Statistics New Zealand
TATAURANGA AOTEAROA

A Report on the 2006 Post-enumeration Survey

The 2006 Census counted 98 percent of all New Zealand residents in the country on census night.

2006

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Preface

A Report on the 2006 Post-enumeration Survey carries background information and the main results from New Zealand's third post-enumeration survey (PES). The survey was conducted shortly after the 2006 Census of Population and Dwellings. Like the first two PESs in 1996 and 2001, its main aim was to provide information on the completeness of census coverage, that is, to gauge how many New Zealand residents were missed, or counted more than once, in the census. Statistics New Zealand intends to draw upon the PES results to adjust the population base for deriving post-censal population estimates and demographic projections. Users of census and population data will find this report informative and useful.

It is important to note that a PES is one aspect of examining the quality of census output and processes. Results from the 2001 PES contributed to 2006 enumeration plans, and similarly the 2006 PES will assist Statistics NZ in developing an enumeration strategy for the 2011 Census of Population and Dwellings.

I would like to acknowledge the contribution of all Statistics NZ staff who were involved with the development and implementation of the 2006 PES, the processing and analysis of the PES results, and the preparation of this publication. The cooperation of the New Zealand public in the successful conduct of the 2006 PES is also acknowledged.

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Where consecutive figures have been compiled on different bases and are not strictly comparable, a footnote is added indicating the nature of the difference.

Source

All data is compiled by Statistics NZ, except where otherwise stated.

Symbols

The interpretation of the symbols used throughout this report is as follows:

P	provisional
R	revised
..	figures not available
...	not applicable

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Highlights

A post-enumeration survey (PES) was conducted in New Zealand, following the 2006 Census of Population and Dwellings, to gauge the completeness of census coverage. The main findings of the 2006 Post-enumeration Survey were:

- About 98.0 percent of New Zealand residents in the country on census night were counted in the 2006 Census. This represents a net undercount of 2.0 percent or 81,000 people.
- The net undercount resulted from an estimated undercount of 92,000 people, offset by 11,000 people being counted more than once (overcount).
- While the 2006 Census counted 4.03 million residents in New Zealand, the 2006 PES results suggest that the number of New Zealand residents in New Zealand on census night was closer to 4.11 million.
- The 2006 Census missed more men than women. The undercount rate was estimated at 2.1 percent for males and 1.8 percent for females.
- People aged 15–29 years – the most mobile segment of the population – had the highest undercount (4.1 percent), while those aged 30–44 had the lowest (1.3 percent).
- Ethnic differentials were marked. Net undercount was higher for the Asian (5.2 percent) and Māori (3.1 percent) populations than for Pacific peoples (2.3 percent) and the European population (1.4 percent).
- About 6,300 or 0.4 percent of private dwellings were missed by the 2006 Census.
- The total non-response rate to census was 5.2 percent. Total non-response is the number of people imputed in the census and therefore included in the census count, plus the net undercount as measured by the PES.

Note: All undercount estimates quoted above have a sampling error and in most cases differences of undercount rates between subgroups are not statistically significant.

Chapter 1

Introduction

A census of population and dwellings is often the largest data gathering exercise in any country. In principle, it requires counting everybody in the country on census night. The census yields a wealth of valuable information for analysing changes in the socio-demographic profile of the population, and for monitoring, planning, and decision making at the national and local level, by government, business and the general community. It is also integral to the derivation of reliable post-censal population estimates and for charting future demographic trends.

Given the strategic significance of the census data and its diverse applications, Statistics New Zealand, like other national statistical organisations, makes concerted efforts to ensure universal coverage of its five-yearly census. Yet, censuses everywhere tend to miss some people. A significant initiative for the 2006 Census was the development and implementation of an Internet return option. This online option may assist in increasing response rates in future censuses as its use becomes more widespread.

Incomplete coverage may result from, for example, inadvertent omission of young children, difficulty in enumerating people on the move and those living in apartments, as well as people not willing to cooperate with census enumerators.

There are a myriad of statistical procedures that demographers and others use to check the accuracy of census coverage (Shryock and Siegel, 1973). These include: (a) checks against demographically derived estimates, (b) comparison of census figures with administrative records and other sources, and, (c) a post-enumeration survey (PES).

A PES is undertaken shortly after the census to evaluate the completeness of census coverage. It involves an independent re-enumeration of a statistically designed sample of all dwellings and the people within them covered by the national census. Post-enumeration surveys are an essential feature of census-taking in many countries.

The 2006 PES was the third to be undertaken in New Zealand since the inaugural PES in 1996. The main objective of the 2006 PES was to measure the level of national coverage (undercount and overcount) in the 2006 Census.

This report describes and discusses the salient features of the 2006 PES, including its scope, methodology, the information gathered and the results. Discussion of the survey results also covers implications for post-censal population estimates and other demographic series.

Organisation of the report

The report is organised into four chapters and two appendices. The highlights summarise the survey results. Chapter 1 outlines the significance of the PES, its objective, its history, as well as the known sources of census miscount. Chapter 2 presents details on the survey methodology, including the survey population, sample design, data collection procedures and estimation method, as well as sampling and non-sampling errors. The survey's main findings are described and discussed in Chapter 3. The results include an analysis of age, sex, ethnic and broad geographical differentials, and a comparison of New Zealand's undercount results with the latest available figures for Australia, Canada, England and Wales, and the United States.

Chapter 4 discusses the 2006 PES results, and also includes an outline of the adjustments made to the base population for deriving post-censal population estimates and projections. The PES results are a vital element in this statistical process. Technical details such as dwelling weights, person weights and non-response adjustment are contained in Appendix 1, while Appendix 2 includes the post-enumeration survey form.

Miscount and its sources

In such a large and complex exercise as a census, it is inevitable that some people will be missed and some counted more than once (Dunstan, Heyen and Paice, 1999). Reasons for people and dwellings being missed are many and varied, and include:

- dwellings entirely missed by enumerators
- occupied dwellings misclassified as vacant
- people deliberately avoiding the census – refusing or unwilling to respond (eg for fear that information given will be used against their interests)
- people being reluctant to open their door to strangers
- people shifting from one house to another around the time of the census
- multiple households living at the same address
- people being away temporarily (eg work, school)
- people having no usual residence (eg transients, street kids)
- newborn babies being overlooked.

Conversely, there are situations in which people can be overcounted:

- students living away at school or university (and also being counted at the home of their parents)
- children under joint custody
- people living away from home while working
- people shifting from one house to another around the time of the census
- people living in institutions
- people with dual residences
- erroneous enumeration of deceased persons, babies born after census night, residents temporarily overseas on census night, emigrants, etc
- vacant dwellings classified as occupied (non-respondent) dwellings, leading to the creation of substitute forms.

An error in recording the geographic location of a person does not constitute a coverage error. For example, a person who is enumerated in the wrong area does not represent overcoverage for the area in which the person was enumerated nor undercoverage for the area in which the person should have been enumerated.

Why measure the undercount?

In New Zealand there is growing interest in accurately determining the level of coverage of the census. This helps improve both census processes and the general quality of post-censal population estimates. Population estimates are used for a variety of purposes:

- allocation of funds to organisations using population-based weightings
- denominators for the calculation of rates (eg birth and death rates) and per capita time series
- determination of population weights for various surveys
- administration, policy-making and planning, by both central and local government
- demographic, social and economic studies
- starting-point for demographic projections.

The experience of other countries is that those groups who are mobile or difficult to enumerate are most likely to be missed in the census. In New Zealand, results from previous post-enumeration surveys and indirect evidence drawn from demographic analysis, birth registrations and school enrolments, suggests that the census does miss some people and that this under-enumeration varies across different groups.

History of the Post-enumeration Survey

Before the 1996 Census, Statistics NZ had evaluated certain aspects of the general quality of census data but had not attempted to measure the level of undercount or overcount directly via a census coverage survey. In 1990, a pilot test as a preliminary to a PES was conducted, but the survey did not go ahead. In 1994, appropriate funding was approved by the Government to allow Statistics NZ to undertake a PES in conjunction with the 1996 Census. The 1996 PES was the first survey of its type in New Zealand. The inaugural PES was conducted soon after the 1996 Census, starting after the collection of the census questionnaires had been completed to avoid overlap of census enumerators and PES interviewers in the field (Statistics New Zealand, 1998), and similarly the 2001 PES commenced two weeks after the 2001 Census (Statistics New Zealand, 2002). The 2006 Census was held on 7 March, and the 2006 PES was conducted from 21 March to 3 April 2006.

Chapter 2

About the Post-enumeration Survey

Objectives

The 2006 PES was a sample survey of individuals in private dwellings. The main objective of the PES was to measure the level of national coverage (undercount and overcount) in the 2006 Census. The survey did not aim to check the general accuracy or quality of the responses to specific questions in the census.

Scope – who made up the survey population?

The 2006 PES was based on a stratified, multi-stage sample of 10,900 permanent private dwellings. The survey population consisted of New Zealand residents, either usually resident in a New Zealand private dwelling, or staying at one during the survey period. For the first time, in 2006 overseas visitors who were resident in a private dwelling at the time of the PES and were somewhere in New Zealand on census night, were also included. Overseas visitors were surveyed to investigate the consistency of identification of person type (resident or overseas visitor) between the census and the PES. For practical reasons, non-private and other private dwellings were excluded from the survey, as were dwellings in remote areas. In line with international statistical practices, the following population subgroups were therefore excluded:

- people living or staying in non-private dwellings
- people living in other private dwellings (eg tents, caravans, yachts)
- people who died after census night
- babies born after census night
- overseas diplomats, their families and people living with them
- people on offshore islands (except Waiheke Island, which was included).

Sample design

The 2006 PES is based on the sample design of Statistics NZ's Household Labour Force Survey (HLFS). The main reasons for choosing the HLFS design included:

- reduced costs for enumeration and field collection – interviewers were already working in and familiar with the geographic areas used in the sample, and fieldwork made use of existing maps and street listings
- minimisation of respondent burden by controlling the overlap between the PES and other household surveys.

The sampling process was complex (Figure 1). The geographical framework of New Zealand consists of 41,392 meshblocks (a meshblock in urban areas is usually a block of residential area containing about 40 dwellings surrounded by streets; in rural areas a meshblock covers a much wider area because dwellings are sparsely spread). For the purposes of the HLFS, these meshblocks are aggregated into 20,394 primary sampling units (PSUs). To improve the sampling efficiency these PSUs are stratified into 119 groups (or strata) based on region, urban/rural mix, ethnic population, and other socio-economic variables (income, employment status, population aged 65 years and over). Each stratum consists of about 160 PSUs on average.

Across the 119 strata, 1,768 PSUs have been randomly selected for the HLFS. The PES randomly selected PSUs from among these, using sampling fractions dependent on the stratum characteristics:

- All PSUs from strata with simultaneously high numbers of Māori, Asian and Pacific residents, or simultaneously high numbers of Māori and Pacific residents
- 5/8 of PSUs from other strata with high numbers of Māori, Asian or Pacific residents
- 1/2 of PSUs from other South Island strata
- 3/8 of PSUs from the remaining strata.

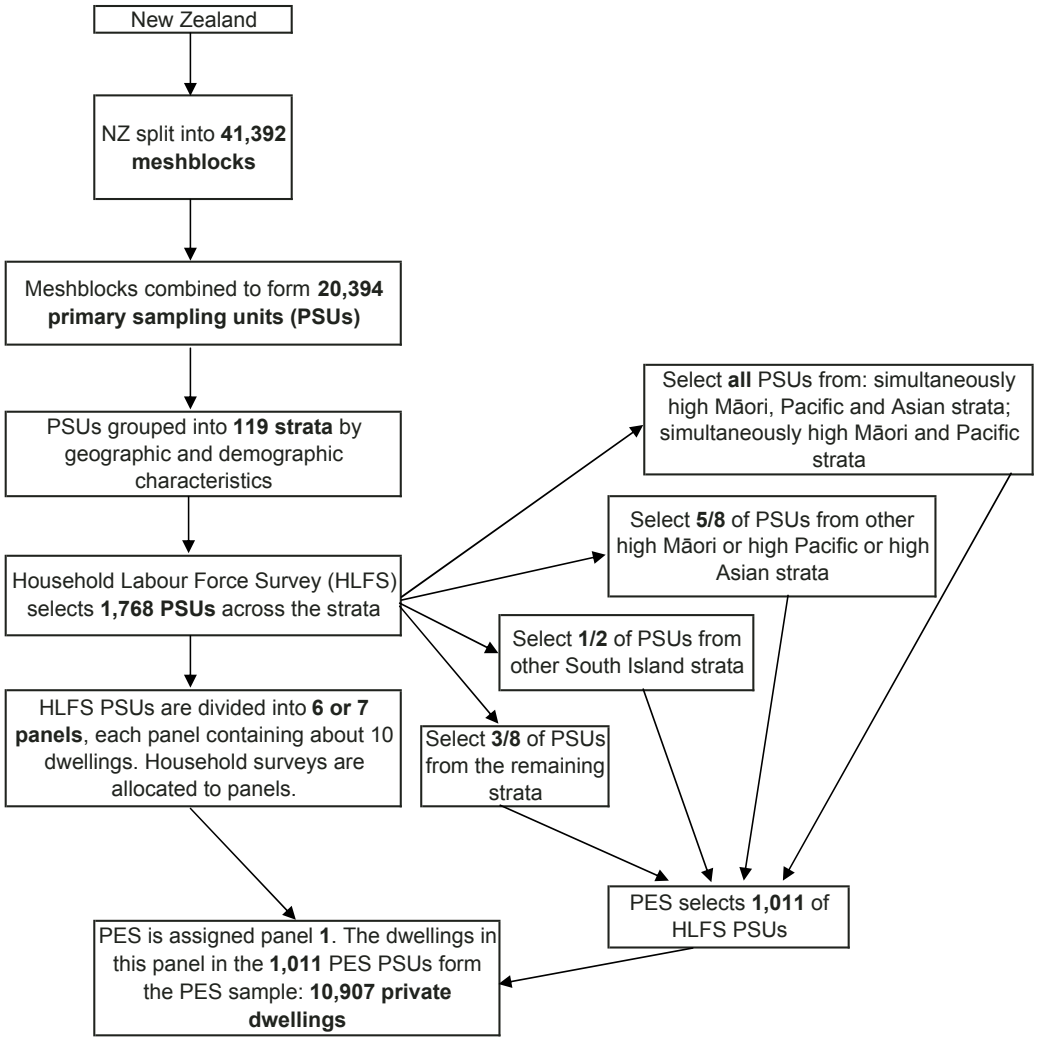
Experience in New Zealand and overseas suggests that ethnic minorities and young persons are more likely to be missed by the census (Australian Bureau of Statistics 2003; Statistics New Zealand, 2002; US Census Bureau, 2003). The higher sample ratios for ethnically diverse areas were therefore designed to help increase the accuracy of the undercount estimates for subgroups of the population by reducing their sampling errors.

Each PSU in the HLFS comprises six or seven panels, and each panel consists of about 10 randomly selected private dwellings. Most of the panels within a PSU are used by the HLFS on a rotational basis with one panel being used for each survey quarter in a year. A spare panel from each of the PSUs was used to make up the PES sample frame for sample selection.

The 2006 PES sample comprised 1,011 PSU panels containing 10,900 dwellings (or about 0.7 percent of total permanent private dwellings in New Zealand).

Figure 1

2006 Post-enumeration Survey: Sampling Process



Data collection

The survey was carried out during 21 March–3 April 2006, following the planned completion of census fieldwork. The survey period was chosen to avoid overlap of census enumerators and PES interviewers in the field, while being close enough to census date (7 March) to assist respondent recall. Data was collected by 159 specially trained interviewers using a household questionnaire. Information on occupants of the dwelling who satisfied the scope and coverage criteria was collected through a face-to-face interview wherever practicable. Alternatively, a proxy interview was conducted (ie details were obtained from another adult in the dwelling) and a follow-up interview was done over the telephone (unless the respondent insisted on a face-to-face interview). The 2006 PES had a response rate of 84 percent, which is the proportion of eligible households who responded to the PES interviewer and contained at least one fully responding eligible person. In total, 24,900 people responded to the survey.

Personal details sought on the PES questionnaire included: name, sex, date of birth or age, ethnicity and address. Besides usual address and census night address, the survey also collected information on any other addresses where the person might have been included on any other census form. This was to help increase the chances of finding and matching any individual census forms for a particular person, and to help identify multiple counts. A copy of the PES questionnaire is included in Appendix 2.

In order for the PES to achieve its objectives, the processes needed to be independent of the census. To ensure this independence, the PES:

- used no census field staff
- was conducted after the majority of census fieldwork was completed to avoid contact between census enumerators and PES interviewers

- used interviewers to gather information from occupants of the dwelling, whereas the census relied on individuals to fill in the census forms.

The 2006 PES used more tightly controlled collection procedures, and more experienced and better trained field staff than the census.

Matching and searching

The objective of matching was to determine if a PES respondent was counted in the census at each address at which they stated that they had completed a census form, or at each address where a census form may have been completed for them (search address). This was achieved by comparing the information given by PES respondents with the information given on census forms. If an address given was different to the PES address, searching was carried out to locate the address in census before matching could be attempted.

Matching was performed clerically, using the PES questionnaires and the images of census documents. The first part of the matching process involved locating the census dwelling/address that corresponded with the one given in the PES. This provided an estimate of the number of dwellings found in the survey but missed in the census.

Once a dwelling was located, separate searches were carried out for each person to locate their census form(s). Matching determines whether a person was counted or not counted in the census at each search address. The most important variables available for comparison were:

- name
- date of birth (or age)
- sex.

Other information used included:

- ethnic group
- usual resident or visitor
- household structure and relationships
- address where the respondent completed a census form.

The matching of a person based on two data sources is not an exact science. There are always cases where variables do not agree exactly and yet the records do belong to the same person, so the match is therefore accepted. For example, a woman may have married between the census and the PES, and changed her maiden name to her married name. Therefore, her surname in the census form will not match that in the PES form, but all other data will be the same (ie first name, date of birth, sex and ethnicity). In this case a conclusion that a match has been made appears justified.

The underlying policy for person matching was that unless there is clear evidence that the person under consideration was not counted, they will be regarded as counted at the address being examined. This basic assumption was important to ensure that the number of non-matches is not unduly increased because of inexact matches.

Estimation

Data collected in the PES is used to estimate census coverage for both people and private dwellings. An estimate of the true census population is based on the following equation, which accounts for people either missed or counted more than once in the census:

$$X = \frac{x}{y} Y + S$$

X = PES estimate of the true census population

x = PES estimate of the population who should have been counted in the census less substitutes

y = PES estimate of the population who were counted in the census less substitutes

Y = Census count of the population in private dwellings less substitutes

S = Census count of the population in private dwellings where the whole household was imputed as substitutes

A substitute is a census form created by Statistics NZ where there is sufficient evidence that a person or occupied dwelling exists but Statistics NZ has no corresponding form. Substitute form creation is a method of imputation for unit non-response to the census that is included within the census count. There are different types of substitute forms raised in the census, but in the context of this equation substitutes refer only to persons where the whole household was imputed as substitutes.

Net undercount is the difference between the PES estimate of the true census population and the actual census count.

More details on person and dwelling weights, and weight adjustments are included in Appendix 1.

Sampling and non-sampling errors

Net undercount estimates produced from the PES are subject to both sampling and non-sampling errors. Since only a sample of dwellings was included in the PES, estimates derived from the survey may differ from figures that would be obtained if all dwellings had been included. The sampling error indicates the extent to which an estimate from the PES might have varied by chance because only a sample of dwellings was included.

Because of the limited sample size, it is only possible to provide reliable estimates of undercount for broad groups of the population. Some estimates have high sampling errors, and their use warrants caution. In general, the sampling errors associated with subnational estimates (eg breakdowns by area or ethnic group) are larger than for the national estimate.

The imprecision due to sampling variability is a separate matter from non-sampling errors. Non-sampling errors in surveys typically arise from a variety of sources including non-response, imperfections in reporting by respondents, data collection, and data processing. The impact of these non-sampling errors can be reduced by careful form design, training and supervision of interviewers, and efficient operating procedures. The matching of PES forms to census forms is an additional source of non-sampling error encountered by this survey. When undercount estimates are compared, both sampling and non-sampling error must be kept in mind.

The requirement for independence between the census and the PES (whereby people missed in both census and the PES are assumed to be missing at random) may not always be met and can therefore contribute to non-sampling error. Lack of independence can occur when a person missed in census is more likely to be missed in the PES, for example if they are deliberately avoiding contact with government agencies. As a result, the PES estimates of undercount are likely to be lower than the true value.

Changes in methodology since 2001

The estimation methodology for the 2006 PES includes several improvements over that used in 2001 and 1996. This change in methodology has had some impact on the comparability of undercount estimates between 2006 and earlier PESs. Essentially, the 2006 methodology has reduced bias at the expense of some increase in sampling error. The main changes are described in more detail below.

Eligibility

Not all people responding in the PES are eligible to be included in the estimation formula. Examples of ineligible respondents are babies born after census night, overseas visitors and people who provided inadequate address information for us to search for them in the census. In 2001 a household was deemed eligible if at least one person in the household was eligible. This resulted in some people being included in the estimation formula whose eligibility was not known.

In 2006, the eligibility criteria are determined at the individual level, and so, only people known to be eligible are included in the estimation. The impact of this change is that the undercount should be slightly lower under the 2006 eligibility criteria.

Late returns

In 1996 and 2001, the estimation methodology incorporated special procedures for census forms received after PES interviews had started. We refer to these forms as ‘late returns’. Being selected for the PES may prompt some respondents to return their census forms if they had not already done so at the time of the PES. If this happens, the assumption of independence between the PES and census is violated and the resulting undercount estimate may be too low.

In 2006, difficulties with the census field management meant that the number of census late returns was unable to be accurately determined (that is, we could not always identify whether a census form was returned late or on time). An estimate using the PES sample of the number of census late returns was compared with the available census late return count. After discussion with census field management staff, it was concluded that the PES estimate was of a similar magnitude to the number of late returns that census management believed should have been identified. This similarity of late return counts between PES and census estimates reassured us that there would be no appreciable bias in the PES undercount estimate as a result of not being able to specially treat the late returns.

Weight adjustment

The information collected from the PES sample is combined using weights to provide an estimated undercount for the whole population. In 2001, a person’s ‘weight’ was determined initially by their probability of selection into the PES sample, and then adjusted to account for non-response in the sample.

In 2006, the weight adjustment process has been improved in order to reduce bias which may result from sample imbalance. If the composition of the PES sample does not accurately reflect the characteristics of all New Zealanders, and some subgroups of people are more likely to be undercounted than others, then undercount estimates will be biased unless some adjustment is made.

The weight adjustment process also reduces bias arising from the requirement for independence between census and the PES, because estimation of undercount is performed within smaller subgroups.

The impact of the improvement in weight adjustment is a decrease in bias of the estimated undercount at the expense of a slight increase in sampling error. For more details of the weights and weight adjustments see Appendix 1.

Sampling error calculation

Prior to the 2006 PES, estimates of sampling error were calculated using an approximate analytical formula. The changes to the weight adjustment methodology and standardisation of methods for calculating sampling errors within Statistics NZ has meant that the 2006 PES sampling errors are calculated using a replicated sampling technique. Essentially, replicated sampling is a process by which multiple subsamples are drawn from the PES sample. An undercount estimate is calculated from each of these subsamples and the sampling variance of the total sample is estimated from the variability of the subsample estimates. We do not consider that this change in methodology has had an impact on the size of sampling error.

Chapter 3

Post-enumeration Survey results

This chapter presents and analyses the undercount estimates derived from the 2006 PES. In addition to the aggregate results, the analysis features breakdowns by age, sex, ethnicity and area. Context to the census enumeration environment is also provided.

Analysis of PES results

As outlined in Chapter 2, temporary and non-private dwellings were excluded from the 2006 PES for practical reasons, as were dwellings in remote areas. The 2006 PES sampled individuals in permanent private dwellings only. Although the net undercount rate may be different in dwellings other than permanent private dwellings, the same net undercount rates have been assumed in deriving the undercount estimate for the total population, due to a lack of additional data.

The total population as defined in this report is the estimated 'true' number of New Zealand residents in New Zealand on census night. The total population is therefore equivalent to the census usually resident population count plus the estimated census net undercount of New Zealand residents.

Table 1 shows the 1996, 2001 and 2006 net undercount estimates and the sampling errors for these estimates. Because of the small sample size and the resulting large sampling errors, it has been necessary to aggregate age groups and geographical areas.

Overall, the 2006 Census coverage was high, and this reflects the cooperation and support of the New Zealand public. The 2006 PES estimated that about 98.0 percent of New Zealand residents in the country on census night were counted in the 2006 Census. This represents a net undercount of about 2.0 percent or 81,000 people. The net undercount figure resulted from an estimated gross undercount of 92,000 people (2.2 percent) offset by 11,000 people (0.2 percent) being overcounted. The estimated net undercount for the 2001 PES was 2.2 percent or 85,000 people, and for 1996 PES the net undercount was about 1.6 percent or 60,000 people.

While the 2006 Census counted 4.03 million residents in New Zealand, the 2006 PES results suggest that the number of New Zealand residents in New Zealand on census night was closer to 4.11

Table 1

1996, 2001 and 2006 Post-enumeration Survey Results

Variable	1996 Census usually resident population count (000)	Net undercount 1996			2001 Census usually resident population count (000)	Net undercount 2001			2006 Census usually resident population count (000)	Net undercount 2006		
		(000)	Percent	Sampling error[1] (percent)		(000)	Percent	Sampling error[1] (percent)		(000)	Percent	Sampling error[1] (percent)
Total	3,618	60	1.6	0.2	3,737	85	2.2	0.3	4,028	81	2.0	0.4
Male	1,777	34	1.9	0.3	1,823	48	2.6	0.4	1,966	42	2.1	0.5
Female	1,841	25	1.3	0.2	1,914	37	1.9	0.3	2,062	38	1.8	0.6
0–14 years	832	14	1.7	0.4	848	23	2.7	0.5	868	14	1.6	0.5
15–29 years	808	21	2.5	0.5	752	24	3.1	0.6	814	35	4.1	1.6
30–44 years	834	13	1.5	0.3	862	20	2.3	0.5	892	11	1.3	0.6
45+ years	1,144	12	1.0	0.3	1,275	18	1.4	0.3	1,455	21	1.4	0.5
European[2]	2,879	38	1.3	0.2	2,871	48	1.7	0.3	2,610	37	1.4	0.4
Māori[2]	523	20	3.7	0.7	526	24	4.4	1.0	565	18	3.1	1.2
Asian[2]	174	..	..	..	238	6	2.4	0.8	355	19	5.2	3.4
Pacific peoples[2]	202	8	3.9	1.1	232	13	5.2	1.6	266	6	2.3	1.0
Northern North Island[3]	1,780	35	1.9	0.3	1,896	52	2.7	0.5	2,092	50	2.4	0.7
Southern North Island[4]	938	12	1.3	0.3	934	21	2.2	0.5	968	13	1.3	0.7
South Island	899	12	1.3	0.3	907	12	1.3	0.3	968	17	1.8	0.7

(1) The sampling error indicates the extent to which an estimate from the PES sample might deviate from the true value. For example, there is a 95 percent chance that the true undercount for New Zealand in 2006 would have been between 1.6 and 2.4 percent.

(2) Ethnic figures are based on total responses.

(3) Northland, Auckland, Waikato and Bay of Plenty regional council areas.

(4) Gisborne, Hawke's Bay, Taranaki, Manawatu-Wanganui and Wellington regional council areas.

million. This figure excludes New Zealand residents temporarily away overseas on census night.

Given the small size of the 2006 PES sample, the estimates of net undercount yielded by the survey are subject to sizeable sampling error margins. Therefore the undercount estimates need to be interpreted with caution.

The net undercount of 2.0 percent as estimated by the 2006 PES had a sampling error of 0.4 percent. Hence there is a 95 percent probability that the true population undercount was between 1.6 and 2.4 percent, not allowing for non-sampling error. Similarly, with an overall sampling error of 0.3 percent in the 2001 PES, the 2001 true net undercount was between 1.9 and 2.5 percent. Thus there is no statistically significant difference between 2001 and 2006 results at the national level.

Non-response in the census

Net undercount obtained from the post-enumeration survey is one measure of census non-response. Census has processes that allow known unit non-response to be included. Census counts include counts for missing households, and for people missing within enumerated households, known as substitutes. The combination of net undercount (estimated by PES) and substitutes (counted within census) gives a more complete picture of non-response to census. In 2006, the total census non-response rate was 5.2 percent, compared with 5.0 percent in 2001 and 4.4 percent in 1996 (Table 2). Although the 2006 net undercount was slightly lower than in 2001, this was more than offset by a higher number of substitute forms, resulting in a higher rate of total non-response overall in the 2006 Census.

Imputation for non-response during census processing is common practice internationally. In the 2001 England and Wales Census, however, a very large Census Coverage Survey was used to estimate total non-response in census (Abbott, Diamond and Jackson, 2003). No imputation was undertaken during census processing. The effect of this change in methodology on the undercount rate is apparent in Table 3.

Difficulty of enumeration

Net undercount is also one indicator of the difficulty of census enumeration. Other indicators include:

- gross undercount and gross overcount: undercount and overcount both reflect errors in census enumeration. The sum rather than the net difference is a better indicator of difficulty
- late returns: census forms returned late are an indication of slow response and extended field activity
- substitute form creation.

The number of substitute forms increased from 2001, and the number of late returns was significantly higher. Some form of difficulty with enumeration was encountered for 9.3 percent of the census usually resident population count in 2006, compared with 7.2 percent in 2001 and 6.1 percent in 1996.

International comparison

Given the strategic significance of census data, many countries conduct surveys to measure the coverage of their population census. The Australian Bureau of Statistics, for example, has run evaluation programmes since 1966; the U.S. Census Bureau since 1951; Statistics Canada since 1966; and the

Table 2

Sources of Non-response

For census usually resident population, 1996, 2001 and 2006

Source	1996		2001		2006	
	Number (000)	Percent of estimated total	Number (000)	Percent of estimated total	Number (000)	Percent of estimated total
Census enumerated	3,517	95.6	3,631	95.0	3,895	94.8
Substitute forms						
Substitutes within enumerated households	..	..	27	0.7	38	0.9
Substitutes from missing households	..	..	80	2.1	95	2.3
Plus Total substitutes	102	2.8	107	2.8	133	3.2
Equals Total census usually resident population count	3,618	98.4	3,737	97.8	4,028	98.0
Plus Net undercount	60	1.6	85	2.2	81	2.0
Equals Estimated New Zealand residents in New Zealand on census night	3,678	100.0	3,822	100.0	4,109	100.0

National Statistical Office of the United Kingdom since 1981. Net undercount rates for these four countries and New Zealand at recent censuses are compared in Table 3.

The undercount rate of 2.0 percent for New Zealand's 2006 Census is similar to the rates for Australia and Canada. Differences in undercount rates by sex, age and ethnic minorities have also been found internationally.

However, international comparisons should be interpreted with caution because of the differences in sample size, in enumeration procedures and practices, and in the nature and size of sampling and non-sampling errors. The precise impact of these variations on the undercoverage levels cannot be readily ascertained.

Undercount differentials

Below the national level, there are significant variations in net undercount by age, sex, ethnicity and geographic area. Some population groups are more likely to be missed by the census than others. This section examines the findings of the 2006 PES on the undercount differentials in New Zealand, and compares these with the 2001 and 1996 PES results. Figures 2–5 contain estimated rates of undercount for each subgroup, and sampling error intervals are included to give the range of the true undercount at the 95 percent confidence level.

Males and females

Table 1 shows that the 2006 Census missed fewer females than males – an estimated 38,000 females compared with 42,000 males. Males accounted for about 52 percent of the estimated 81,000 people missed in the census, although they account for less than 49 percent of all New Zealanders.

The net undercount rate was 2.1 percent for males and 1.8 percent for females (Figure 2). In 2001, the net undercount was higher for both males and females, estimated at 2.6 and 1.9 percent, respectively. Given the sampling errors, the 2006 net undercount ranged between 1.6 and 2.6 percent for males and between 1.2 and 2.4 percent for females.

Overseas studies also indicate that males are more likely to be missed in a census than females. For example, in Australia in 2001, the net undercount was 2.2 percent for males and 1.4 percent for females (Australian Bureau of Statistics, 2003). Similarly, in 2001 the Canadian estimated undercount was 4.0 and 2.0 percent for males and females, respectively (Statistics Canada, 2004).

Age groups

Demographic literature also offers a substantial body of evidence on the undercounting of young children and youth in any census (eg Kerr, 1998; West and Robinson, 1999). After young adult males, babies are the next group most likely to be missed

Table 3

Estimated Census Undercount
New Zealand and selected countries

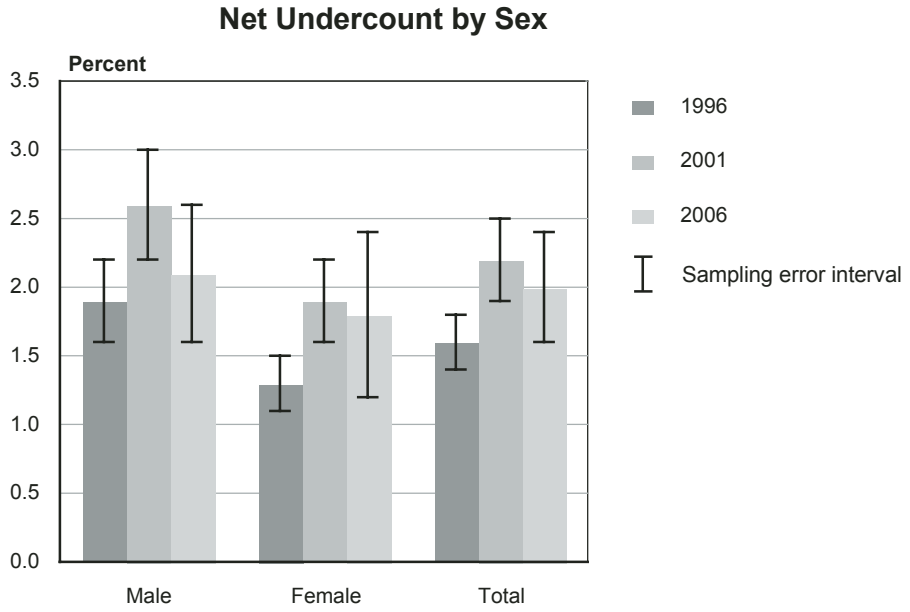
Country	Census year	Number (000)	Percent
Australia	1991	310	1.8
	1996	290	1.6
	2001	350	1.8
Canada	1991	810	2.9
	1996	720	2.4
	2001	920	3.0
New Zealand	**1996**	**60**	**1.6**
	2001	**85**	**2.2**
	2006	**81**	**2.0**
England and Wales	1991	1,100	2.1
	2001	3,100 (1)	6.1 (1)
United States of America	1990	4,000	1.6
	2000	-1,300 R	-0.5 R

(1) Includes 'absent households', which were imputed in previous censuses and therefore not included as undercount in 1991.

Sources: Australian Bureau of Statistics, Office for National Statistics (UK), Statistics Canada, Statistics New Zealand, U.S. Census Bureau.

Note: Negative figure denotes net overcount.

Figure 2



by the census (Simpson and Middleton, 1997). Undercount of babies is significant from a statistical perspective because post-censal estimates based on the unadjusted, or inadequately adjusted base figures, highlight the poorly enumerated birth cohorts, and are of limited value for planning, eg for pre-school education.

When the overall sample size is small, demographers face a difficult task in analysing the PES results by age and other characteristics, because sampling errors are relatively large. For this analysis, age data have been aggregated to four broad age groups: under 15 years (0–14), 15–29 years, 30–44 years, and 45 years and over (45+).

In general, the age differentials in undercount are more pronounced than the gender differentials outlined in the preceding section, with significant variation in the completeness of coverage of age groups (Figure 3). Based on the 2001 experience, young adults (aged 15–29 years), who are quite mobile and therefore have a higher risk of being missed in a census, were identified as a target group in the 2006 Census communication strategy. However, Table 1 shows that about 35,000 people missed by the 2006 Census were in this age group, up from 24,000 in 2001. They accounted for 43 percent of those missed in 2006, although they comprised only 20 percent of all New Zealand residents. Young adults also had the largest sampling error at 1.6 percent, compared with 0.5–0.6 percent for the other age groups. The true net undercount rate for young adults is therefore between 2.5 and 5.7 percent. The net undercount rate for children (aged 0–14 years) in 2006 (1.6 percent) was significantly lower than that recorded in 2001 (2.7 percent). People in the 30–44 years and 45+ age groups had the lowest undercount rates at 1.3 and 1.4 percent, respectively.

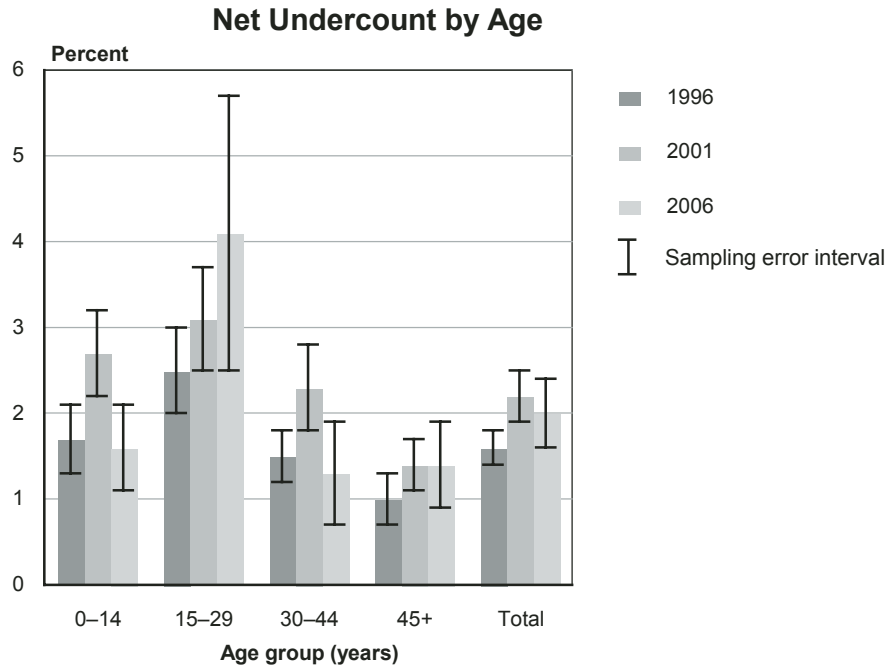
Ethnicity

Ethnic differentials in census undercount are marked. Ethnic minorities, in particular, are likely to be poorly enumerated. In Australia's 2001 PES, the net undercount rate for indigenous Australians was considerably higher than that of non-indigenous Australians (Australian Bureau of Statistics, 2003). Similarly, in 2000 in the United States, where there was an overall net overcount of 0.5 percent, the net undercount rate for Black males aged 30–49 exceeded 8 percent (U.S. Census Bureau, 2003).[1]

In New Zealand, the 2001 PES found that the net undercount was much higher for Māori and Pacific peoples (4.4 and 5.2 percent, respectively) than for the majority European population (1.7 percent). Consequently, for the 2006 Census, Statistics NZ identified that it needed to find more effective methods of reaching Māori, Pacific peoples, and ethnic and youth communities (Statistics New Zealand, 2006). More focus needed to be placed on Auckland, which has a concentration of these groups. Māori and Pacific liaison officers led communications programmes to encourage people to participate, and for the first time, two youth ambassadors (māngai rangatahi) took the 2006 Census message directly to youth. (Further detail on the 2006 Census communication strategy is available in the Statistics NZ report *Introduction to the Census (2006)*.)

(1) The original US estimate of net undercount in the 2000 Census, as obtained by the Accuracy and Coverage Evaluation (ACE) project in March 2001, was 1.2 percent. The ACE Revision II subsequently revised the coverage estimate in the 2000 Census to a net overcount of 0.5 percent (U.S. Census Bureau, 2003).

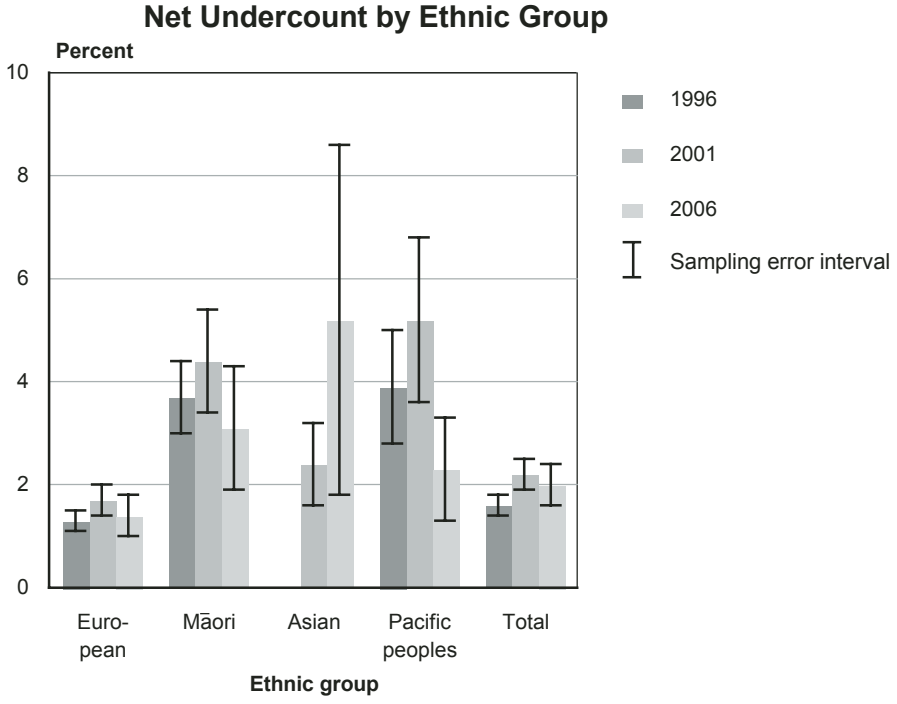
Figure 3



The rates of undercount for European, Māori and Pacific peoples were reduced in 2006, significantly so for Pacific peoples (Figure 4). The Asian ethnic group was the only one to record a higher undercount rate in 2006 than in 2001. The net undercount was highest in 2006 for the Asian ethnic group at 5.2 percent, followed by 3.1 percent for Māori, and 2.3 percent for Pacific peoples. The rate of undercount was again lowest for the European ethnic group (1.4 percent), which makes up about two-thirds of all New Zealanders. The Asian undercount estimate in 2006 was also subject to the largest sampling error of 3.4 percent. The range for the net undercount of this group was therefore 1.8–8.6 percent. In contrast, with sampling error of 0.4 percent, the European ethnic group estimate ranged from 1.0–1.8 percent.

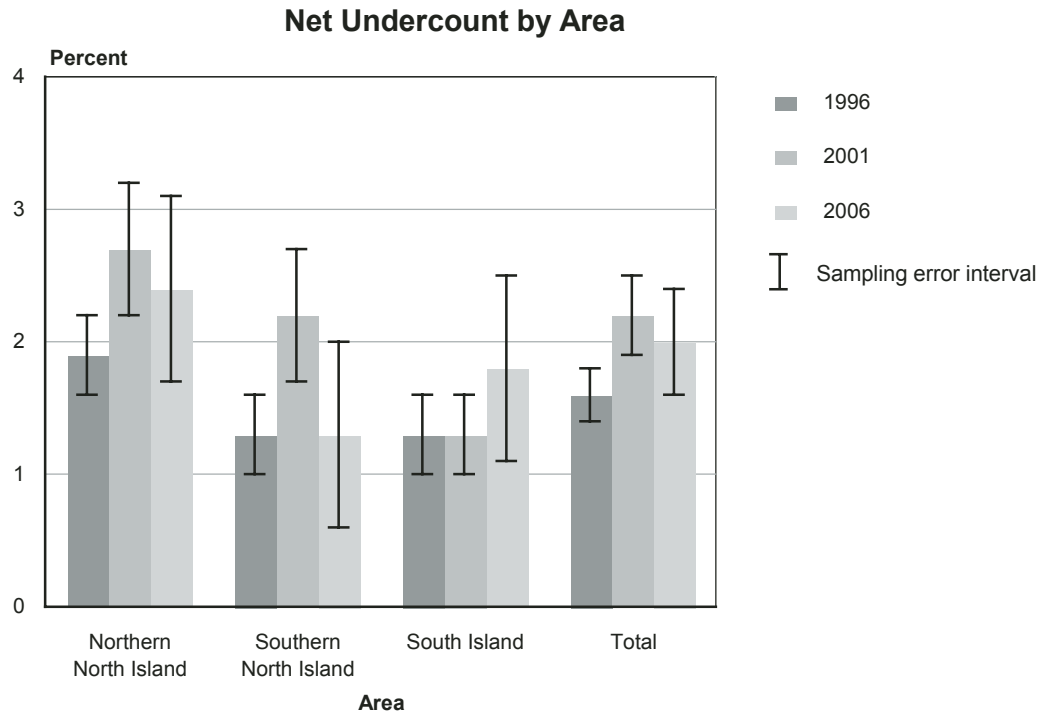
Ethnic differentials in net undercount may be partly attributed to the differences in the age structures of the various groups. Māori, Asian and Pacific peoples have a more youthful population. The Asian

Figure 4



Note: An estimate of the undercount of the Asian ethnic group is not available for 1996.

Figure 5



population under 30 years is concentrated in the 15–29-year age group, with this group comprising nearly one-third of all Asian residents.

Spatial variations

In addition to age and ethnicity, area of residence can be an important determinant of census coverage. Overseas studies indicate significant variations both between and within areas. In 2001 in Australia, for example, state undercount rates ranged between 1.0 and 4.0 percent, while state capitals were better enumerated than the remaining state areas (Australian Bureau of Statistics, 2003).

The rate of undercount for the northern North Island, which consists of the Northland, Auckland, Waikato and Bay of Plenty regions and is home to more than half of all New Zealanders, was 2.4 percent (Figure 5). It exceeded the national figure of 2.0 percent. The net undercount in the southern North Island (Gisborne, Hawke's Bay, Taranaki, Manawatu-Wanganui and Wellington regions) was just 1.3 percent. The undercount rate fell in both the northern and southern North Island areas in 2006, from 2.7 and 2.2 percent, respectively, in 2001. With a net undercount rate of 1.8 percent, the South Island was the only area to record increased undercount in 2006, compared with 2001 (1.3 percent). The higher undercount in the northern North Island may be partly attributed to the differences in the age and ethnic structures of the population. Over half of Māori and about three-quarters of Asian and Pacific peoples reside in the four northernmost regions, compared with less than half of Europeans. The northern North Island also has a higher proportion of its population aged less than 30 years.

Undercoverage of dwellings

The estimated number of permanent private dwellings undercounted by the 2006 Census was about 6,300 or 0.4 percent nationally, compared with 2,400 (0.2 percent) in the 2001 Census and 6,000 (0.5 percent) in the 1996 Census (Table 4). The overall sampling error for dwellings in 2006 was 0.2 percent. Therefore, there is a 95 percent probability that the true dwelling undercount was between 0.2 and 0.6 percent, not allowing for non-sampling error.

Table 4

Undercount of Dwellings
New Zealand

Year	Number	Percent	Sampling error (percent)
1996	6,000	0.5	0.2
2001	2,400	0.2	0.1
2006	6,300	0.4	0.2

Chapter 4

Summary and discussion

This report presented key results from New Zealand's third PES, which was held during 21 March–3 April 2006 following the 2006 Census. Like the first two surveys in 1996 and 2001, its main objective was to gauge the level of national coverage in the census.

"For the 2006 Census, there was a broad public communications programme, using advertising, news media, a series of community programmes and a website. The primary purpose was to provide information about the census and how to take part in a way that had a positive impact on the quantity and the quality of census data collected." (Statistics New Zealand, 2006) The campaign was aimed at the population as a whole, but Statistics NZ had also identified Māori and Pacific peoples, and ethnic and youth communities as target groups. Multiple return methods for the 2006 Census, including Internet and mailback options, provided people with more choice to encourage greater response, and uptake of these options was good.

Overall, census coverage was high. The 2006 Census missed about 81,000, or just 2.0 percent, of the New Zealand residents in the country on census night. This compares with a net undercount of 2.2 percent at the 2001 Census. However, comparisons between 2001 and 2006 should be made with caution. In both the 2001 and 2006 PESs the sample size was small, the sampling error was relatively significant, and the effect of non-sampling errors is unknown. In addition, the 2006 methodology was improved from that used in the earlier surveys. In 2006 the estimate of true net undercount ranged between 1.6 and 2.4 percent, and in 2001 between 1.9 and 2.5 percent. Therefore, the range of estimates is broadly similar for 2001 and 2006.

Statistics NZ's experience with other household surveys suggests that the general public is becoming less willing to cooperate with information gathering. This is reflected in the increasing difficulty of census enumeration, which, in addition to gross undercount and overcount, includes substitute forms and late returns. Some form of difficulty with enumeration was encountered for 9.3 percent of the total census usual resident population count in 2006, compared with 7.2 percent in 2001. Similarly, the total non-response rate to census has increased from 4.4 percent in 1996 to 5.0 percent in 2001, and 5.2 percent in 2006.

As Redfern (2001) suggests, the net undercount in a census "is a function of many factors, including demographic, social and housing structures, public attitudes to the census, the census methods employed and the effectiveness of the instrument used to measure undercount".

The results across subgroups were broadly consistent from 1996 to 2006 and with overseas findings. Females were better enumerated than males. Older age groups were better enumerated than children or young adults. The majority European ethnic group was better enumerated than the Māori, Asian and Pacific ethnic groups.

A PES is one aspect of examining the quality of census output and processes. Results from the 2001 PES contributed to 2006 enumeration plans, and similarly the 2006 PES results will assist Statistics NZ in developing an enumeration strategy for the 2011 Census. A key element of this will need to be continued focus on improving the enumeration of young adults and minority ethnic groups, which are growing at a faster rate relative to the remaining population.

Adjusting the base population

The PES results are integral to the derivation of reliable national and subnational post-censal population estimates and demographic projections. Results from the 2001 PES were used to adjust the population base for net undercount for the purpose of deriving post-censal population estimates (national and subnational) as well as demographic projections. Census counts were not adjusted as such.

Following the approach in 2001, Statistics NZ intends to use an adjusted base population for deriving the post-2006 population estimates and projections. The base population will be adjusted for the census undercount, as estimated by the 2006 PES, and for the estimated number of New Zealand residents temporarily away overseas on census night. Once again, the 'adjustment methodology' is perceived as a restricted statistical initiative. The 2006 Census counts will not be revised in light of the 2006 PES results. Post-censal demographic series will use the estimated resident population at 30 June 2006 as the base population.

The assumption implicit in this approach is that the adjusted estimated resident population base yields a more realistic estimate of the people who, for example, normally reside in an area and use schools, hospitals and other local services, and therefore should be regarded as the target population for most planning, administrative and decision-making purposes.

Appendix 1:

Technical details

This appendix contains technical information relating to the 2006 Post-enumeration Survey estimation, in particular the adjustment to the sample weights.

To put the need for weight adjustments into perspective; consider the estimation formula from Chapter 2.

$$X = \frac{x}{y} Y + S$$

X = PES estimate of the true census population

x = PES estimate of the population who should have been counted in the census less substitutes

y = PES estimate of the population who were counted in the census less substitutes

Y = Census count of the population in private dwellings less substitutes

S = Census count of the population in private dwellings where the whole household was imputed as substitutes

In the equation above, the PES estimates of x and y are calculated by applying weights to each sampled person. Ideally, these weights would result in y, the PES estimate of the population counted in the census, being as close as possible to Y, the actual census count. The weight adjustments aim to do this.

Three different stages in weight adjustments are identified:

Design weight: each sampled dwelling and person within the dwelling has an initial weight which is based on the probability of selection of the dwelling.

Dwelling weight: a weight adjustment is made at the dwelling level to improve the overall estimate of dwelling undercount, and to allow for the fact that certain types of dwelling are more likely than others to be missed in the PES.

Person weight: a final weight adjustment at the person level is applied to improve the overall estimate of undercount for persons, and to allow for the fact that certain categories of people are more likely than others not to respond to the PES.

Details of the three stages of weight creation are provided below.

Design weight

A design weight is assigned to each dwelling to reflect its probability of being selected into the survey.

For sampled dwellings in PSU i in stratum h, we calculate the design weight:

$$\text{design weight} = W_h \times K_{hi}$$

where

$$W_h = \frac{\text{Number of private dwellings in all PSUs in stratum h}}{\text{Number of private dwellings in sampled PSUs in stratum h}}$$

and

$$K_{hi} = \frac{\text{Number of private dwellings in PSU hi}}{\text{Number of sampled private dwellings in PSU hi}}$$

This design weight is also adjusting for the differing size of PSUs in the stratum.

Dwelling weight

For this weight, we do a post-stratification, which achieves two objectives. We post-stratify so that the estimate from the PES sample of the census totals for dwellings matches the corresponding census totals for the post-strata. The choice of post-stratum also allows for differing likelihood that certain types of dwelling will be missed in the PES.

PES dwellings are classified into post-strata based on the region and 'form type' of the census dwelling to which the PES dwelling is matched. Within these post-strata, the design-weights are prorated to represent the counts of those dwelling types in the census. For a dwelling j in PSU i in stratum h in post-stratum g, we calculate:

$$\text{Dwelling Weight}^{g}_{hij} = \text{design weight}_{hi} \times \text{post - stratification factor}^{g}$$

where there are different post-stratification factors for each dwelling type and region combination.

Regions used are Northland, Auckland, Waikato, Bay of Plenty, Gisborne/Hawkes Bay, Taranaki, Manawatu-Wanganui, Wellington, Tasman/Nelson/Marlborough/West Coast, Canterbury, Otago and Southland.

The dwelling type categories (using the status of PES dwellings in the census) are occupied private dwelling and unoccupied private dwelling.

The post-stratification factor for matched dwellings in post-stratum g is

$$\text{Post - Stratification factor}^{g} = \frac{\text{Census Count of private dwellings in post - stratum g}}{\text{Sum of design weights for all PES dwellings in post - stratum g}}$$

Additional post-strata are formed for PES dwellings which are not found or are matched to a non-private dwelling in the census. These dwellings are given a post-stratification factor using an average adjustment from the matched dwellings within each region.

Person weight

This stage of weight adjustment, called calibration, adjusts the weights so that the PES estimate of people counts for some key groups is the same as the census counts for these groups. It simultaneously adjusts for person non-response in the PES. PES respondents matched to a census substitute household are removed from person-level weighting.

In calibration, we begin with a set of initial weights (in this case the dwelling weights) and a set of auxiliary or benchmark variables, with known totals. We aim to produce a set of final weights (in this case the person weights) which add to the totals for the benchmark variables, and which are as close as possible to the initial weights, 'close' being measured by some suitable distance measure.

Weights are adjusted within benchmark groups. These groups are formed so that within a benchmark group the likelihood of a person being missed in the census is unrelated to their being missed in the PES. The PES estimate of the number of times persons were counted in the census is calibrated to the census person counts within a benchmark group. An individual who was not counted in the census has their weight adjusted by the same amount as someone who was counted in the same benchmark group. This means that the units in the population not covered, and potentially not responding to the

PES, are now also represented by individuals who are missed in the census.

The final weight for person k in dwelling j in PSU I and stratum j is calculated as follows:

$$\text{person weight}_{hijk} = \text{dwelling weight}_{hij} \times \text{weight - adjustment}^{*}_{hijk}$$

* This weight adjustment differs for people according to age, sex, ethnicity, region and whether they stated they were overseas on census night.

Each person takes the dwelling weight of the dwelling they are located at during the PES.

Benchmark groups

The benchmark group totals are counts from the 2006 Census of all New Zealand residents whose usual residence is a private dwelling. This count will exclude substitutes. The use of benchmarking means that omissions from the survey population can be allowed for in the estimates.

The benchmark groups used to calibrate the weights in the person-weighting stage are:

- New Zealand residents temporarily overseas on census night
- Sex by age by ethnicity
- Region.

The categories used in the benchmark groups are:

- Sex: male, female
- Ten-year age group: 0–9, 10–19, 20–29, 30–39, 40–49, 50–59, 60–69, 70+years
- Ethnicity: Māori or Pacific ethnicity, or not
- Region: northern North Island, southern North Island, South Island.

The census aims to exclude New Zealand residents who are temporarily overseas on census night. However, some of these people may have filled in a form before they went overseas in which case they contribute to the overcount. The PES includes some of these people who have returned by the time the PES interviewers visit, but we are missing a section of the population that we would want to cover in the PES – namely those who received a census form prior to departure but had not returned in time for selection into the PES. The calibration of weights for persons in the PES who said that they were overseas on census night accounts for this.

Appendix 2:

2006 Post-enumeration Survey form

Statistics New Zealand
TATAURANGA AOTEAROA

PES REFERENCE NUMBER V

CENSUS ADMIN MESHBLOCK

HOUSEHOLD PARTICIPATION CODE

NUMBER OF FORMS OF

NUMBER OF PEOPLE IN **THIS** FORM

INTERVIEWER NAME

OFFICE USE ONLY

SEARCH ADDRESSES

Census Post-Enumeration Survey

21 March - 3 April 2006

THE INFORMATION RECORDED ON THIS QUESTIONNAIRE IS SUBJECT TO THE CONFIDENTIALITY PROVISIONS OF THE STATISTICS ACT 1975.

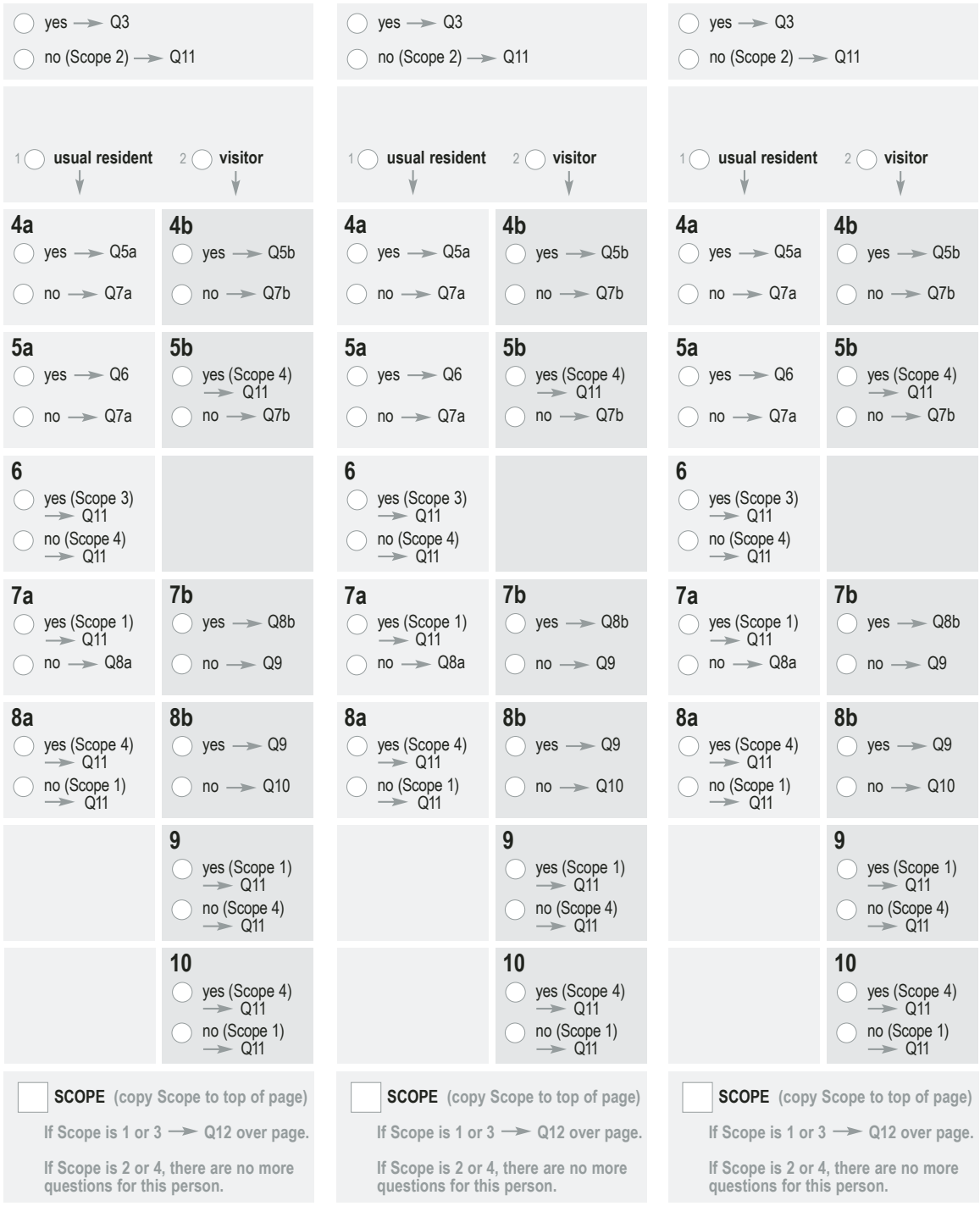
What is the address of this dwelling?

Record telephone number

Area Code

Telephone Number

		PERSON ☐ SCOPE ☐	PERSON ☐ SCOPE ☐
1	**Please could you tell me the names of all the people who usually live here, or who are staying here tonight.** Record all the names.	first names family name	first names family name
2	**Was ..... born before census night, 7 March this year?**	◯ yes → Q3 ◯ no (Scope 2) → Q11	◯ yes → Q3 ◯ no (Scope 2) → Q11
3	**Does ..... usually live here, or is ..... visiting?**	1 ◯ **usual resident** 2 ◯ **visitor**	1 ◯ **usual resident** 2 ◯ **visitor**
	usual resident ↓ / **visitor** ↓	↓ ↓	↓ ↓
4a	Has ..... been overseas within the last 4 weeks?	**4a** ◯ yes → Q5a ◯ no → Q7a	**4a** ◯ yes → Q5a ◯ no → Q7a
4b	Has ..... been overseas within the last 4 weeks?	**4b** ◯ yes → Q5b ◯ no → Q7b	**4b** ◯ yes → Q5b ◯ no → Q7b
5a	Was ..... overseas on census night on Tuesday 7 March?	**5a** ◯ yes → Q6 ◯ no → Q7a	**5a** ◯ yes → Q6 ◯ no → Q7a
5b	Was ..... overseas on census night on Tuesday 7 March?	**5b** ◯ yes (Scope 4) → Q11 ◯ no → Q7b	**5b** ◯ yes (Scope 4) → Q11 ◯ no → Q7b
6	Has ..... returned to New Zealand?	**6** ◯ yes (Scope 3) → Q11 ◯ no (Scope 4) → Q11	**6** ◯ yes (Scope 3) → Q11 ◯ no (Scope 4) → Q11
7a	Will ..... be staying here tonight?	**7a** ◯ yes (Scope 1) → Q11 ◯ no → Q8a	**7a** ◯ yes (Scope 1) → Q11 ◯ no → Q8a
7b	Does ..... live in a private dwelling in New Zealand?	**7b** ◯ yes → Q8b ◯ no → Q9	**7b** ◯ yes → Q8b ◯ no → Q9
8a	Will ..... be away for all of 7 March - 3 April?	**8a** ◯ yes (Scope 4) → Q11 ◯ no (Scope 1) → Q11	**8a** ◯ yes (Scope 4) → Q11 ◯ no (Scope 1) → Q11
8b	Will ..... be away from that place for all of 7 March - 3 April?	**8b** ◯ yes → Q9 ◯ no → Q10	**8b** ◯ yes → Q9 ◯ no → Q10
9	Is here the first private dwelling ..... has stayed at since 21 March?	**9** ◯ yes (Scope 1) → Q11 ◯ no (Scope 4) → Q11	**9** ◯ yes (Scope 1) → Q11 ◯ no (Scope 4) → Q11
10	Is there anybody at that dwelling any night from 21 March - 3 April?	**10** ◯ yes (Scope 4) → Q11 ◯ no (Scope 1) → Q11	**10** ◯ yes (Scope 4) → Q11 ◯ no (Scope 1) → Q11
11	Record person's Scope in the box. If Scope is 1 or 3 → Q12 over page. If Scope is 2 or 4, there are no more questions for this person.	☐ **SCOPE** (copy Scope to top of page) If Scope is 1 or 3 → Q12 over page. If Scope is 2 or 4, there are no more questions for this person.	☐ **SCOPE** (copy Scope to top of page) If Scope is 1 or 3 → Q12 over page. If Scope is 2 or 4, there are no more questions for this person.


yes → Q3
no (Scope 2) → Q11
1 usual resident
2 visitor
4a
yes → Q5a
no → Q7a
4b
yes → Q5b
no → Q7b
5a
yes → Q6
no → Q7a
5b
yes (Scope 4) → Q11
no → Q7b
6
yes (Scope 3) → Q11
no (Scope 4) → Q11
7a
yes (Scope 1) → Q11
no → Q8a
7b
yes → Q8b
no → Q9
8a
yes (Scope 4) → Q11
no (Scope 1) → Q11
8b
yes → Q9
no → Q10
9
yes (Scope 1) → Q11
no (Scope 4) → Q11
10
yes (Scope 4) → Q11
no (Scope 1) → Q11
SCOPE (copy Scope to top of page)
If Scope is 1 or 3 → Q12 over page.
If Scope is 2 or 4, there are no more questions for this person.

12 **Is ..... male or female?**

1 ◯ male
2 ◯ female

1 ◯ male
2 ◯ female

13 **What is ..... date of birth?**

IF DOB unknown, give age last birthday.

day ☐☐ month ☐☐ year ☐☐☐☐

age last birthday ☐☐☐

day ☐☐ month ☐☐ year ☐☐☐☐

age last birthday ☐☐☐

14 **Which ethnic group does ..... belong to?**

Tick all that apply.

11 ◯ New Zealand European
21 ◯ Māori
31 ◯ Samoan
32 ◯ Cook Island Maori
33 ◯ Tongan
34 ◯ Niuean
42 ◯ Chinese
43 ◯ Indian
◯ other such as Dutch, Japanese, Tokelauan. Please state:

11 ◯ New Zealand European
21 ◯ Māori
31 ◯ Samoan
32 ◯ Cook Island Maori
33 ◯ Tongan
34 ◯ Niuean
42 ◯ Chinese
43 ◯ Indian
◯ other such as Dutch, Japanese, Tokelauan. Please state:

15 **Where does ..... usually live?**

1 ◯ here
2 ◯ overseas
3 ◯ elsewhere in New Zealand. Please state address:

1 ◯ here
2 ◯ overseas
3 ◯ elsewhere in New Zealand. Please state address:

1 male
2 female

day month year

age last birthday

11 New Zealand European
21 Māori
31 Samoan
32 Cook Island Maori
33 Tongan
34 Niuean
42 Chinese
43 Indian
other such as Dutch, Japanese, Tokelauan. Please state:

1 here
2 overseas
3 elsewhere in New Zealand. Please state address:

1 male
2 female

day month year

age last birthday

11 New Zealand European
21 Māori
31 Samoan
32 Cook Island Maori
33 Tongan
34 Niuean
42 Chinese
43 Indian
other such as Dutch, Japanese, Tokelauan. Please state:

1 here
2 overseas
3 elsewhere in New Zealand. Please state address:

1 male
2 female

day month year

age last birthday

11 New Zealand European
21 Māori
31 Samoan
32 Cook Island Maori
33 Tongan
34 Niuean
42 Chinese
43 Indian
other such as Dutch, Japanese, Tokelauan. Please state:

1 here
2 overseas
3 elsewhere in New Zealand. Please state address:

16 **What address was ..... staying at on census night, that is on 7th March this year?**	1 ◯ here 2 ◯ at the address given in Q15 3 ◯ elsewhere. Please state address:	1 ◯ here 2 ◯ at the address given in Q15 3 ◯ elsewhere. Please state address:
17 **Did ..... fill out a census form or have one filled out for (you / her / him)?**	1 ◯ yes → Q18 2 ◯ no → Q19	1 ◯ yes → Q18 2 ◯ no → Q19
18 **At what address did that happen?**	1 ◯ here 2 ◯ at the address given in Q15 3 ◯ at the address given in Q16 4 ◯ elsewhere. Please state address:	1 ◯ here 2 ◯ at the address given in Q15 3 ◯ at the address given in Q16 4 ◯ elsewhere. Please state address:
19 **Could ..... have filled out a census form or have had one filled out for (you / her / him) anywhere else?**	1 ◯ yes → Q20 2 ◯ no → Q24	1 ◯ yes → Q20 2 ◯ no → Q24
20 **At what address could that have happened?**	1 ◯ here 2 ◯ at the address given in Q15 3 ◯ at the address given in Q16 4 ◯ elsewhere. Please state address:	1 ◯ here 2 ◯ at the address given in Q15 3 ◯ at the address given in Q16 4 ◯ elsewhere. Please state address:

1 ◯ here
2 ◯ at the address given in Q15
3 ◯ elsewhere. Please state address:

1 ◯ yes → Q18
2 ◯ no → Q19

1 ◯ here
2 ◯ at the address given in Q15
3 ◯ at the address given in Q16
4 ◯ elsewhere. Please state address:

1 ◯ yes → Q20
2 ◯ no → Q24

1 ◯ here
2 ◯ at the address given in Q15
3 ◯ at the address given in Q16
4 ◯ elsewhere. Please state address:

1 ◯ here
2 ◯ at the address given in Q15
3 ◯ elsewhere. Please state address:

1 ◯ yes → Q18
2 ◯ no → Q19

1 ◯ here
2 ◯ at the address given in Q15
3 ◯ at the address given in Q16
4 ◯ elsewhere. Please state address:

1 ◯ yes → Q20
2 ◯ no → Q24

1 ◯ here
2 ◯ at the address given in Q15
3 ◯ at the address given in Q16
4 ◯ elsewhere. Please state address:

1 ◯ here
2 ◯ at the address given in Q15
3 ◯ elsewhere. Please state address:

1 ◯ yes → Q18
2 ◯ no → Q19

1 ◯ here
2 ◯ at the address given in Q15
3 ◯ at the address given in Q16
4 ◯ elsewhere. Please state address:

1 ◯ yes → Q20
2 ◯ no → Q24

1 ◯ here
2 ◯ at the address given in Q15
3 ◯ at the address given in Q16
4 ◯ elsewhere. Please state address:

21 **Is there any other address where that could have happened?**	1 ◯ yes 2 ◯ no → Q24 Please state:	1 ◯ yes 2 ◯ no → Q24 Please state:
22 **Any other addresses?**	1 ◯ yes 2 ◯ no → Q24 Please state:	1 ◯ yes 2 ◯ no → Q24 Please state:
23 **Any other addresses?**	1 ◯ yes 2 ◯ no → Q24 Please state:	1 ◯ yes 2 ◯ no → Q24 Please state:
24 **Person Participation Code**	1 ◯ full response 2 ◯ full refusal 3 ◯ part refusal 4 ◯ non-contact	1 ◯ full response 2 ◯ full refusal 3 ◯ part refusal 4 ◯ non-contact

1 ◯ yes 2 ◯ no → Q24
Please state:

1 ◯ yes 2 ◯ no → Q24
Please state:

1 ◯ yes 2 ◯ no → Q24
Please state:

1 ◯ yes 2 ◯ no → Q24
Please state:

1 ◯ yes 2 ◯ no → Q24
Please state:

1 ◯ yes 2 ◯ no → Q24
Please state:

1 ◯ yes 2 ◯ no → Q24
Please state:

1 ◯ yes 2 ◯ no → Q24
Please state:

1 ◯ yes 2 ◯ no → Q24
Please state:

1 ◯ full response
2 ◯ full refusal
3 ◯ part refusal
4 ◯ non-contact

1 ◯ full response
2 ◯ full refusal
3 ◯ part refusal
4 ◯ non-contact

1 ◯ full response
2 ◯ full refusal
3 ◯ part refusal
4 ◯ non-contact

	Office use	Office use

PERSON SCOPE	PERSON SCOPE	PERSON SCOPE
first names	first names	first names
family name	family name	family name
Office use	Office use	Office use

HOUSEHOLD PARTICIPATION CODES

01 Full response

02 Full refusal

03 Part refusal

04 Confirmed occupants away for survey period

05 Non-contact, unable to contact household

06 Part non-contact

07 Cannot interview due to illness / death

08 All persons out on scope

09 Vacant dwelling

10 Dwelling under construction

11 Non-dwelling / non-private

12 Dwelling derelict / demolished

Please give non-participation details / comments

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