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OVERVIEW

General Introduction

As the American Statistical Association celebrates its sesquicentennial this year, the Census Bureau is preparing to mark the bicentennial year of census-taking in the United States in 1990. Throughout the history of the decennial census, the quality of census data--both the count and the characteristics collected--has been of interest. As early as the first census in 1790, George Washington expressed dismay that the count fell short of the 4 million persons he had expected. It was not until 1940, however, that the interest in and need for accurate demographic data, coupled with advances in the science of statistics and sampling, led to establishing a formal program of census evaluation. So the Bicentennial Census of 1990 will also celebrate the 50th anniversary of formal and recognized research done as part of the census.

Just as the functions of the American Statistical Association have expanded over its history, census research efforts have expanded from a small set of targeted evaluations to a full program of developmental research, extensive evaluation, and methodological experimentation. The combination of studies of these various types is referred to as the Research, Evaluation, and Experimental (REX) Program. And just as the ASA both influences and is influenced by developments in the statistical and world community, the decennial census REX Program both influences and reflects developments in census-taking. Major advances in data collection methodology, coverage evaluation methodology, and the way the census is processed have been based on the results found in the REX Program.

There are several general themes which can be discerned in reviewing the evolution of the REX Program over the past five decades. Among them are:

1. The REX Program is an ongoing effort, encompassing not only studies that take place during the decennial census but throughout each decade. Prior to each census, there are a number of census tests that allow development of specific methodologies. The objectives of these tests are defined to address or incorporate the results of the previous census experience and research program, and findings from the tests are used to define the way the

next census will be taken. These tests may be full-scale censuses taken in local areas subjectively identified as "typical" of the particular problems being studied, or may be targeted investigations to address specific concerns. The results are always limited by the local nature or narrow focus of the test, but they are inevitably generalized to what can be expected to be a successful application in the next census. The applications in the next census are evaluated, leading to new ideas or hypotheses to be explored in the subsequent decade.

2. Much of the program is defined once a potential or real problem is recognized. These problems could be those of data quality, special coverage concerns, procedural or operational difficulties, or human resource concerns. A program of developmental studies is then designed to best correct the problem; new procedures are then defined and their efficacy evaluated. Sometimes procedures that hold little promise for one census--either because of technological limitations or environmental conditions--become feasible for the next. The REX Program, therefore, undergoes various cycles of testing, implementation, and further improvement.

3. In the course of carrying out REX studies, there are expansions and improvements in the methodologies of the studies themselves. We are interested in continually refining measurement techniques, and in assuring that the results of individual component studies are fully integrated with each other, so that interrelationships between the studies are identified and used.

The purpose of this paper is to explore these themes in detail for one area of continuing interest in the REX Program--the improvement of population coverage of the census over time. While there are numerous aspects of the REX Program, we have chosen coverage improvement because the count of the population is a critical product of the decennial census. Counts at the state level, for the purpose of reapportioning the House of Representatives, are mandated by the Constitution, and the accuracy of these counts affect political power over the decade. Counts at small area levels are available only from the census, and they affect resource allocation over the decade. So efforts to improve the counts are a critical part of the REX Program. In particular, we will show how population coverage has been improved in the following areas: by correcting

misclassification of vacant housing units; by addressing problems with the coverage of persons who move near census time; by incorporating the knowledge and resources of the U.S. Postal Service (USPS); and by the use of administrative records.

In addition to providing a history of the REX Program as illustrated by efforts to develop and improve population coverage techniques, we also speculate on how these themes will be reflected in work into the next century.

Overview of the REX Program

Before detailing the development of selected population coverage improvement techniques, however, it is appropriate to provide an overview of the REX Program itself. This will provide a perspective for where these specific studies fall into the full range of topics addressed in the REX Program over time.

The overall objective of the census research and evaluation program is twofold: to measure errors so that limitations of the data are provided to those who use them, and to identify the sources of errors so that they can be minimized in future censuses. Experimental programs help identify and develop new methodologies to increase the accuracy and efficiency of the census process.

In general, the aspects of census-taking that we address in the REX Program fall into three areas: questionnaire content evaluation and improvement; population coverage evaluation and improvement; and evaluation and improvement of procedures and processing methodologies. In each of these areas, we try to measure and improve the quality, timeliness, and cost-effectiveness of the techniques used. While the lines between these three categories are not always clear--for example, improvements in coverage are accompanied by improvements in the quality of the content for the otherwise missed population--it is useful to think about the studies in this taxonomy.

Several major research, evaluation, and experimental methodologies have been employed in the REX Program over time. Among these are record checks, which have been used to evaluate and improve both questionnaire content and population coverage quality; reinterviews, which also can be effective in assessing and enhancing characteristics data and the counts; and experimental designs, which are often used to develop and evaluate new methodologies or alternative techniques. For some evaluations, procedures are replicated in a controlled environment and the results compared with those obtained in the census. While these basic methodologies have remained the

same over time, their application has become increasingly sophisticated and effective. The expanded availability of automation has been largely responsible for this. Automation has allowed the application of more advanced statistical techniques; allowed better control over experimental designs and the administration of data collection activities; fostered better and more consistent record keeping; and replaced manual data capture, tabulation, and analysis. In this last regard, automation has allowed more accurate and timely release of results.

Another aspect of the REX Program that has been expanded over time has been the gathering of ideas from outside of the Census Bureau. Just as the Census Bureau has expanded its consultations with regard to overall objectives, content, and administration of the census, consultations about the REX Program itself have increased. Contacts with data users, other government agencies at the Federal, state and local level, and private or academic data collection experts have helped identify the goals for each REX Program. These contacts identify data interests, management concerns, and methodological advances that should be incorporated into the program. Technical advice is sought from formal advisory panels--American Statistical Association, Population Association, American Marketing Association, and American Economic Association--as well as under contract from the Committee on National Statistics. In professional society forums, we seek advice on the content and design of all aspects of the REX Program.

Before our specific discussion of coverage improvement efforts, it might be useful to review how these themes enter into one major global aspect of the decennial census--data collection methodology. This will illustrate how the evaluations of error in the data due to enumerators evolved into the interest in a mail census; how the mail census was developed and expanded; and how conditions have dictated a partial retreat from a census carried out maximally by mail-out/mail-back techniques.

Evolution of Data Collection Methodology: The Mail Census

A mail-out/mail-back census is a logical extension of census-taking by self-enumeration. In the United States, self-enumeration had its real beginning in the 1940s and 1950s [1]. In the 1940s, the Census Bureau planned experiments aimed at providing estimates of some of the different kinds of variance and biases. Several of these were carried out in the 1950 census. One such study done during the 1950 census showed that the variance

introduced by an enumerator was at about the same level as the variance of a sample of self-enumerations [2]. These results were one reason why the Census Bureau turned to the use of self-enumeration techniques in the 1960 census [3].

In turning to self-enumeration we removed the necessity of having enumerators travel to every housing unit. Therefore, concurrent with tests for self-enumeration were various tests of different methods for delivering questionnaires to households and retrieving them. In 1948, we experimented with enumerator and mail carriers delivering questionnaires [4, 5]. In the 1950 census, we conducted an experiment in six district offices in which enumerators left questionnaires with respondents to fill out at their convenience and mail back to regional census offices [6].

Self-enumeration and methods of delivering and retrieving the questionnaires were tested in three major pretests before the 1960 census [7]. By the 1960 census, self-enumeration was developed to the point where it could be included as a basic part of the decennial census procedures for data collection [8].

The experience with self-enumeration in 1960 encouraged the Census Bureau to continue its experimentation and to develop procedures so that respondents could receive and return their questionnaire by mail.

For an effective mail census, the Census Bureau had to develop complete and accurate residential address lists and assign geographic codes to each address; produce a mailing package containing the correct questionnaire (long or short form), appropriate instructions, and a return envelope; and design a means for accounting for each questionnaire and housing unit. In addition, the feasibility of the mail method depended in large measure on the degree of public cooperation in filling out and returning questionnaires. In five full-scale mail tests conducted between 1964 and 1968, the percent of households mailing back census forms ranged from 66 to 91 percent [9].

The nearly 10 years of pretesting and formulating the techniques to be used in the mail census had been focused mainly in urban centers with the exception of a few listing and post office tests done in rural areas. So for the 1970 census, the Census Bureau decided that approximately 60 percent of the households in the Nation, those located in the larger metropolitan areas and some adjacent counties, would receive their questionnaires by mail. The remainder of the country was enumerated by the conventional method [10]. The national return rate for 1970 proved to

be 87 percent.

Although approximately 60 percent of the population was included in the mail census, less than 7 percent of the nation's land area was involved. To consider the feasibility and economy of extending the mail census to 1970 conventional areas, the REX Mail Extension Test was devised to provide a means of comparing directly, under decennial census conditions, the two basic 1970 census procedures--mailout/mailback and conventional. We found that population coverage was about the same with both procedures, but using a mail-out method designed for an urban address system resulted in delivery problems when applied to rural-type areas [11, 12, 13].

Given the positive coverage results of the Mail Extension Test, the Census Bureau decided to try to extend the mail-out/mail-back method even further for 1980. This necessitated focusing on improving procedures for compiling mailing lists for rural areas. In an operation the Census Bureau calls "prelist," address lists are constructed by census enumerators listing the address and recording the location information of each unit they find in their assigned area.

In the fall of 1975, the Census Bureau tested three alternative prelisting procedures in each of three areas in the rural South. The purpose of the test was to determine which of the three procedures was best in terms of cost and housing unit coverage [14].

At the same time, we were also improving our urban list development procedures. From 1975 to 1977, we tested issues related to creating mailing lists from lists purchased from commercial vendors. In urban centers that have city delivery areas, the Census Bureau purchases the initial mailing lists on computer tapes from commercial vendors. In these areas most addresses are geographically coded by computer [15, 16, 17]. The mailing list for the Travis County, Texas pretest in 1976 was created from purchased commercial lists and three checks by the USPS [18, 19]. The list was also checked for completeness by census enumerators in an operation called "precanvass" [20]. Precanvass involves a field canvass in which workers updated the purchased mailing list by adding missed units and correcting geographic codes.

In 1980, the Census Bureau used the mail-out/mail-back method for 95 percent of the housing units and the conventional method for the remainder of the country. This was essentially the same approach as in 1970, except that the mail census procedure was used more extensively in 1980. About 83.3 percent of all occupied housing units returned their questionnaires by mail [21].

Although the high mail-return rate in the 1980 census was a sign of success for the mail census, there were operational and coverage problems in some areas. In particular, the USPS had difficulty recognizing some of the addresses that had been prelisted by census canvassers, and there were some delivery problems in inner cities, especially in large housing developments, where there was evidence of poor mail delivery. This experience and the REX Program coverage improvement studies for the 1980 census confirmed our concerns about the effectiveness of the mail-out/mail-back census in rural and inner city areas [22].

Another part of the 1980 REX Program, was a test of a procedure called "update-list/leave" in which enumerators, rather than the USPS, delivered addressed questionnaires and asked respondents to mail them back. The results of this experiment were largely positive and led to further testing during the decade of the 1980s in preparation for the 1990 census.

In 1986, we tested the use of update/leave/mail-back procedures in the rural South [23]. In the dress rehearsal, we successfully used the update/leave/mail-back procedures in the rural Midwest as well as using an urban update/leave/mail-back procedure in the city of St. Louis to improve the deliverability of questionnaires in large multiunit structures. Use of the update/leave/mail-back procedure was a major strategy in developing data collection methodologies for the 1990 census.

In addition to replacing mail-out/mail-back procedures with update/leave/mail-back procedures in many areas, we also tested expanding mail-out/mail-back techniques to areas that had been conventional in 1980. Small towns in conventional areas that are serviced by USPS city delivery are prelisted and will be included in the mail-out/mail-back census. We call these areas "prelist pockets" [24]. The result of this work is a tailoring of address list compilation and data collection efforts to differing geographic and social conditions we expect to encounter in the 1990 census.

The Census Bureau plans to use the mail-out/mail-back procedure again in 1990 for most of the Nation's housing units. However, the lessons learned from 1980 in rural and inner city areas have helped guide the development of new methods of delivering questionnaires to housing units. Our address list is compiled in the same two ways as it was in 1980. For the highly urban areas of the country, we purchase residential addresses from commercial vendors and in some suburban areas, small cities, and rural parts of the country we prelist

areas. We continue to use the conventional method (which we now call "list/enumerate") for about 6 percent of the housing units.

However, for the 10 percent of the housing units located in areas where addresses are predominantly identified by rural routes, post office boxes, or general delivery, we will use the update/leave/mail-back procedure. Enumerators, shortly before Census Day, will recanvass some of these previously prelisted areas (mainly in the South, Midwest, and Appalachia), updating the address list and leaving a questionnaire at each housing unit. Householders still will be asked to fill out the questionnaire and mail it back, as in mail-out/mail-back areas [25, 26].

For about 200,000 housing units in urban areas, we will use a variation of the rural update/leave in areas where there are large public housing complexes and we anticipate questionnaire delivery problems, delivery mix-ups, and low-mail return rates. We will hire residents of these buildings as enumerators and they will deliver questionnaires and urge the residents to fill them out and mail them back. They will also help residents fill out the questionnaires as necessary. In urban areas where there are clusters of blocks containing boarded-up, multi-unit buildings, census enumerators will update address lists and complete questionnaires for persons found living in these areas.

Evolution of Population Coverage Improvement Efforts Through the REX Program

Mobility

A major problem in taking a census of the United States, is how to include travelers or persons who are moving during the census period. The Census Bureau has undertaken special operations to count persons who are traveling ever since the 1930 census when we first went to all hotels and motels on a single night and left questionnaires for persons to fill out [27]. But clearly, just enumerating persons at hotels does not count all mobile persons nor does it count persons at their usual residence.

Like some of the other coverage problems presented in this paper, the Census Bureau's general approach to the question of mobility evolved through several stages:

- o We recognized that a problem with mobility existed.
- o We adopted efforts to deal with the simplest elements of the problem.
- o We measured and evaluated the extent of the problem.
- o Upon seeing that it was significant, we designed a coverage improvement effort to correct it.
- o We continued to measure the results and perfect or even change the program to effectively deal with

undercoverage.

Through 1960 the Census Bureau had no measure of the size of the population who moved during the census period. After the 1960 census we first attempted to measure specifically the extent of coverage error due to moves at this time. Then after being assured that the coverage of "movers" was a significant problem, we tried to address it with coverage improvement operations in subsequent censuses.

This process began in the 1964 test census of Louisville, Kentucky. Two experiments were undertaken. First, field operation was initiated to deal with "in-movers." If someone had just moved into an address that was vacant on Census Day and said (s)he had not been enumerated, a questionnaire was completed for them at their new address. This new procedure helped include movers but also included for a bias toward counting persons at their new address rather than their Census Day address.

Second, the Census Bureau obtained a sample of "Change of Address" forms from the USPS for the month around Census Day. Immediately after conducting the census, we searched census records for the persons on these forms. Operationally, this was difficult to do within census time constraints. However, we found that 30 percent had not been enumerated.

Based on the Louisville experimental operations and the measurements of coverage gain, a movers' operation was included in subsequent test censuses [28]. The process of checking change of address cards against census results remained cumbersome but was judged to be effective enough to be included in the 1970 census as a coverage improvement operation.

The 1970 movers check was only carried out in metropolitan areas. It had as its base "Change of Address" notices that the Census Bureau checked against census records. The yield in coverage was a disappointing gain representing only 0.06 percent of the population in areas where the operation was undertaken. Nationally, the yield was trivial. In three pretests in which the movers check was attempted, the yield had been about 0.2 percent. Reasons given for the disparity were that many persons were inappropriately determined to be "already enumerated" and that some offices did not finish the clerical record check [29]. As a result of this experience, there was no movers check using "Change of Address" cards in subsequent censuses.

Even though the movers' operation was incorporated into the 1970 census, the problem of counting them where they actually lived on Census Day was largely ignored. The 1990 census will be the first in which the Census Bureau finds

it operationally feasible and efficient to go through the following steps for movers:

- o Capture information for movers wherever they are enumerated;
- o Determine their proper Census Day address;
- o Search the census for that address; and
- o If not already enumerated there, count the movers at their actual Census Day address.

After the 1970 experience, the mover problem became interwoven with another coverage problem, the problem of misclassifying occupied housing units as being vacant. This problem occurred when, for example, after several fruitless visits, enumerators incorrectly concluded that a home was vacant on Census Day. Any measures taken to correct this problem would affect our enumeration of movers, the persons who had just moved out of the housing unit.

Vacancy

In both the 1950 and 1960 censuses, reenumeration surveys were taken to attempt to measure population coverage. resulting estimates were not consistent with demographic analysis results. However they did classify missed persons as either complete household omissions (from housing units missed in the census or housing units classified as vacant) or partial omissions (missed persons in housing units that were occupied).

For the 1964 test census of Louisville the Census Bureau asked the USPS to check its list of housing units. The information gained had a later effect on housing unit misses and on the information available about types of housing unit misses [28].

The USPS check in the 1965 Cleveland Special Census led to an interesting discovery about types of housing unit misses. Follow-up enumerators were informed of the units the USPS had classified as "vacant." This instruction probably had an important effect on coverage of persons, because follow-up enumerators had a tendency to accept the USPS classification without sufficient further investigation. On the basis of the coverage analysis, there was a net loss of about 6,300 persons because more occupied units were misclassified as vacant than vice versa [30].

In summary, the 1950 and 1960 census coverage measurement programs had uncovered a problem: that persons and housing units were being missed. The first solutions, checks of enumerators' address listings in 1960, and the USPS check in Louisville in 1964 were directed at the obvious part of the problem--missed housing units. The evaluation and measurement revealed the less obvious--that persons were being missed at units that had been counted.

By the 1970 census, the Census Bureau addressed both problems. We found the resources for a coverage improvement program that included both a movers check and a check of housing units classified as vacant.

The 1970 census included a check of a sample of vacant units to see if they should be classified as occupied. Additionally, the Census Bureau applied the results from this sample to the national universe of vacant units by imputing occupied households to a proportionate part of that universe. This operation was called the National Vacancy Check. Along with the 1970 Post-Enumeration Post Office Check (explained in the next section of this paper), this is the only time the Census Bureau has augmented census counts from sample results. About one million persons were added to the census in this way. These persons were added to 8.5 percent of vacant units and comprised 0.5 of 1 percent of the 1970 population count. (Added persons from the 1970 Post-Enumeration Post Office Check comprised another 0.2 of 1 percent of the count) [31].

The 1980 vacant/delete check also incorporated measures to correct enumeration problems due to persons moving. Before the census we tested other approaches to enumerating movers including mailing follow-up questionnaires to movers and searching census records (to avoid duplication) whenever the mover returned the follow-up form [32]. These did not work: low mail response, timing problems and inaccurate reporting were cited as reasons.

Furthermore, a review of research indicated that to enumerate movers during the vacant/delete check might result in over-counting them. So in the 1980 vacant/delete check, those movers who responded that they had been previously enumerated were not enumerated by the follow-up of vacant and deleted housing units. The purpose of this later check was to minimize over counting of movers. All others were enumerated at the current address" [33].

One problem remained in the combined vacant/delete/movers check: if movers had not been enumerated at their Census Day address, they were instead enumerated at their new address. The check furthered one goal of a census--to count all the persons, but not the other goal--to count them at their usual residence. We have improved that for the 1990 census. If a household lived elsewhere on Census Day and has not been enumerated, we will search the census for their Census Day address. If they are not captured there already, we will transfer the information for the household to that actual Census Day address. If already counted there, no

action is needed.

Some work has also been done since 1980 on the vacancy problem of the vacant/delete check. It was feared that in an enumerator's zeal to do well, (s)he might "find" deleted units too often, call them existent, enumerate them and create duplicate enumerations. Results from our test censuses in 1985 [34] and 1986 [35] have dispelled this concern. This problem did not appear to be significant.

For the 1990 census, we have created, through a process of forty years of research and evaluation, a viable, reasonably effective answer to the problem of misclassification of housing units.

Address List Quality and Coverage

As we have mentioned, through the 1950 census, the Census Bureau enumerated the population by sending interviewers to every household. But as the trend towards a mail census developed, it became logical to involve the USPS in our enumeration efforts.

In early pretests before the 1950 census, the USPS started distributing census forms to households. Given this involvement, it followed that the USPS's intimate knowledge of addresses might also be used to complement the Census Bureau's effort to cover all addresses and to ensure the quality of those addresses.

In 1957, in one postal zone in Indianapolis, Indiana, the Census Bureau utilized the USPS to check the address list we had compiled during our conventional enumeration. The Indianapolis USPS operation increased the housing unit count by 1.7 percent.

The Indianapolis research led to the commitment to continue this coverage improvement experimentation in the 1960 census. Fifteen postal regions were chosen for the 1960 USPS check coverage improvement experiment [7]. The result was that the "test provided considerable evidence of the feasibility of improving census coverage through utilization of the local knowledge of postal carriers" [36].

The 1964 test census of Louisville was a major feasibility test of the mail-out/mail-back system of questionnaire delivery. A year in advance of the census the Louisville enumerators canvassed the area and listed all addresses. A premail-out USPS check of the entire file of addresses took place the following March. The test was successful; the check resulted in adding 1.4 percent more housing units to the address list [37].

The Louisville test served to point out the importance of the USPS checking the quality of addresses. For a mail-out census we had to prepare addresses that both the USPS and an enumerator could use effectively. That is, we had to

produce addresses which were both "deliverable" by the USPS and "locatable" for visits to households who did not mail back their questionnaires.

We have looked at both post-enumeration and preenumeration USPS checks; in a 1967 test the Census Bureau included additional checks by the USPS in the time period right around Census Day. In these, the addresses on the actual census questionnaires were checked in the post office and later at delivery. The checks were called the "casing check" (the carriers cased the census mailing pieces and told us when addresses were omitted) and the "time-of-delivery check" (the carriers checked the mailing pieces while they were actually walking their routes) [38].

In the 1950s and 1960s, the Census Bureau had addressed the problem of missed addresses by undertaking postal coverage checks. We had tested many scenarios and measured their effects. The experimental groundwork had been laid for a fully evolved range of USPS checks in the 1970 census:

- o An advance post office check (APOC) was undertaken in February 1969.

- o In March 1970, the casing check was performed.

- o A time-of-delivery check was undertaken when the questionnaires were delivered.

- o In May in 16 rural states, a post-enumeration Post Office check (PEPOC) was applied to address lists derived through door-to-door enumeration.

The PEPOC operation was noteworthy in that it was used to add persons to the census counts. A sample of the addresses listed as missing by the USPS was followed up in the field. The results were used to impute housing units and persons into the census. About 484,000 persons in 174,000 housing units were added to the 1970 census by imputations based on the PEPOC operation [29].

During the next decade, the Census Bureau strived to perfect these checks. We examined the process, inspected its errors and investigated how to improve the information the USPS could provide.

The 1980 census postal checks were very similar to those used in 1970. These operations were analyzed for the yield and quality of the addresses identified as missing from the census. The quality of the addresses which had been missed was measured by determining their final enumeration status. Addresses identified by APOC as missing from our list of housing units comprised 5.5 percent of the total number of housing units enumerated in the census in areas of the country covered by APOC. Casing and time of delivery adds comprised 3.4 percent of the total addresses in mail-out/mail-back areas of the country.

The PEPOC operation was not as

successful. Addresses identified as missing from our list during PEPOC comprised only 0.68 percent of the housing units in conventionally enumerated areas [22]. This led to the conclusion that in 1990 PEPOC will not be a census operation.

During the test censuses of the 1980s, the Census Bureau has continued to refine our postal checks by experimenting with ways to make addresses initially prelisted by enumerators both "deliverable" by the USPS and "locatable" by enumerators. In the 1986 test census in East Central Mississippi, the Census Bureau experimented with a new "APOC Reconciliation" operation. Basically, this operation is a field check by Census Bureau enumerators of addresses identified as duplicate or undeliverable, and any missing addresses identified by APOC [39].

Going into the 1990 census, the APOC reconciliation and update/leave operations further refine the Census Bureau's interaction with the USPS. The 1990 census will be the first for which the Census Bureau will have an enumerator or a postal carrier review all addresses in our mail-back areas.

Administrative Lists

Population coverage was one of the main concerns of the evaluation program for the 1950 census. The best available evidence indicated that the total population count in the 1950 census may have been deficient by about 2.3 percent. Coverage errors were more serious than this for some population groups such as young children, nonwhites, young adult males, and persons in rural nonfarm housing units [40, 41].

As a consequence of these results, new methods were sought to improve population coverage. Special coverage improvement procedures were incorporated into a Special Census of Indianapolis in 1957. These procedures included using administrative lists to identify persons likely to be undercounted, and the recognition that it may be more productive to target some coverage improvement programs in certain social and geographic areas [42].

The major objective of using administrative records in the 1960 evaluation program was to consider alternative methods of identifying errors in coverage. One such attempt was the Reverse Record Checks to Measure Undercoverage of Special Groups. This study was directed primarily toward evaluating the enumeration and the age reports of two special population groups: aged social security beneficiaries and students enrolled in colleges and universities [43, 7].

The planning for the 1970 census included continuing the experiments in

using administrative and independent lists to improve population coverage. In 1967, we checked lists of special population groups, assumed to represent groups of persons seriously undercounted by the census, against the census to identify those not enumerated and to add them to the counts [44].

A number of special procedures were employed in the 1970 census to improve the population coverage in areas where enumeration had been the most difficult in earlier censuses. One such program aimed at obtaining information about the causes of undercoverage was a record check study for a sample of males, ages 20-29, who newly obtained or renewed drivers licenses in the Washington, D.C. area [45].

The use of administrative lists to improve coverage was tested in three major pretests during the planning for the 1980 census [46]. We checked administrative lists of names and addresses against census records to determine the usefulness of such lists to identify persons who may have been missed in the census. The operation was aimed at reducing the differential undercount between whites and minorities. We called the operation the "Nonhousehold Sources Program" [47, 48].

These tests provided favorable results concerning the potential coverage improvement of underenumerated persons, particularly when the program was targeted at difficult to enumerate areas. It was found in these tests that the number of persons added to the census from this operation was equal to about 10 percent of the list processed [49].

Based on these pretest results, the 1980 census included the Nonhousehold Sources Program. The administrative lists for the program were drivers licenses and a file obtained from the Immigration and Naturalization Service. In addition, the City of New York also provided a public assistance file. The program was targeted at selected census tracts that were in urban areas, and which had been identified as having a high proportion of minorities.

The results of the 1980 Nonhousehold Sources Program were not encouraging. The program added about 2 percent of the total list processed--substantially lower than the 10 percent test experiences had predicted. It was hypothesized that the contents of the lists, the scope of the program (which included suburban areas), and operational difficulties contributed to the low rate of census adds. Without these and other strictures, the national rate of added persons might have been increased to approximately 5 percent [50].

The 1986 Test Census in Los Angeles County included the only test of the

Nonhousehold Sources Program in the 1990 planning cycle. The 1986 test was designed to address the major operational problems through automation. The results showed that automation would not eliminate enough of the operational matching complexities to make the use of lists feasible for an operation that must be conducted by a relatively unskilled clerical work force. The resulting recommendation for 1990 was that these lists be used strictly for coverage measurement as opposed to coverage improvement [51].

However, some administrative lists will be used to improve coverage of the 1990 census. As in previous censuses, they will be used to aid enumeration in some institutions and segments of the military population. Current plans call for the use of lists of persons on parole and probation as a check on their enumeration status. We also will work with localities to obtain and update lists of shelters, street locations, and the like where some components of the homeless population will be found.

Looking to the Future

In summary, this paper has intended to provide an overview of the history of the decennial census REX Program, illustrated by some specific examples in the area of population and housing unit coverage improvement. As noted before, there are many other aspects of development, evaluation, and testing within the scope of the entire REX Program over time. They cover many areas within the general framework of content; coverage evaluation as well as measurement; and an inclusive range of methodological, procedural, and processing concerns. The Census Bureau has a commitment to continue these efforts into the 1990 census and beyond.

The future holds even greater challenges. Over the past decade or so, profound questions about the decennial census have been raised. These questions cover several basic themes: the traditional character of the census as a headcount; alternative sources of data; the relationship between the decennial census and other data collection efforts of the Census Bureau and other organizations; and the application of technological advances and statistical techniques to help solve the growing problems of taking a census every 10 years. However these questions get formulated and ordered, the Research, Evaluation, and Experimental Program will be an essential means of answering them.

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1930; the "Absent Family Schedule" in 1910, 1930, and 1940; and the "Confidential Report on Income" and various residential finance questionnaires in 1950. An "Advance Schedule of Population" was delivered to households in 1910, and answers were then transcribed to the official schedule. In farm areas, an agriculture questionnaire was used in the same manner in 1910.

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