

# COVERAGE ISSUES FOR THE 1991 CANADIAN CENSUS OF POPULATION

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**KEYWORD:** Undercount

## 1. INTRODUCTION

Censuses in Canada have a tradition stretching back over 300 years, since the early settlement in New France. Regular decennial Censuses began in 1871, and for the past three decades, Canada has carried out a Census of Population every five years. The most recent Census took place in June 1986 and produced a wealth of data on demographic and social conditions in Canada in the mid-1980s.

An important part of the evaluation of the 1986 Census was an assessment of the coverage achieved. Measurement of coverage is important both for informing data users of the quality of the data and for guiding those planning the next Census in 1991. In the case of the 1986 Census, there was a significant increase in the level of undercoverage, from the 2 percent observed in the preceding three censuses to 3.2 percent in 1986. This is the highest level recorded since undercoverage was first measured in 1966. The increase was noticed first through demographic analysis, and was later confirmed through the Reverse Record Check, the method Statistics Canada uses to estimate undercoverage.

This increase has raised a number of questions which are dealt with in this paper. These are:

1. What are the factors that may have contributed to higher undercoverage in 1986? (Section 2)
2. What are the impacts on the uses of Census data? (Section 3)
3. What steps should be taken to improve coverage in the 1991 Census? (Section 4)
4. What changes are needed in our coverage measurement programme? (Section 5)

The last section of the paper concludes with some proposals for longer-term research into coverage issues in the Canadian Census.

It should be borne in mind that many of our plans are preliminary, and may or may not be implemented depending on the level of funding the 1991 Census receives. Some of the research is still at a relatively early stage.

## 2. FACTORS CAUSING INCREASED UNDERCOVERAGE IN 1986

To date, there is very little hard evidence concerning the reasons for an increase in the level of undercoverage in 1986. Possible differences in the way undercoverage was measured in 1981 and in 1986 have been ruled out. Furthermore, analysis of undercoverage results has not revealed any particular subgroup where the increase in undercoverage was concentrated. Instead, the increase seems to be across the board, in all geographic regions and among all demographic groups (see Appendix Tables A.1 and A.2).

One suggestion is that some of the increase is due to changes in Canadian society itself. For example, the key census concept of a "usual residence" is increasingly ambiguous for the homeless, married couples living in different cities, joint custody children, and persons with secondary residences. Increased labour force participation by women, smaller households, and concerns about privacy have also made it more difficult to personally contact respondents.

Such changes in society have been gradual, however, and it is unlikely that they could completely explain the sudden jump in undercoverage observed in 1986.

It was also suggested that the increase could have been due to an increase in mobility, based on a known correlation between mobility and undercoverage. However, when the mobility data from 1986 were produced, they showed that fewer people moved between 1981 and 1986 than had moved in the previous five-year period.

These observations suggest that the increase in undercoverage had more to do with the manner in which the Census was carried out, rather than being due to significant changes in the external environment. Many of these "internal factors" were related to the cancellation of the Census in November 1984, less than two years before Census Day, and a subsequent re-instatement several weeks later. This disruption not only resulted in the loss of valuable time at a critical point, but the loss of several key personnel as well.

The re-instatement was also achieved at the cost of serious budget cuts. These cuts resulted in the cancellation of the Postal Check (a traditional coverage improvement method), the complete elimination of paid advertising and a reduction in the Telephone Assistance Service. All of these reductions could be expected to contribute to an increase in undercoverage.

Another condition of the re-instatement was that enumerators would be hired largely under a student/youth employment programme. While there is no evidence to suggest they did an inferior job, they were certainly less experienced, and turnover was higher, than in 1981. Census Commissioners (the enumerator's supervisor) also tended to be less experienced. Finally, to compound the difficulties, the budget reductions resulted in an increase in the number of enumerators each Commissioner had to hire, train and supervise. Again, this reduced level of supervision of enumerators could be expected to lead to some increase in undercoverage.

One further, special, coverage problem in the 1986 Census should be mentioned. A number of Indian bands refused to allow enumerators to complete the Census on their reserves. As a result, it is estimated that some 45,000 reserve residents were omitted from the Census. The published total population and dwelling counts at the Canada and province levels include estimates for the missing reserves. (The corresponding undercoverage rates shown in Appendix Table A.1 treat these Indian reserve residents as "enumerated".) All other Census estimates, including sub-provincial counts and all demographic breakdowns, exclude these reserves. (The undercoverage rates shown in Appendix Table A.2 therefore treat these reserve residents as "missed".)

## 3. IMPACT OF HIGHER UNDERCOVERAGE ON USES OF CENSUS DATA

Census data are important to a wide variety of users, including governments, businesses, researchers, interest groups and journalists. Requirements for Census data are embedded in a number of acts and regulations. For example, Census counts are used to determine the number of seats in the House of

Commons and the delineation of federal electoral boundaries. In addition, a range of demographic and social statistics depend on Census data. In particular, the quarterly and annual population estimates are benchmarked to Census counts, as are estimates of employment and unemployment from the monthly Labour Force Survey (LFS). Many other surveys are conducted as supplements to the LFS and these too are adjusted to the Census-based monthly population estimates. A number of government programmes and other legislation involve the use of Census data through these derivative statistics. Federal transfer payments to provinces are based on provincial population estimates, and Unemployment Insurance benefits depend in part on unemployment rates derived from the Labour Force Survey.

If undercoverage were constant from one Census to the other and across all sub-groups of the population, it would be of relatively minor concern to data users. Unfortunately this is not the case.

From 1971 to 1981, the undercoverage rate was relatively stable at around 2 percent. The increase from 2 percent to over 3 percent in 1986 clearly impacts on estimates of change, including population growth. Had undercoverage not increased, the reported overall growth in the Canadian population between 1981 and 1986 would have been some 30 percent higher (5.4% instead of 4.2%).

As Tables A.1 and A.2 in the Appendix show, undercoverage varies considerably from province to province and among different age groups. (Undercoverage rates by other Census characteristics are given in Statistics Canada, 1988). This differential undercoverage introduces some distortion in the distribution of the population by geographic location and by demographic and socio-economic characteristics. Although for most users such potential distortions are unimportant, they can have significant implications for specific applications. For example, federal transfer payments to the provinces would differ by millions of dollars each year if there were no undercount. The higher undercoverage in 1986 has led to renewed interest in the possibility of adjusting Census counts.

#### 4. COVERAGE IMPROVEMENT IN THE CENSUS

In planning the 1991 Census, the increase in undercoverage has led to considerable emphasis on measures to improve coverage. Before describing our plans for 1991, a brief review of traditional coverage improvement methods and some estimates of their effectiveness are presented.

##### 4.1 Traditional Coverage Improvement Methods

Most coverage improvement methods used in past Censuses may be categorized as those aimed at improving coverage of dwellings, and those aimed at improving coverage of persons within dwellings.

In terms of dwellings, map checks are conducted in the field prior to the Census to make sure that the maps are accurate. An extensive publicity campaign is mounted around Census Day, to inform Canadians of the Census and to urge them to complete their questionnaires. In conjunction with this, there is a Telephone Assistance Service (TAS), where respondents who did not receive a questionnaire may call to request one. In urban areas, we have, prior to 1986, also conducted a Postal Check, where the list of dwellings compiled by the enumerator is checked by Canada Post

immediately after drop-off. Another check used is a comparison of counts of the number of dwellings listed by the enumerator to an estimate of the number of dwellings expected. If there is more than a 10% variance in the counts, the Census Commissioner is required to investigate. During their familiarization with their area, Census Commissioners are also to make note of "hard to enumerate" dwellings, and to pass these on to the enumerator. Finally, a list of collective dwellings from the previous Census is provided to the enumerator to assist in identifying dwellings that might otherwise be missed.

Steps are also taken to improve the coverage of persons within dwellings. First, the questionnaire itself contains detailed "whom to include" instructions to the householder, describing who should be listed. The questionnaire also contains three special coverage improvement questions: a question on the number of usual residents in the household, a question asking about persons who may have been left out, and a question asking if there were any temporary residents in the dwelling on Census Day. The Telephone Assistance Service also plays a role in improving within-dwelling coverage. Respondents who need a second questionnaire because their household contains more than six persons obtain it through the TAS service. Specialized collective dwelling procedures are used for the enumeration of persons living in these types of dwelling.

Several procedures are used to improve coverage for persons missed in dwellings classified as vacant by the enumerator. First, during the field follow-up phase, each dwelling listed as unoccupied at drop-off is re-visited by the same enumerator, and if it is found to be occupied it is enumerated. Second, in mail-back areas, a questionnaire is dropped off at unoccupied dwellings. Finally, a special study, known as the Vacancy Check is conducted shortly after Census Day. Specially-trained enumerators re-visit a sample of dwellings classified as vacant by the original enumerator and determine the true status of the dwelling on Census Day. The study provides estimates of the number of persons missed in such dwellings, and the estimates are included in the final Census counts.

A special study is also conducted to estimate, on a sample basis, the number of persons missed because they were Temporary Residents during the Census. In principle, every person who is not at his or her usual place of residence on Census Day is enumerated as a temporary resident on a special questionnaire which asks, among other things, for the exact address of the respondent's usual place of residence. A sample of these questionnaires is selected and matched back to the usual address given by the respondent. The Census questionnaire for that address is then examined to see if the person was missed. Estimates of the number of Temporary Residents missed are produced and included in the final Census counts.

How effective are all of these coverage improvement methods? Unfortunately, this is a difficult question to answer. Many of the methods are such an integral part of the collection operation that their effect could never be isolated and measured in any practical way. Others could be evaluated but only at considerable expense and with great difficulty. Table 1 presents results for some of the methods. For example, in 1986 there were about 33,000 calls to the TAS service concerning no questionnaire dropped off. Assuming an average household size of about three, and that such households followed-through and responded, this check would have added about 100,000 persons.

**Table 1: Effectiveness of Traditional Coverage Improvement Methods**

Telephone Assistance Service	33,000 calls	(1986)
Postal Check	29,000 persons	(1981)
Vacancy Check	94,000 persons	(1986)
Temporary Residents	76,000 persons	(1986)

For the Postal Check, last conducted in 1981, an evaluation study estimated that about 29,000 persons were added directly. However, it is virtually impossible to measure the true effectiveness of this check, since the above estimate does not take into account the higher quality of listing resulting simply because the enumerators knew their work was being checked.

For the Vacancy Check and Temporary Residents Study, the number of persons added is known exactly. However the numbers are subject to both sampling and non-sampling errors. For example, there is probably considerable under-enumeration of temporary residents, leading to a downward bias in the estimate.

About the best that can be concluded with existing data is that the effectiveness of each method is approximately an order of magnitude less than the total Census undercoverage, which in 1986 was estimated at 839,000 persons. Furthermore, serious problems of differential undercoverage between different geographic areas and demographic groups remain.

#### 4.2 Strategy for 1991

Because the exact reasons for the increase in undercoverage are unknown, we are taking a fairly "broad-brush" approach to improving coverage in 1991. One of the key thrusts of the strategy so far for 1991 is the "return to 1981" philosophy. Thus, we plan to reinstate paid advertising, at least for the critical period around Census Day. In addition, we plan to increase the TAS service back to 1981 levels, and to increase the number of supervisors, possibly even above 1981 levels.

In order to cope with a relatively inexperienced work force in 1991, considerable efforts are also being made to improve our training methods. A complete evaluation and revision of all collection training programmes is underway. The use of simplified "job aid" manuals is also being studied.

We are also reviewing some of the specific procedures which appear to be problematic. A review of the procedures for enumerating temporary residents is underway. There is also a programme in place to improve the quality of maps in rural areas by incorporating updates from 1986 enumerators.

There is also a strong programme of research into methods of coverage improvement, the major elements of which are described below.

##### 4.2.1 Address Register Research

The concept of creating a machine-readable list of residential addresses is not a new one in Canada; it was first studied by Fellegi and Krotki (1967) for the 1971 Census. In previous research, however, the major use envisaged for an address register was a mail-out Census. For 1991, we are investigating the use of address registers primarily for coverage improvement.

The methodology used to create an address register consists of five basic steps:

1. obtain and merge several administrative files (e.g., tax, family allowance, municipal assessment, utility company);
2. edit and standardize addresses using special software;

3. unduplicate addresses using both exact matching and record linkage methods and software;
4. fine-tune address lists through edit and imputation (e.g., missing units in apartments can often be imputed); and
5. geo-code the address using a conversion file to convert Postal Code to Census geography.

In November 1987, we conducted a large-scale test in five sites to determine the potential of the address register for coverage improvement. Two methods plus a control method were tested. In the control method, an enumerator would canvass an Enumeration Area (EA) using the same procedure as the 1986 Census. A record was kept of the dwellings listed at this point. Then, for the "Visitation Record" (VR) method, the same enumerator was provided with the Address Register for the EA. The enumerator matched his/her list to the Address Register, and any dwellings on the AR but not on the enumerator's list were followed up by the enumerator. This produced the final "VR" list for the EA.

The "AR" method was carried out by a different enumerator. This enumerator was given the Address Register for the EA and was simply required to update it. The result of this enumerator's work was the final "AR" list. Each EA in the sample was listed in this fashion. Field organization and training were such that the two enumerators in each EA were not to know of each other's existence. In addition, we randomly designated one enumerator in each EA as either "contact", where the enumerator attempted to make contact with the household, or "no contact". Following the listing operations the final VR and final AR were matched, and discrepancies were reconciled in the field in order to establish a "true" list of dwellings in each EA.

Results of the study are shown in Table 2 (undercoverage rates) and Table 3 (overcoverage rates). The results are encouraging and indicate that the Address Register can indeed improve dwelling coverage. Overall, using the AR as a post-drop-off check appears to work the best. Further analysis is needed before a final decision on the method to be used in 1991 can be made.

Certain technical problems also need to be solved before the address register can be used to its fullest potential. There were a number of geocoding problems with the AR, and the match operation between the AR and VR was time consuming and tedious since the addresses were listed in different orders on the two lists. While these problems are not enough to negate the value of the AR for coverage improvement, their solution would make use of the AR a much more efficient and less expensive operation.

**Table 2: Percent Undercoverage for Standard Census Method, Census Method Plus Post-Drop-off Check, and Address Register Pre-list, by Test Site, November 1987 Address Register Test**

Test Site	Valid Dwellings in Test Area	Standard Census Method	Plus Post-Drop-off Check	AR Pre-list
Halifax	9201	3.9	1.9	2.9
Montréal	9556	4.3	2.8	2.1
Toronto	7459	9.5	4.6	5.3
Edmonton	7517	5.5	4.9	8.8
Vancouver	8824	5.0	2.7	6.2

**Table 3: Percent Overcoverage for Standard Census Method, Census Method Plus Post-Drop-off Check, and Address Register Pre-list, by Test Site, November 1987 Address Register Test**

Test Site	Valid Dwellings in Test Area	Standard Census Method	Plus Post-Drop-off Check	AR Pre-list
Halifax	9201	1.7	2.0	1.7
Montréal	9556	1.7	2.0	1.3
Toronto	7459	1.7	2.8	5.4
Edmonton	7517	1.8	1.8	9.4
Vancouver	8824	1.6	2.2	2.4

#### 4.2.2 Quality Control on Listing

The address register, because it depends on the link between Postal Code and Census geography, is only being investigated for the larger urban areas. For small urban and rural areas, other approaches have been investigated, although they have not been ruled out for urban areas at this point.

Our original thought was to develop some type of quality control programme for the operation of listing dwellings. For example, a sample of dwellings could be listed a few weeks prior to drop-off by a separate field staff. The enumerator would then list and drop-off in the normal manner. The pre-list sample would then be compared to the enumerator's list and if too many dwellings were missed the assignment would be rejected.

However a feasibility study we carried out in early 1988 suggested that we go in a different direction. The study found that due to the quality of rural addresses, matching two separate lists would be extremely problematic. As well, the effect of a high rejection rate during the collection operation would be devastating. Finally, an operation of this nature would be aimed at shoddy work by enumerators, whereas the real problem may be simply that the area is difficult to enumerate and that the tools given to the field staff (e.g., maps) are inadequate.

As a result of this study a number of recommendations have come forward. First, the quality of rural maps should be improved by incorporating updates from the previous Census. Second, the possibility of an Advance Mapping Programme a few weeks before Census Day should be considered. Third, enumerators should be required to provide more substantial reports of drop-off, to emphasize the importance of this step in their minds, and to identify and rectify major problems. Fourth, efforts should be made to improve the rate of contact between enumerators and respondents.

The possibility of a field test of one or more of these proposals is now under study. A pre-requisite to such operational methods, however, is the development of statistical models to identify "high risk" EAs. Work on this is just beginning.

#### 4.2.3 Questionnaire Design Research

Because much of the undercoverage is due to persons missed within enumerated dwellings, there is considerable interest in improving the coverage-related aspects of the Census questionnaire. With a self-enumeration Census, the questionnaire is really the only source of information on the number of persons residing in a dwelling.

One activity underway is to conduct a review of basic coverage concepts, such as who is included in the target population and where they should be counted.

This may lead to changes to the "whom to include" instructions to take account of growing phenomena such as joint custody children and secondary residences.

We are also evaluating respondents' understanding of the current instructions and coverage questions using qualitative research techniques such as cognitive methods and focus groups. Such research has already revealed that most respondents have only a fuzzy idea of what we mean by temporary and foreign residents, and that they do not read the instructions.

Another technique being evaluated is the use of a "household roster" question, a method the U.S. Bureau of the Census has found to be very effective. This question asks the respondent, as the very first task, to make a list of everyone in the household. The number of persons on the roster is compared to the number of persons for whom data are provided and a follow-up is conducted for discrepancies. Our first test of this method was disappointing, however, as the roster added virtually no additional persons over and above our existing coverage questions. A modified version of the question will be included on our National Census Test this fall on a sample of 32,000 households. (In addition, two of the existing coverage improvement questions will be given a more prominent location on the questionnaire in an effort to improve their effectiveness.)

Finally, we are exploring the possibility of including temporary and foreign residents on the regular questionnaire rather than screening them out at the start. These persons would be included on the questionnaire and then identified by a direct question on usual place of residence, rather than attempting to make the respondent understand the terms "temporary resident" and "foreign resident". In the case of temporary residents, we would ask on the questionnaire for their address of usual residence.

#### 4.2.4 District Office Concept

In the longer term, we feel we should move in the direction of increased centralization of our field edit and follow-up operations. Under the current methodology in mailback areas, the questionnaire is mailed back to the same enumerator who did the drop-off. The enumerator edits the questionnaire and follows up non-response out of his/her home.

With a district office organization, the questionnaire would be mailed back to a central site, where field edits and telephone follow-up would be conducted by a specialized staff under office conditions. The remaining field follow-up would still be conducted by the local enumerator. The benefit of this approach would be better control over the edit and follow-up operations. This should improve coverage, since there would be improved control over the follow-up of the coverage questions, vacant dwellings, and temporary residents.

At present we plan to undertake a feasibility study this year with a view to testing the concept within the 1991 Census for possible implementation in 1996. The feasibility of the concept is closely linked to the feasibility of the Address Register, since such a register would be a pre-requisite to the automated control of check-in, telephone follow-up and field-follow-up operations.

### 5. MEASURING COVERAGE ERRORS

Although it is hoped that the steps just described will improve coverage, they cannot be expected to eliminate coverage errors entirely. Hence it will

always be necessary to have in place an effective coverage measurement programme. The increase in undercoverage in 1986 has occasioned a review of the existing evaluation studies and, as a result, we are embarking on some research aimed at introducing enhancements into the 1991 programme. Before describing these research activities, an overview of the methods used to study coverage errors in the 1986 Census will be presented. Apart from the special checks of unoccupied dwellings and temporary residents referred to earlier, there were two coverage measurement studies conducted for the 1986 Census, the Reverse Record Check and an experimental Overcoverage Study.

### 5.1 The Reverse Record Check

The official estimates of undercoverage are derived from a study known as the Reverse Record Check (RRC). In this study, which has been conducted for each Census since 1966, a sample of persons who should have been enumerated in the Census is selected from sources that are independent of the current Census. Various tracing operations are undertaken to establish the Census Day address of each person included in the sample. The Census documents corresponding to these addresses are then searched to determine whether or not the selected person has been enumerated.

The sample is drawn from the population resident in the ten provinces of Canada at the time of the previous Census, together with persons who were born or who immigrated between the previous and current Census. For the 1986 RRC, a sample of 32,200 persons was selected from the 1981 Census. This, combined with the (approximately) 1,100 persons in the previous RRC sample identified as missed in the 1981 Census, represents the total population as of June 1981. Additional samples of 1,800 birth records and 1,300 persons selected from immigration records, completed the picture. The total sample represents (with a few exceptions to be noted later) the target population for the 1986 Census. (Further details of the RRC methodology are given in Statistics Canada, 1988).

As with any such evaluation, the methodology of the RRC is subject to a number of limitations. First, it should be pointed out that it is designed to measure only gross undercoverage. In practice, some people are incorrectly included in the Census or double counted, and this overcoverage will offset undercoverage to some extent. The net undercoverage may not be nearly as high as the RRC undercoverage rates themselves might suggest.

Secondly, even as measures of gross undercoverage, the RRC results are subject to errors and uncertainties. The sampling frames are not completely comprehensive. The study does not cover the Yukon and Northwest Territories because of the difficulty and high cost of tracing people in these areas and because the sample design is inappropriate for these regions where there is high mobility to and from the provinces. The exclusion of the territories from the sampling frame also impacts on the coverage of the provincial samples. Persons who move from the territories to one of the ten provinces between Censuses are ineligible for selection into the RRC sample. Canadians returning to Canada after a period of residence abroad are similarly excluded.

Nearly four percent of the sample could not be traced, and since the untraced persons may have different chances of enumeration in the Census than traced persons, this introduces a potential bias into the estimated undercoverage rates. Another source of

potential bias in the undercoverage rates is due to the fact that classification errors are not symmetric. Persons classified as enumerated are those who were found on a Census return. Persons classified as missed were not found enumerated at their traced address, but if the address information were incorrect, it is possible that they were enumerated somewhere else.

Since sampled persons traced to a usual place of residence in Canada on Census Day are classified as either enumerated in the Census or missed, the RRC can itself be used to derive an estimate of the enumerated population. The RRC estimate of the enumerated population is significantly lower than the corresponding Census count. While some difference would be expected because of the exclusion from the RRC frame of migrants from the territories to the provinces and of Canadians returning from abroad, and because of overcoverage in the Census, misclassification of enumerated persons as "missed" cannot be ruled out. For a more detailed description of the RRC methodology and its limitations see Burgess (1987).

There were no changes to RRC procedures between 1981 and 1986 which could explain the increase in the estimated undercoverage rates. Moreover, the increase in undercoverage of about one percentage point at the national level seems to be confirmed by demographic analysis.

### 5.2 Overcoverage Study

As previously mentioned, the RRC methodology can only provide estimates of gross undercoverage. Until 1986 there had been no comparable study of overcoverage. It had always been assumed that overcoverage was an order of magnitude lower than undercoverage. In 1986 a limited, and experimental, investigation of overcoverage was conducted. A sample of approximately 11,000 1986 Census questionnaires was selected. The households in question were contacted about two months after Census Day and re-enumerated. Persons who had moved into the dwelling since May 1986 were asked for their previous address. Respondents were asked for the names and current addresses of anyone who had moved out over the same period. In addition, respondents who were staying temporarily at a hotel, cottage, student residence, etc., in May or June 1986, were asked to provide the address. Finally respondents were asked if any of the household members might have been included on someone else's questionnaire – a parent's, for example. The Census questionnaires for all these additional addresses are being checked to see if anyone was enumerated twice.

In addition, a small sample of hotels and jails was selected, and for persons enumerated in the Census as usual residents of these establishments, records were examined to obtain a previous or alternative address. Census questionnaires for such addresses are being examined to see if anyone was enumerated at a private dwelling as well as at the hospital or jail.

Results from these overcoverage studies are not yet available. However, even when processing is finished, it may not be possible to obtain a definitive estimate of overcoverage. The original objectives were to confirm or refute the premise that overcoverage is an order of magnitude lower than undercoverage, and to identify some of the principal situations in which overcoverage can occur. The study was not comprehensive, nor did resources permit the follow-up and reconciliation of discrepancies between the list of persons enumerated in the Census and in the study. Consequently, there are a number of unresolved cases

which will introduce a degree of uncertainty into the final results.

### 5.3 Improvements for the 1991 Census

Given the limitations of the 1986 studies, Statistics Canada intends to strengthen its coverage measurement programme for the 1991 Census. In particular, we must not only improve the RRC but also attempt to obtain reliable estimates of net undercoverage. We also need to be able to identify the types and causes of coverage error better than we can at present. We are, therefore, undertaking three major research activities:-

First, we are examining the feasibility of extending undercoverage measurement to the Yukon and Northwest Territories. Given the sampling and tracing problems referred to earlier, a simple extension of the RRC is unlikely to prove satisfactory. We are, therefore, exploring an alternative approach, namely an administrative list check. The idea is to select a sample from a current administrative file and match the sample to Census documents to identify persons enumerated and missed. Ideally the administrative files should cover the entire territorial populations and contain accurate and up-to-date address and other information. In practice, no such file or combination of files exists, but we intend to evaluate the territories' health care insurance files to determine whether their coverage and quality are adequate for our purpose. Even if coverage of these files is not complete we may be able to integrate them with the standard RRC frames using multiple frame techniques.

Secondly, we are reviewing all of the RRC operations in order to minimise non-sampling errors. In particular, we shall be investigating a broader range of administrative files to be used in the tracing operation so that the no-trace rate can be reduced. This will require improvements to the record linkage methodology used to identify alternative addresses. We shall also be comparing alternative ways of adjusting for the no-trace cases. The procedures used to classify cases as missed, enumerated, no-trace etc., will also be examined to reduce errors as far as possible.

Thirdly, we are investigating better ways of measuring overcoverage and/or net undercoverage. Included in this is a study of the feasibility of conducting a Post-Enumeration Survey (PES). Such a survey would involve a relisting of dwellings within a sample of small geographic areas, and interviews with the households resident in these dwellings. The list of residents obtained in the PES would be compared with the corresponding Census questionnaires and any discrepancies would be followed-up to obtain an explanation. In this way it should be possible not only to measure gross and net undercoverage but also to identify exactly why coverage errors occurred.

If a PES were to be conducted in 1991, it would not replace the RRC but be conducted in parallel.

Statistics Canada has acquired considerable experience in applying the RRC methodology and it would be unwise to replace it with what, for us, would be a new and untested approach. Furthermore, while the PES methodology has many advantages it suffers from a number of limitations of its own. A re-enumeration is likely to miss many of the same people as the original Census and this would tend to bias the estimates of undercoverage downwards. Secondly, it probably would not be feasible to conduct a re-enumeration until at least six weeks after Census Day, by which time some people will have moved and many more may be away on vacation. Given such limitations, a PES should be seen as supplementing the existing methods of measuring undercoverage rather than as a potential replacement for them.

## 6. SUMMARY AND CONCLUSIONS

There is no doubt that improved coverage is a high priority for the 1991 Census. It is equally sure, however, that to achieve this will mean that the collection phase of the Census will cost considerably more than in 1986. Measures such as lower supervisory ratios, paid advertising, address register and centralized edit are expensive. Unless the overall Census budget is increased, cost reductions will have to take place elsewhere.

Second, we feel that our long-term strategy must be in the direction of more automation, in particular automation of address lists, and centralization, particularly of edit and follow-up operations.

Finally, there is a need to improve our coverage evaluation studies. In addition to improving the methodology of our traditional undercoverage study, the Reverse Record Check, we are aiming to develop reliable estimates of net undercoverage. In this regard, the re-enumeration surveys proposed for the 1991 Census must be seen as a step in a longer term development of a comprehensive and integrated coverage measurement programme. We also recognize the need to obtain a better understanding of the causes of undercoverage, drawing on both quantitative studies, such as the Reverse Record Check and re-enumeration surveys, and on more qualitative research methods.

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**Table A.1**  
Undercoverage Rates in the 1986 and 1981 Censuses by Province of Residence

Province	1986 Census Population Undercoverage		1981 Census Population Undercoverage	
	Estimated Rate (%)	Standard Error (%)	Estimated Rate (%)	Standard Error (%)
	Newfoundland	2.01	0.32	1.74
Prince Edward Island	2.16	0.80	1.17	0.54
Nova Scotia	2.63	0.38	1.05	0.34
New Brunswick	2.83	0.36	1.81	0.30
Québec	3.06	0.29	1.91	0.21
Ontario	3.40	0.19	1.94	0.14
Manitoba	2.22	0.40	0.98	0.35
Saskatchewan	2.51	0.36	0.99	0.37
Alberta	2.75	0.33	2.54	0.36
British Columbia	4.49	0.39	3.16	0.33
Canada (excluding the Yukon and the Northwest Territories)	3.21	0.12	2.01	0.09

**Note:** The estimated population on incompletely enumerated Indian Reserves has been subtracted from the number of "missed" persons in the calculation of the 1986 undercoverage rates shown in this table.

**Table A.2**  
Undercoverage Rates in the 1986 and 1981 Censuses by Sex and Age Group - Canada (\*) -

Sex and Age Groups	1986 Census Population Undercoverage		1981 Census Population Undercoverage	
	Estimated Rate (%)	Standard Error (%)	Estimated Rate (%)	Standard Error (%)
	<b>Both Sexes</b>	3.38	0.12	2.01
0 to 4	2.28	0.48	1.21	0.22
5 to 14	2.12	0.26	1.23	0.21
15 to 19	3.89	0.60	2.96	0.52
20 to 24	9.06	0.45	5.51	0.29
25 to 34	4.76	0.32	2.31	0.28
35 to 44	2.40	0.32	2.20	0.26
45 to 54	1.77	0.28	0.81	0.23
55 to 64	2.09	0.31	0.91	0.29
65 and over	1.94	0.33	0.71	0.30
<b>Male</b>	3.91	0.16	2.37	0.13
0 to 4	2.22	0.67	1.32	0.33
5 to 14	2.04	0.32	1.27	0.29
15 to 19	4.18	0.75	3.12	0.68
20 to 24	10.71	0.59	6.03	0.48
25 to 34	5.81	0.41	2.70	0.44
35 to 44	3.40	0.51	3.42	0.40
45 to 54	2.00	0.52	1.21	0.38
55 to 64	1.88	0.47	0.91	0.40
65 and over	1.70	0.52	0.69	0.47
<b>Female</b>	2.87	0.16	1.65	0.12
0 to 4	2.35	0.60	1.10	0.33
5 to 14	2.21	0.33	1.19	0.31
15 to 19	3.58	0.83	2.80	0.73
20 to 24	7.33	0.71	4.98	0.43
25 to 34	3.71	0.43	1.92	0.32
35 to 44	1.37	0.32	0.93	0.31
45 to 54	1.53	0.37	0.41	0.26
55 to 64	2.28	0.51	0.92	0.34
65 and over	2.11	0.44	0.71	0.42

\* : Excluding the Yukon and the Northwest Territories

**Note:** The population on incompletely enumerated Indian Reserves has been treated as "missed" in the calculation of the 1986 undercoverage rates shown in this table.