to the Census Bureau.

- ;Continue to establish question: naire assistance centers in cen: sus tracts which are document: ed to have residents with language barriers to completing the census questionnaire or which are otherwise known to be difficult to enumerate.

4.9 Census Day (April 1, 2000) as the reference date

Evaluation source information comes from Carter (2002b).

A key concept of census-taking is the collection of person and HU information as of a fixed date. For decennial censuses, this fixed or reference date for data collection has traditionally been April 1. For Census 2000, the Census Bureau conducted an evaluation to deter- mine how well respondents adhered to the April 1 reference date when responding to the cen: sus.

4.9.1 Date of reference for age/date of birth

The Census Bureau's investigation into respondent adherence to April 1, 2000 as the reference date focused on how respondents answered the age/date of birth questions on the Census 2000 questionnaire. The way respon: dents answer these questions can be influenced by whether or not they are using Census Day as their date of reference. By including a reference to April 1 on the Census 2000 age question, the Census Bureau hoped to reduce the dis: crepancy between respondents' reported ages and actual ages. Additionally, the Census 2000 age/date of birth question asked respondents to report a full date of birth for all household members rather than just the person's birth year.

4.9.2 Date of reference study methodology

The study methodology consisted of using the Hundred-Percent Census Unedited File (HCUF) [39] so analysis could be done solely on data provided by respondents prior to the editing and imputation process. The Census Bureau also calculated each person's age, as of April 1, 2000, using the date of birth provided by the respondent. A person's age was considered to be misreported if the age reported for that person differed from the age calculated from the date of birth. A person's age added to his or her year of birth shows whether or not that person's age had incre: mented (implies having had a birthday) for that year. The sum of 2000 indicates the age having been incremented for the year of 2000, while the sum of 1999 shows that the age has not yet been incremented for the year. The Census Bureau calculated the sum for every person in the analy: sis.

If every person's age was correctly reported, the proportion of sums that equaled 2000 would be equal to the proportion of persons who have a birthday between January 1 and April 1. If the proportion is different, it indicates that some date other than April 1, 2000 was used as a reference date. If the proportion is matched to a distri: bution of dates of birth throughout the year, the day corresponding to the percentage would indicate the average date of reference (Carter 2002b).

The Census Bureau also examined final mail return rates. The mail return rate is a measure of respon: dent cooperation in mailback areas.[40] The mail return rate repre: sents the number of occupied HUs with corresponding nonblank ques- tionnaires[41] checked in through the end of the year, December 31, 2000, divided by the total number of occupied HUs in the mailback universe.[42]

4.9.3 Date of reference study limitations

Obtaining complete and accurate data from respondents, while a key goal of all data collection efforts, is particularly difficult to measure. For purposes of the evaluation of respondents' answers to the age/date of birth questions, the Census Bureau assumed that respondents correctly reported dates of births for all household members. Thus, all reported

[39] After removing duplicate HUs and persons who reported blank or other invalid data for their age/date of birth, the base universe for the evaluation consisted of approximately 252.5 million persons, or about 93 percent of HU persons on the HCUF.

[40] These areas included the following types of enumeration (TEA) areas: mailout/mailback (TEA1), Update/Leave (TEA2), Military (TEA6), Urban Update/Leave (TEA7), and mailout/mailback converted to Update/Leave (TEA9).

[41] Includes actual mail return question: naires, Be Counted forms, Internet returns, and responses from Telephone Questionnaire Assistance, and Coverage Edit Followup.

[42] Undeliverable as addressed (UAA) ques: tionnaires as well as deleted addresses from TEA2 and TEA7 areas were excluded from the denominator. To be included in the denominator, addresses must have been added to the DMAF through an operation that occurred prior to NRFU.

discrepancies are attributed to respondents failing to correctly report the ages of household mem: bers.

4.9.4 Census movement or average date of reference

Calculating the sum of all person ages and dates of birth (either 2000 or 1999)[43] revealed that 29.9 percent of persons had an observed sum of 2000. These are persons whose age had increment: ed for the year, meaning that their age reflected having had a birthday sometime between January 1 and April 1, 2000. The remaining 70.1 percent of persons had an observed sum of 1999, meaning that their age reflected that their birthday was after Census Day.

To determine the Census move: ment or average date of reference, the Census Bureau compared the 29.9 percent against a distribution of dates of birth for the entire year.[44] The results of this analysis revealed that April 20 was the average date of reference for Census 2000. This was a notable improvement compared to the May 5 average date of reference for the 1990 Census.

The movement of the average ref: erence date to April 20 may be attributed to including a specific reference to April 1, 2000 on the age question, delivering Census 2000 questionnaires earlier than in the 1990 Census, and completing the Census 2000 NRFU operation earlier than in 1990.

Additionally, there was a consider: able difference in the average date of reference between households who self-enumerated and those who were enumerated by a census enumerator. The average date of reference for self-enumeration questionnaires was April 12 com: pared to May 18 for enumerator completed returns (Carter 2002b).

Evaluation results show that a state's mail return rate seems to be correlated with the date of refer: ence for the state. As a state's mail return rate increases, the date of reference for the state gets clos: er to April 1, 2000. This is attrib: uted to the fact that a higher mail return rate means that more respondents are completing their questionnaires and returning the forms in the mail. It is also likely that these respondents will not be part of NRFU as they are enumerat: ed closer to April 1. Thus, these respondents are less likely to mis: report their ages.

4.9.5 Date of reference recommen: dations for the 2010 Census

- ;Include a reference to Census Day, April 1, 2010 when asking respondents to provide the ages of household members.
- ;Consider a compressed enumer: ation time frame which may aid respondents to correctly report age.
- ;Stress the importance for enu: merators to state the April 1 ref: erence date when asking the age question during NRFU.

4.10 Coverage improve ment followup

For the 1990 Census, source infor: mation Coverage Improvement Followup (CIFU) comes from U.S. Department of Commerce (1993) and, for Census 2000, from Clark and Moul (2003).

- 1990 Census

The objectives of the Field Followup operation were to improve data quality and census coverage by following up on ques: tionnaires with inconsistent or missing data. This was accom: plished by enumerators who: 1) verified the status of units report: ed during NRFU as vacant or delete; 2) followed up on question: naires that were checked in, but were not data captured (missing or misplaced); 3) checked addresses on the ACF for which no question: naires were checked in and; 4) revisited units with coverage/con: tent edit failures.

- Census 2000

The program designed to improve coverage of HUs in mailback areas following the completion of NRFU was changed from Field Followup (used during the 1990 Census) to CIFU. While the majority of the CIFU workload consisted of units classified as vacant or nonexistent (delete)[45] during NRFU, some addi: tional components of CIFU includ: ed new construction adds from local officials, blank mail return forms, and HU adds from various sources that could not be included in the mail delivery or in NRFU.

While the primary focus of CIFU was coverage improvement, the nature of the CIFU field work was similar to other data collection operations. The effectiveness of CIFU and its value to the overall census-taking process is noted in several operational results. Most notably, more than 5 million people were enumerated. Similar to NRFU, CIFU enumerated a higher

[43] Persons whose age and year of birth totaled something other than 2000 or 1999 were eliminated from the analysis. This reduced the universe for the analysis phase to about 244.2 million persons.

[44] Because the Census 2000 age/date of birth question asked for each person's full date of birth, the Census Bureau was able to develop a distribution of dates of birth for each day of calendar year 2000.

[45] Units that were identified as vacant or delete in two previous census operations, units identified as seasonal vacants, and units identified as undeliverable as addressed were excluded from the CIFU workload.

percentage of the groups that are typically undercounted, such as males, young people (34 years old and younger), Hispanics, Blacks, and Some Other Race. Importantly, more than 1.5 million vacant/delete units were converted to-occupied units. These converted-units resulted in a gain of 3.1 mil--lion people. -

5. Synthesis of Findings and Recommendations for Future Study

This report highlighted the results of Census 2000 evaluations, assessments, and auxiliary reports pertaining to field data collection activities. Its examination of the major challenges and successes of several data collection operations, coupled with the analysis of study data and/or findings from field observations, reveals that the overall data collection program was operationally successful.

Two components of the Census 2000 data collection effort that contributed to its successful and timely completion were the Census Bureau's recruiting campaign and pay rate program. The Westat study found a higher than expected correlation between high census pay (relative to prevailing pay rates) and above average recruiting performance. A robust national recruiting program, carefully monitored and nurtured by Census Bureau headquarters and the Regional Census Centers, yielded more than enough applicants to efficiently conduct all field data collection activities.

Recruiting - Although there were considerable differences in recruiting performance across all 520 local census offices, most local census offices significantly exceeded their recruiting goals. Westat (Jacobson, Petta, and Yudd 2002), who examined the factors affecting Census 2000 recruiting performance, opined that the local census offices regarded recruiting goals as minimums. Notably, by April 2000, 82 percent of the local census offices exceeded recruiting goals, usually by considerable amounts.

Pay Rates - Census 2000 recruiting efforts were greatly facilitated by increases in enumerator pay to more than 75 percent of the Bureau of Labor Statistics prevailing wage rate. Specifically, hourly pay was increased by almost 38 percent on average relative to the 1990 Census pay rate (adjusted for inflation). We believe this increase in pay also had a corresponding effect on enumerator retention which was improved nearly 23 percent from 1990.

Frontloading - Frontloading was an innovative strategy in which slightly more than twice the number of enumerators actually needed for field production work were invited to training with the expectation that most trainees could be given a work assignment immediately following training. Frontloading was facilitated by the Census Bureau's highly successful recruiting program which, in most cases, provided sufficient numbers of qualified applicants. The increase in enumerator retention, coupled with the frontloading of enumerator training sessions and work assignments, were instrumental in keeping major operations on schedule and for maintaining the efficiency with which field operations were conducted. These results were evidenced in all operations that were frontloaded, but none more dramatically than Nonresponse Followup, which was completed in the average LCO in about seven weeks during Census 2000 as compared to nearly ten weeks in the 1990 Census. It appears that the degree to which local census offices exceeded operational schedules was a function of the amount of frontloading that they were able to achieve. Importantly, about 80 percent of the local census offices met or exceeded their frontloading goals. In Census 2000, the slowest performing local census offices completed their work about 1.5 weeks faster than the fastest performing local census office in 1990.

NRFU Enumerator Training : The Census 2000 Evaluation H.7, *Study of Nonresponse Followup (NRFU) Enumerator Training* (Burt and Mangaroo 2003), indicates that the Census 2000 NRFU enumerator training program adequately prepared trainees to effectively perform the tasks of the NRFU enumerator position. About three-fourths of the NRFU enumerators who participated in a survey of training satisfaction reported that they were satisfied with the training they received. This evaluation also reveals that almost all of the enumerators properly identified themselves at the followup address, showed their ID card, stated the purpose of their visit, and determined the HU's Census Day status. Additionally, most enumerators verified that they were at the correct address and provided respondents with a Privacy Act Notice. While the majority of enumerators recorded responses accurately and legibly, a significant number of enumerators did not always read questionnaire items as written and often did not use the flashcards provided.

Tool Kit - The use of special tool kit enumeration techniques (blitz enumeration, paired enumeration, and local facilitators) during Nonresponse Followup also con: tributed to the efficiency of field data collection operations. The *Assessment of Non-TEA Tool Kit Methods* (Tenebaum 2001b), reported that the field staff thought the tool kit enumeration techniques simplified their jobs, made them feel safer, improved supervision, reduced respondent reluctance to cooperate, and increased productivity.

Better than expected local census office recruiting performance, increased enumerator pay and retention, frontloading, tool kit strategies, and effective regional census center management all worked together to provide syner: gy that resulted in an operationally successful data collection effort.

Recommendations for future study and/or implementation:

- ;Continue the practice of offering locally competitive pay rates to allow regions to attract, recruit, and retain staff in their local census offices.
- ;Assess the optimal NRFU sched: ule and degree of frontloading field staff (combined with replacement training) that would substantially reduce cost with- out reducing the likelihood of meeting the operations sched: ule.
- ;Periodically identify and remove late mail returns from the Nonresponse Followup workload to reduce the workload and the number of housing units with multiple data captures. The planned use of mobile comput: ing devices in the 2010 Census potentially will improve the con: trol and tracking of the NRFU universe by accounting for Late Mail Returns and, therefore, reduce multiple enumerations.
- ;Consider reassessing how test scores and the availability to work many hours are used as hiring screens. Data analysis suggests that the capacity to complete Nonresponse Followup would have been enhanced had test scores of about 82 percent been used as the first selecting criteria (unless applicants had a special language skill) and the order of contacting applicants had been based on the hours of availability (at least 20 hours per week) as reported on their job applications.

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