

## **Research and Testing of Telephone Survey Methods at Statistics Canada**

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### **ABSTRACT**

Findings from the research and testing of telephone and computer assisted survey methods for household surveys are presented, followed by discussion of how these findings will influence the redesign of household surveys at Statistics Canada during the 1990's. Significant emphasis is given in the presentation to the Canadian Labour Force Survey.

**KEY WORDS:** Data collection; Household surveys; Sample design.

### **1. INTRODUCTION**

The 1980's have seen significant changes in survey taking due to advances in technology and the development of modern telephone survey methods, and the pace of these changes will likely accelerate during the 1990's. In this paper we will describe the research, testing, and development of methods that will form the infrastructure underpinning the data collection activities for Statistics Canada's household surveys during the 1990's. This research has focused in particular on the Canadian Labour Force Survey, and was carried out from 1985 to 1989 with a view to identifying improvements to be implemented during the 1991 post-censal redesign of the survey.

### **2. RESEARCH AND TESTING PROGRAM FOR LFS**

The Canadian Labour Force Survey (LFS) is the largest household survey conducted by Statistics Canada, with a sample size of 62,300 households per month. It follows a rotating panel design in which households remain in the sample for six consecutive months, after which they are rotated out. It is based on a multi-stage area sample, with a decentralized interviewing staff of 1,000 local interviewers located across Canada and reporting to one of five Regional Offices.

Until the early 1970's, all interviewing was face to face. In 1972 telephone interviewing was introduced in large urban areas for follow-up interviews with households after they had received a face to face interview during their first month in the sample. In the literature, such telephone follow-up is referred to as "warm telephoning", to distinguish it from "cold telephoning" where the telephone interview is not preceded by a face to face interview (Groves *et al.* 1988).

The warm telephoning was initially restricted to major urban areas due to the frequency of party lines in smaller urban and rural areas and concerns this raised about the confidentiality of the data being collected. However, during the 1981 redesign of the survey, warm telephone interviewing was tested for the small urban and rural areas, and it was found respondents were willing to be interviewed by telephone, and the procedure had no impact on response rates or survey estimates (Choudhry 1984). The extension of telephoning to these areas in 1984 resulted in a 10% reduction in the data collection costs for the survey.

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In 1985, following introduction of a redesigned sample, a research program was started to investigate what further improvements in data collection could result from: (i) more use of the telephone in collection, (ii) telephone survey methods where the telephone is used both for sampling and for data collection, and (iii) Computer Assisted Interviewing (CAI) methods.

In the study of telephone and CAI methods it was useful to characterize the survey design in terms of a number of design factors as follows:

- (i) **Mode of collection.** As already noted, the current mode of collection is warm telephoning, with an initial face to face interview and predominantly telephone interviews in later months. Alternative modes of collection include cold telephone interviewing with face to face follow-up of telephone nonrespondents, and cold telephoning without face to face follow-up.
- (ii) **Organization of interviewers.** The LFS currently features a local organization, with the local interviewers doing a mixture of face to face interviews and telephone interviews from their homes. An alternative is a central organization, with interviewers working out of one or more central cities – in the case of Statistics Canada, its five Regional Offices across the country. A third organizational model is a mixed one where interviewing is done by a combination of local and central interviewers.
- (iii) **Technology.** The current technology for the survey is traditional paper and pencil. The alternative technology considered most viable for household surveys is Computer Assisted Interviewing. CAI is commonly referred to as CATI (Computer Assisted Telephone Interviewing) when done centrally, and CAPI (Computer Assisted Personal Interviewing) when done locally using portable computers that interviewers use for face to face interviews and for telephone interviewing from their homes.
- (iv) **Frame and sample design.** The survey has been based on an area sampling design since its inception in 1945. Alternatives include: telephone frames based on either Random Digit Dialing (RDD) methods (Waksberg 1978) or a combined use of RDD and list frames of published telephone numbers; other list frames which unlike telephone lists, are conceptually complete; and dual frame methods combining two or more of the above frame options.

In the following sections findings from the research and testing program pertaining to each of these design factors are discussed.

### 3. MODE OF COLLECTION

A major test was carried out from 1985 to 1989 to determine the impact of cold telephone interviewing with face to face follow-up as an alternative to the current warm telephoning. This test was referred to as the Telephone First Interview Test. The test was embedded into the ongoing LFS in urban areas of Quebec and Ontario. The methodology is reported fully in Drew, Choudhry and Hunter (1988). In brief, newly sampled LFS dwellings were matched to lists purchased from the telephone companies on the basis of address information. Match rates of 65% were obtained. Test and control samples were selected from the matched dwellings such that each test dwelling was paired with a control dwelling within the same sampling unit (city block). For the test dwellings, telephone numbers were provided to interviewers, who were to attempt a telephone interview, but to use face to face follow-up if necessary. Interviewers were unaware of the existence of a control sample, and followed normal procedures for all dwellings for which telephone numbers were not provided.

**Table 1**  
 Telephone First Interview Test (October 1985 – March 1989)  
 Estimate for Test Treatment as Percent of Estimate for Control Treatments

| Characteristic         | Ontario |             | Quebec  |             |
|------------------------|---------|-------------|---------|-------------|
|                        | Percent | t-statistic | Percent | t-statistic |
| Employment             | 98.5    | -1.22       | 97.2    | -1.64       |
| Unemployment           | 96.3    | -0.94       | 111.8   | 2.27*       |
| Not in LF              | 101.1   | 0.88        | 98.2    | -0.63       |
| Pop. 15 +              | 909.2   | -0.86       | 98.5    | -1.31       |
| Pop. in Hhld = 3 +     | 97.8    | -0.76       | 94.1    | -1.26       |
| Pop. in 1 person Hhlds | 100.6   | 0.25        | 104.1   | -0.93       |
| Pop. in 2 person Hhlds | 101.1   | 0.26        | 101.0   | 0.43        |
| Pop. in 3 person Hhlds | 98.6    | -0.56       | 94.7    | -1.28       |
| Emp. Male 15-24        | 95.2    | -0.75       | 88.7    | -2.00*      |
| Emp. Male 25 +         | 98.5    | -1.11       | 96.7    | -1.54       |
| Emp. Female 15-24      | 99.0    | -0.11       | 111.5   | 1.44        |
| Emp. Female 25 +       | 99.2    | -0.65       | 97.1    | -1.11       |
| Unemp. Male 15-24      | 105.6   | 0.53        | 119.0   | 1.53        |
| Unemp. Male 25 +       | 94.5    | -0.80       | 96.7    | -0.31       |
| Unemp. Female 15-24    | 99.6    | -0.15       | 119.4   | 1.30        |
| Unemp. Female 25 +     | 90.9    | -1.22       | 123.9   | 2.71**      |
| Not in LF Male 15-24   | 99.8    | -0.07       | 99.9    | 0.47        |
| Not in LF Male 25 +    | 105.6   | 1.57        | 101.3   | 0.07        |
| Not in LF Female 15-24 | 101.9   | 0.56        | 95.3    | -0.56       |
| Not in LF Female 25 +  | 99.2    | -0.14       | 97.3    | -0.92       |
| Pop. Male 15-24        | 97.2    | -0.49       | 95.2    | -0.73       |
| Pop. Male 25 +         | 99.9    | -0.09       | 97.7    | -1.49       |
| Pop. Female 15-24      | 99.9    | 0.16        | 105.4   | 0.95        |
| Pop. Female 25 +       | 98.9    | -1.28       | 98.4    | -1.24       |

\* t-statistic significant at 5% level

\*\* t-statistic significant at 1% level

No significant differences in response rates were found between the test and control samples. For Quebec, response rates were 96.1% for both samples, while for Ontario, the rate of 96.3% for the test sample was marginally lower than that of 96.5% for the control sample.

When comparing the labour force estimates obtained in the test and control samples, certain estimates from Quebec early in the test for the period October 1985 to February 1987 were significantly different. In particular the employed and unemployed males in households of three or more persons were underestimated in the test sample (see Drew, Choudhry and Hunter 1988). Table 1 presents data over the full life of the test from October 1985 to March 1989. For Quebec, a few statistically significant differences existed – which stemmed from the influence of the earlier time period. When the data are analyzed from March 1987 onwards, these differences are not significant. In Ontario, there were no significant differences. Speculating on the differences in Quebec, their co-incidence with a program of inspection of welfare recipients carried out by the provincial government suggests that measures external to the survey led to a climate in which there was decreased trust of cold telephone interviews. We were fortunate

**Table 2**  
Nonresponse Rates: Warm Telephoning versus Cold Telephoning  
with/without Face to Face Follow-up

| Method                                     | Test 1 | Test 2 |
|--|--------|--------|
| Warm telephoning with letter (ongoing LFS) | 4.1    | 5.6    |
| Cold telephoning with letter               | 6.9    | 9.8    |
| Cold telephoning without letter            | 8.5    | -      |

Test 1: October 1985 – September 1986; Ontario and Quebec

Test 2: July 1988 – March 1989; Nova Scotia and Alberta

to have been conducting the test during this period, because the finding that survey results obtained under cold telephoning are more subject to external influences than are those obtained under warm telephone interviewing will be an important consideration in any decisions on extension of telephone interviewing.

Cold telephoning without face to face follow-up was also studied. Two Telephone Sampling Tests were carried out in which the LFS was conducted as a central telephone survey, with interviewing from the Regional Offices. Nonresponse rates for the two tests and comparable rates for the ongoing LFS are presented in Table 2.

The first test studied two sampling methods – RDD, and a combination of list sampling for published numbers and RDD for nonpublished numbers. The list sampling featured introductory letters, but the RDD sampling did not. Differences in response rates would seem to point to the positive effects on response rates of an advance letter. For both tests, the comparison of warm versus cold telephone interviewing revealed nonresponse rates for cold telephoning which were higher at a 5% significance level. The second test was based solely on a list sample of published numbers.

An important issue is the nonresponse bias, if any, resulting from the higher nonresponse under cold telephoning without face to face follow-up. As a proxy to these extra non-respondents, Laflamme (1990) looked at non-first-month-in-sample households from the ongoing LFS who had a telephone, but who were interviewed face to face. He found that size of the proxy group, at 3.5% of respondents, was close to the size of the extra nonresponse under cold telephoning without face to face follow-up. Further, he found the unemployment rate for the proxy group was 12.8%, versus 7.4% for persons in households interviewed by telephone. Exclusion of the proxy group from the sample would have lowered the national unemployment rate from 8.1% to 7.9%. This is clearly a serious bias, given the accuracy required for the LFS national estimates. As the proxy assumption seems a reasonable one, these findings raise serious concerns about cold telephone interviewing without face to face follow-up for the LFS.

Table 3 compares unemployment and participation rates for the first telephone sampling test with corresponding estimates from telephone households in the LFS. The only estimate found to be significantly different at a five percent level from estimates produced for the telephone population from the ongoing LFS was the unemployment rate for Quebec for the RDD treatment. It is worth noting that the test was carried out at the same time that problems emerged with estimates for Quebec in the Telephone First Interview Test. Another point worth noting is that while other differences in unemployment rates were not statistically significant, the rates for cold telephoning were higher. Other researchers have observed differences in the same direction, also without being able to attribute statistical significance to them. These data might benefit from a meta analysis.

**Table 3**  
Telephone Sampling Test (October 1985 – September 1986)  
Unemployment and Participation Rates

| Province | Design | Unemployment<br>Rate<br>(S.D.) |        | Participation<br>Rate<br>(S.D.) |        |
|----------|--------|--------------------------------|--------|---------------------------------|--------|
| Quebec   | LIST   | 12.3                           | (0.78) | 64.1                            | (1.08) |
|          | RDD    | 13.0*                          | (0.88) | 62.8                            | (1.28) |
|          | LFS    | 10.9                           | (0.27) | 63.4                            | (0.29) |
| Ontario  | LIST   | 7.3                            | (0.59) | 69.0                            | (1.11) |
|          | RDD    | 7.9                            | (0.63) | 69.0                            | (1.18) |
|          | LFS    | 6.9                            | (0.16) | 69.0                            | (0.20) |

\* Significant difference between RDD and LFS Unemployment rates for Quebec

In summary, the test results showed cold telephoning without face to face follow-up yielded higher nonresponse rates than the current warm telephoning method, and while inconclusive, there was some evidence that it yielded higher unemployment rates. On the other hand, cold telephoning with face to face follow-up, apart from the one period of time in Quebec, was found to yield data comparable to that under warm telephoning.

On the basis of these findings, it was decided to implement cold telephoning with face to face follow-up for the LFS apartment frame sample, which constitutes roughly 4% of the overall sample. The availability of the telephone number for apartment frame units, it was reasoned, would help overcome problems in gaining access to highrise apartment buildings, and allow for more attempts to find persons at home than is feasible with face to face interviewing. These expectations seem to have been borne out. As reported by Dufour (1990), while first month nonresponse rates for the apartment sample continue to be higher than corresponding first month rates for the non-apartment sample, the gap has narrowed from a difference of 8.7 percentage points in the year before the change to a difference of 5.7 percentage points during the first five months under the new procedure.

Another change to the mode of collection for the ongoing LFS was to introduce telephone follow-up of the first month in sample households which could not be contacted during an initial visit to the dwelling. This procedure was introduced in 1986, and led to a \$100,000 per year savings in data collection costs.

The combined effect of the telephone first interview for the apartments, and the telephone follow-up for first month nonrespondents has been an increase in the overall telephoning rate for the survey from 80% in 1985 to 83% in 1990.

#### 4. ORGANIZATION OF INTERVIEWING STAFF

During the testing program, two alternatives to the current local organization of the interviewing staff were studied. The telephone sampling tests already described considered a "central" organization where all of the interviewing was done out of the Regional Offices. Another test examined a mixed organization, in which the current warm telephoning mode of collection was retained. The test of the mixed organization was carried out from January 1988 to March 1989 in two Census Metropolitan Areas in which Regional Offices are located – Montreal and Halifax. Its primary objective was to measure the cost implications of such a mixed organization.

The test methodology consisted of face to face collection by local interviewers for first month in sample cases, and telephoning by central interviewing staff working out of the Regional Offices for most non-first month cases. Whenever nonresponse follow-up was required for households initially assigned to the central interviewers, this was carried out by the local interviewers. This methodology was initially tested for the Labour Force Survey by Muirhead *et al.* (1975) and has been extensively studied by the United States Bureau of the Census (1987), where the centralized interviewing is being done using Computer Assisted Telephone Interviewing (CATI).

One of the complexities of the method was the practice followed for the first half of the test of transferring cases requiring nonresponse follow-up from the central to the local interviewers at the mid-point of the interviewing week. For the second half of the test, this so-called re-cycling was restricted to cases where the telephone number was determined to be no longer valid. During the first half of the test, nonresponse rates were 8.0% for the test treatment versus 6.1% for the control procedures corresponding to the decentralized interviewing used for the ongoing LFS. The gap narrowed to 7.3% versus 6.7% during the second half.

From the first telephone sampling test, interviewing costs per household were estimated to be \$2.72 for central data collection with telephone list sampling, versus \$3.53 for RDD sampling. The extra costs for RDD methods is due to the time spent in screening for residential telephone numbers. These costs include \$0.46 per household for long distance charges. This amount was estimated based on long distance rates and data on length of calls, since record keeping practices in the regional offices did not permit the extraction of actual costs incurred. Comparable costs for the ongoing LFS were \$4.76 per household for interviewer fees and expenses. The test of the mixed organization yielded savings relative to the ongoing LFS of \$0.78 per household in interviewer fees and expenses. The above cost comparisons do not factor cost of office space and equipment into the costs under the centralized and mixed organizations. Nor do they consider the costs of transferring documents to and from local interviewers under the mixed and local organizations, which under the current paper and pencil technology is accomplished by express mailing of documents, but under CAI scenarios would be transmitted electronically.

The mixed organization was considered only for Regional Office cities, as extension beyond Regional Office cities would imply greater long distance telephoning. More importantly, the sample design for smaller urban and rural areas is clustered so that primary sampling units yield sample sizes corresponding to an interviewer assignment. Centralization of the telephone portion of the sample would necessitate more clustering of the sample in order to retain a sufficient workload for the local interviewers. Also in medium sized urban centres where there are currently four to five interviewers, the number of local interviewers under the mixed organization would be reduced to one or two, significantly reducing the flexibility to have interviewers fill in for one and other during vacations and illness.

Of the three organizational models considered, all had advantages and disadvantages. The local organization yielded the lowest nonresponse rates, albeit at the highest per unit data collection cost. The mixed organization had marginally higher nonresponse and marginally lower costs, and was limited in where it could be applied. In the final analysis, the mixed organization was seen as introducing a lot of complexity for at best marginal gain. The central organization, which offered substantial savings in data collection costs, resulted in a 68-75% increase in nonresponse relative to the local organization. As discussed in section (3), there is evidence that this extra nonresponse would introduce a serious nonresponse bias into the LFS estimates. Moreover there are concerns that the gap in nonresponse rates attainable under local versus central organizations might widen in the future, as increasing exposure to telephone

solicitation and increasing availability of telephone screening technology renders the population less receptive to telephone interviewing. Such developments favour survey design strategies which, although they may allow for flexibility to do telephoning, also allow for face to face follow-up wherever needed. The local organization best offers this flexibility. On the basis of the above considerations it has been decided to retain the current local organization.

## 5. TECHNOLOGY

Catlin, Ingram, and Hunter (1988) carried out a controlled study comparing CATI and paper and pencil interviewing. In the study the LFS questionnaire was administered to RDD samples of 1,000 households per month per treatment over a period of nine months. All interviewing took place from Statistics Canada headquarters in Ottawa.

The study was part of a collaborative research effort with the United States Bureau of the Census (USBC), and the CATI software used was developed by the USBC. The wording of the questionnaires was purposively the same for both treatments. Features unique to the CATI treatment were automatic branching, some basic on-line edits, and automated call scheduling.

Three quality improvements were discernable for CATI relative to paper and pencil methods. First, the overall rate of edit failures during post-collection data processing was 50% lower for CATI. Second, there was a virtual elimination of branching errors under CATI. Importantly, this occurred for certain portions of the questionnaire, which, although infrequently encountered, have a bearing on determination of labour force status, and which under paper and pencil interviewing are subject to high levels of branching errors. Third, the average household size reported under CATI was 3% higher, which represents roughly a 50% reduction in the underenumeration in the LFS relative to the Census. This improvement seems to stem from the enforced probing built into the CATI instrument for additional household members and for persons temporarily away.

Based on these findings, it has been decided that the introduction of Computer Assisted Interviewing should be one of the major thrusts of the 1991 post-censal redesign of the LFS. Due to the preference for maintaining a local organization of interviewing staff, a CAPI implementation is being planned for.

## 6. FRAME AND SAMPLE DESIGN

### Telephone Frames

Telephone coverage and the extent to which characteristics of those without telephones differ from characteristics of those with telephones are important factors in the design of telephone survey methods – particularly as regards frame strategies.

In an international review of telephone coverage, Trewin and Lee (1988) found telephone coverage in Canada to be one of the highest in the world at 97-98%. As is typical of the situation in most countries they surveyed, persons in non-telephone households in Canada tend to have lower incomes and higher rates of unemployment.

Table 4 gives the percentage of non-telephone households in Canada from 1976 to the present. Telephone coverage, while already high in 1976 has been steadily edging upwards, although it appears to have levelled off over the last few years at around 98.5%.

**Table 4**  
Non-telephone Households by Province (%)

|                      | 1976 | 1981 | 1985 | 1987 | 1990 |
|----------------------|------|------|------|------|------|
| Canada               | 3.5  | 2.4  | 1.8  | 1.5  | 1.5  |
| Newfoundland         | 10.0 | 6.0  | 5.1  | 3.6  | 1.9  |
| Prince Edward Island | –    | –    | –    | –    | 2.8  |
| Nova Scotia          | 7.5  | 4.6  | 3.5  | 3.2  | 1.5  |
| New Brunswick        | 5.8  | 5.3  | 5.3  | 3.3  | 2.2  |
| Quebec               | 3.3  | 2.1  | 1.6  | 1.5  | 1.5  |
| Ontario              | 2.5  | 1.9  | 1.0  | 1.0  | 1.2  |
| Manitoba             | 4.1  | 2.3  | 2.7  | 2.4  | 1.7  |
| Saskatchewan         | 3.6  | 2.5  | 2.3  | 2.4  | 2.3  |
| Alberta              | 3.0  | 2.4  | 2.0  | 1.8  | 2.0  |
| British Columbia     | 4.2  | 2.8  | 2.4  | 1.3  | 1.5  |

Source: Statistics Canada, Estimates from Household Facilities & Equipment Survey

**Table 5**  
Labour Force Characteristics by Telephone Status

| Province    | Telephone Status | Unemployment Rate | Participation Rate |
|-------------|------------------|-------------------|--------------------|
| Nova Scotia | published        | 9.0               | 71.9               |
|             | non-published    | 9.8               | 70.2               |
|             | non-telephone    | 17.2              | 62.3               |
| Alberta     | published        | 6.3               | 80.7               |
|             | non-published    | 8.2               | 81.5               |
|             | non-telephone    | 11.1              | 67.0               |

Laflamme (1990) undertook a study comparing characteristics of the non-telephone and telephone universes. The study included a breakdown of those with published versus non-published numbers, obtained by linking telephone numbers supplied by LFS respondents to lists of published telephone numbers. Two provinces were included in the study, Nova Scotia and Alberta. For Nova Scotia 9.7% of numbers, and for Alberta 11.2% of numbers were found to be non-published. Unemployment and participation rates reported by Laflamme are given in Table 5.

This study replicates findings from earlier studies that the labour force characteristics of persons without telephones are very different from those with telephones. The labour force characteristics differ but to a lesser extent between persons with published versus non-published numbers.

While the non-telephone population accounts for only 1.0%-1.5% of the population, the differences in labour force characteristics are sufficiently large that simply excluding the non-telephone population is not a viable option for the LFS, given the accuracy required for the national employment and unemployment estimates (coefficients of variation of 0.5% and 2% respectively).



Another difficulty with telephone frames, particularly for panel surveys is their rapid deterioration. Drew, Dick and Switzer (1989) found a 0.5 – 1.0 % rate of additions and deletions to the stock of published residential numbers per month. Hence telephone samples cannot remain representative of the telephone universe for very long unless they are updated. The authors proposed a strategy of updating samples for a panel survey using files of published numbers acquired on an ongoing basis from telephone companies. An operational test of the procedure over a nine month period was a success. Their procedure applied only to published numbers sampled from a list frame, and did not provide a solution to the problem of keeping a sample selected using Random Digit Dialing methods up to date over the life of a panel.

Because of the coverage and updating problems with telephone frames, approaches where dwellings as opposed to telephone numbers are the sampling units are seen as having more promise for large scale panel surveys. It is worth noting that the situation can be quite different for other surveys. Catlin *et al.* (1984) showed that coverage biases for general population characteristics were less than for labour force characteristics. Further for smaller surveys (*e.g.*, those with sample sizes of 10,000 or less) small biases are less important given the larger relative sampling errors for these surveys. These findings led to establishment of an RDD household survey capacity in 1986. It has been used for numerous one-time surveys and for the General Social Survey, which is an annual survey of 10,000 households.

### **Area Frame**

As has already been described, it is possible in urban areas to match selected addresses from an area frame to telephone lists in order to permit cold telephone interviewing. The experiences with the LFS have been that telephone numbers can be obtained in this fashion for approximately 60% of households. These match rates are based on exact matching after standardization of the address information, and they could be improved through use of record linkage methods. With telephoning for a substantial portion of the first month cases, the clustering of the sample could be reduced somewhat, but a clustered sample remains a constraint imposed by an area frame design.

It is planned to investigate the feasibility of extending these procedures to rural areas, which would entail changing the type of information collected when dwelling lists are created for the survey. The information currently collected tends to be descriptive of the physical characteristics of the dwelling, whereas to successfully match with lists of telephone subscribers, information such as name (often readily available on mail boxes), street name and number, or in their absence the rural route number and postal code, would be required.

### **Address Register**

Statistics Canada is constructing an Address Register in urban areas of Canada. It will be used in the 1991 Census to improve coverage by providing an independent check on the dwelling lists created by the Census enumerators (Drew, Royce and van Baaren 1989). The Address Register will be a machine readable list of addresses constructed by linkage of various administrative data sources, including lists of customers with published numbers purchased from telephone companies. During the use of the Address Register in the 1991 Census, its coverage will be updated to correspond to that of the 1991 Census.

It is planned during the 1991 post-censal redesign of the Labour Force Survey to conduct studies into use of the Address Register as a frame for household surveys in urban areas. If the conclusion is that it should be adopted as a frame, the Address Register will be updated on an ongoing basis following the 1991 Census.

An advantage of the Address Register as a frame over the area frame is that telephone and non-telephone households are known ahead of time. Hence the two can be sampled as separate strata – with a reduced amount of clustering for the telephone stratum, for which a significant portion of the first month interviews could be done by telephone. The non-telephone stratum would include those households with non-published numbers and those households without telephones. Evidence from earlier studies showed the refusal rate when cold telephoning households with non-published numbers to be 12% compared to 4% for all households. Under warm telephoning there is no corresponding increase in the refusal rates for households with non-published numbers, and there is a good success rate in converting these households to respond by telephone in later months. This finding and the desire to be sensitive to privacy concerns of individuals support the face to face interview of such households, which account for an estimated 10-15% of numbers.

### **Dual Frame**

In urban areas, if the coverage of the Address Register as the sole frame is not adequate, a dual frame design in which the Address Register is supplemented by a small area sample will be considered. There are different forms the supplementary sample could take. A promising option, not involving the expense of building and maintaining both a conventional area frame and an Address Register, would be to use an interval approach in which a sample of consecutive dwellings on the Address Register would be selected and checked in the field. Any dwellings found between the Address Register dwellings constitute a sample of dwellings missing from the Address Register.

Mian (1990) has studied dual frame methods considering a cost and variance optimization for the general case where neither of the frames needs to cover the entire universe. This was felt to be a practical model since the area frame, while conceptually complete, in practice suffers from 3-4% undercoverage relative to the Census, in addition to the 5% of the population which is not represented because of nonresponse. Extension of Mian's model to include a non-sampling error component will permit factoring into the optimization what we know or may wish to assume about the coverage and nonresponse biases under alternative frame approaches. It can be used in the context of dual frames combining the Address Register and area frames in urban areas, and combining area and telephone frames in rural areas.

## **7. 1991 POST-CENSAL REDESIGN OF LFS**

The Labour Force Survey is redesigned following each decennial population census. Redesigns have normally focused on redesign of the sample, but in the 1970's a major revision was carried out encompassing a sample redesign, changes to the questionnaire content, wording of questions, and survey outputs, and a major overhaul of the survey processing systems including introduction of a network of mini-computers in the regional offices to support survey operations and regional data capture. In contrast, redesign efforts during the 1980's were restricted to a sample redesign.

While decisions on the scope of the 1991 post-censal redesign have yet to be taken, an effort falling somewhere between the major revision in the 70's and minimal redesign in the 80's appears needed. The work on the redesign is at an early planning stage, and is proceeding through four sub-projects focusing on: (i) content and questionnaire issues, (ii) modernization of the survey processing systems and review of survey outputs, (iii) development, testing, and implementation of Computer Assisted Interviewing, and (iv) sample redesign. (Drew *et al.* 1991).

Sub-projects (iii) and (iv) are those which will be concerned with telephone and CAI methods. Current plans for these sub-projects as they relate to the survey design factors described in earlier sections of this paper are briefly summarized below.

### **Technology and Organization**

Based on the positive findings from testing of Computer Assisted Interviewing for the LFS reported by Catlin *et al.* (1988), it has been decided to make the adoption of CAI one of the major thrusts of the redesign. Moreover, for reasons already discussed, a decision has been taken that the current local organization of the interviewing staff should be retained, so that the implementation of CAI methods will take the form of Computer Assisted Personal Interviewing (CAPI). Specifically, local interviewers will be equipped with lightweight portable computers that they will carry with them for face to face interviewing, and that they will use to conduct telephone interviews from their homes. The mix of face to face and telephone interviewing may remain much the same as it is currently – 83% telephone and 17% face to face – or it may shift to more telephoning if it is decided to adopt more cold telephone interviewing of households during their first month in the sample.

The work plan for the Computer Assisted Interviewing sub-project includes a field test during 1991 of a touch screen portable computer, and in later years development or acquisition of CAI software, a combined test of CAI and questionnaire alternatives, development of on-line editing, and an automated version of the interviewer manual embedded into a help screen accessible during interviewing.

### **Frame and Mode of Collection**

A key research finding was that cold telephone interviewing with face to face follow-up yields response rates and labour force estimates comparable to those under the current warm telephone collection procedure for the LFS, which features face to face interviewing for the first month households in the sample. One exception was observed in Quebec, where, as discussed, for a period of time data differences were seen. The importance of face to face follow-up in maintaining response rates favours the retention of the dwelling as the sampling unit, and supplying the telephone number to interviewers to give them greater flexibility to use both telephone and face to face interviewing in obtaining first month interviews.

In urban areas, both the current area frame and the Address Register as a frame are consistent with this approach. In rural areas, as described earlier in the paper, research into the feasibility of matching area frame addresses to telephone lists to provide interviewers with telephone numbers will be studied. It is also planned to continue to investigate dual frame methods which in urban areas might consist of the Address Register and an area frame, and in rural areas an area frame and a telephone frame.

## **8. SUMMARY**

The current data collection methodology for the Labour Force Survey consists of a face to face interview for households during their first month in the sample and predominantly telephone interviewing in later months. The introduction of telephone interviewing for the later months took place during the 1970's for major urban areas and during the 1980's for remaining areas. In both instances the introduction of telephone interviewing resulted in significant cost savings without any impact on the response rates or survey estimates. Prior to the telephone and CAI research and testing program begun in 1985, 80% of LFS interviews were done by

telephone. This has moderately increased to 83% through the introduction of telephone follow-up for households which could not be contacted during an initial face to face visit, and by supplying interviewers with telephone numbers for the apartment sample.

The primary benefit of the research and testing program has been to identify the frame and data collection options to pursue during the 1991 post-censal redesign of the survey, including the retention of the current local organization of interviewers, the adoption of Computer Assisted Personal Interviewing, the retention of frame and sample design approaches in which the dwelling is the unit of selection, and the provision of interviewers with telephone numbers to permit the flexibility to use a combination of telephone and face to face interviewing to obtain first month interviews.

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