

Post-enumeration Survey: 2013

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Key facts

Coverage results from the Post-enumeration Survey (PES) for the 2013 Census show that:

- The census counted 97.6 percent of New Zealand residents in the country on census night, 5 March 2013, with a sampling error of ± 0.5 percent.
- The national net undercount was 2.4 percent, or 103,800 people.
- The gross undercount was 135,500 people, offset by a gross overcount of 31,700 people (those counted more than once).
- Males (2.6 percent) had a higher percentage undercount than females (2.1 percent).
- Younger adults aged 15–29 years (4.8 percent) had a higher percentage undercount than other age groups.
- People aged 65 years and over had the lowest percentage undercount by age group, at 0.5 percent.
- The percentage undercount for Māori (6.1 percent) and Pacific peoples (4.8 percent), with young age structures, was higher than for Asian (3.0 percent) and European (1.9 percent).
- The northern North Island had an undercount of 3.0 percent, compared with 1.3 percent for the rest of the North Island and 2.2 percent for the South Island.
- The census response rate was 92.9 percent of the estimated population of New Zealand residents in the country on census night.

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Commentary

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National net census undercount of 2.4 percent

Overall, coverage in the 2013 Census was high, reflecting the cooperation and support of the New Zealand public, and the high-quality work of field staff. The 2013 Post-enumeration Survey (PES) showed that about 97.6 percent of New Zealand residents in the country on census night were counted in the 2013 Census. This means there was a net undercount of 2.4 percent, or 103,800 people. The net undercount figure results from an estimated gross undercount of 135,500 people (3.1 percent), offset by 31,700 people (0.7 percent) being counted more than once (overcount). See table 1 for detailed results.

Given the small size of the sample, the net undercount figures provided by the 2013 PES are subject to sizeable error margins, called the sampling error. Therefore, the undercount estimates need to be interpreted with caution. The overall sampling error was 0.5 percent. This means we are 95 percent confident that the undercount lies between 1.9 and 2.9 percent, not allowing for non-sampling error.

International comparison

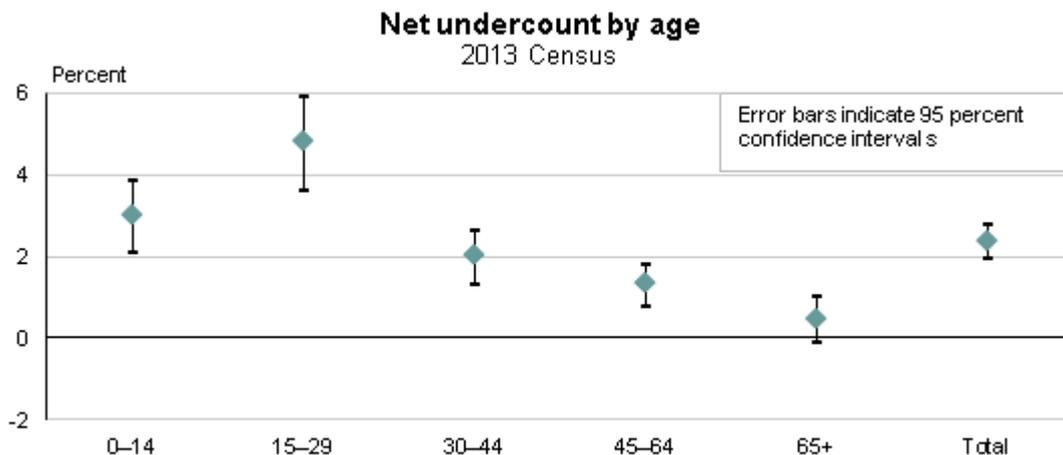
Under-enumeration is a phenomenon shared by many census-taking nations. New Zealand's net undercount rate is comparable with the most recent rates available for other countries. For example, the net undercount for the 2011 Canadian census was 2.3 percent, and for the 2011 Australian census it was 1.7 percent. The methodology used in each country differs in many important ways, so treat international comparisons with caution.

Sex and age: Undercount higher for males and young adults

There were variations in net undercount by sex and age. The 2013 Census missed more males than females, as did the three previous censuses. With a net undercount of 2.6 percent for males and 2.1 percent for females, the difference of 0.5 percentage points between the sexes was smaller than those in 1996 (0.6 percentage points) and 2001 (0.7 percentage points), but larger than in 2006 (0.3 percentage points).

Young adults (aged 15–29 years) had the highest net undercount, of 4.8 percent. Children (aged 0–14 years) had an undercount rate of 3.0 percent, well below that for young adults. New Zealanders aged 30 years and over were well enumerated, with net undercount rate of 2.0 percent for those aged 30–44 years, 1.3 percent for those aged 45–64 years, and just 0.5

percent for those 65 years of age and older. The relatively high level of undercount for young adults is shared with other comparable countries.



Source: Statistics New Zealand

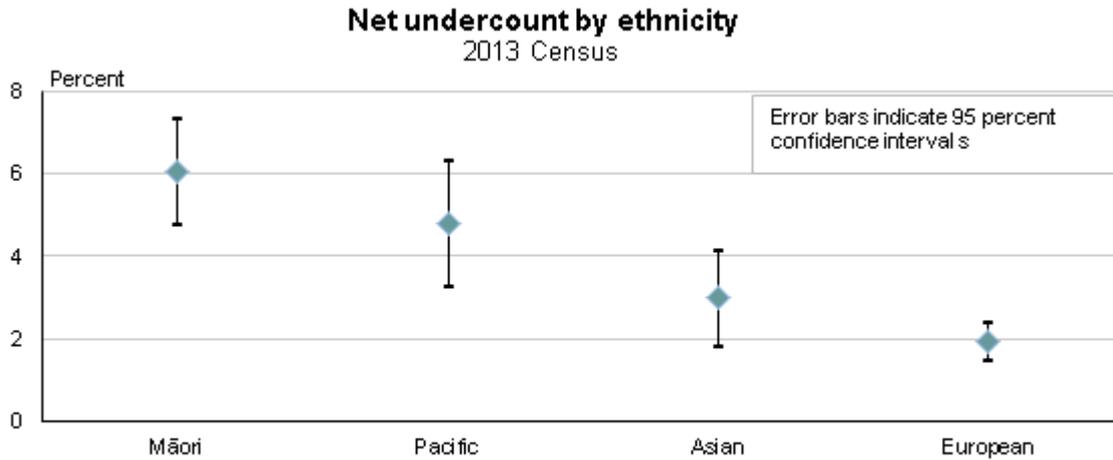
Ethnic groups

Undercount continues to vary between ethnic groupings. Care is required when comparing the ethnic undercount rates with other undercount rates in this information release and with previous PESs, because of methodological differences. The rates given in this section, however, are comparable with each other. This enables us to understand the relative undercount for each ethnic grouping.

The net undercounts by ethnicity were:

- Māori – 6.1 percent
- Pacific – 4.8 percent
- Asian – 3.0 percent
- European – 1.9 percent.

The major change between 2006 and 2013 was among the Asian population, with the undercount halved. This may be related to the drop in the number of international students over the period. International students are frequently missed by censuses or miscoded as overseas residents. Also, being predominantly in the young adult age groups, students have a higher likelihood of not being counted in the census. Sampling errors were high for people of Asian ethnicity in 2006, so treat the 2006 result for this group with caution.



Source: Statistics New Zealand

Geographic area: Undercount highest in northern North Island

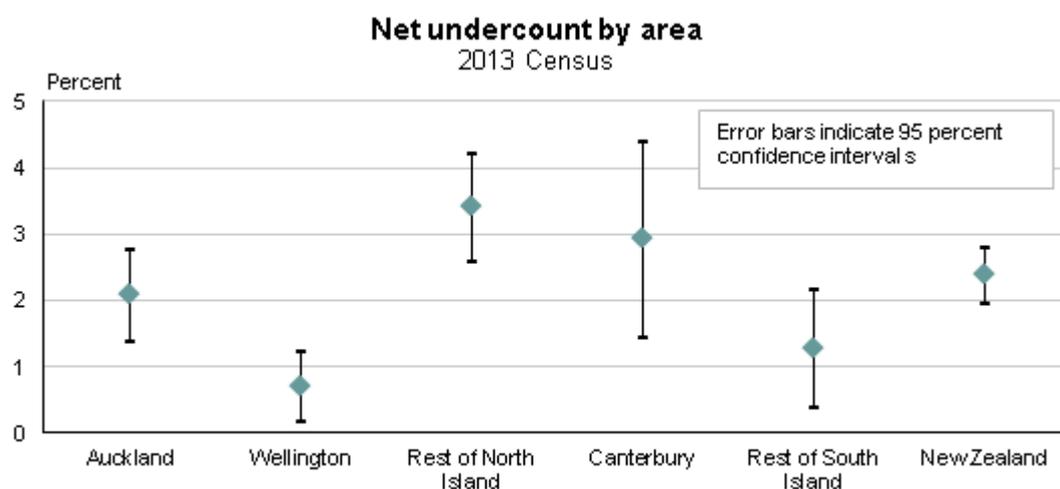
The level of undercount was highest in the northern half of the North Island, at 3.0 percent. The northern North Island is made up of the highly diverse regions of Northland, Auckland, Waikato, and Bay of Plenty. This compares with the undercounts for the rest of the North Island at just 1.3 percent, and the South Island at 2.2 percent.

Differences in undercount by area can be partly attributed to the ethnic and age composition of the population, notably in the case of the northern North Island. The northern North Island not only contains over half of the total New Zealand population, it also has a higher proportion of its population under 30 years of age, at 42 percent, compared with the rest of the North Island (40 percent) and the South Island (38 percent).

Among the major population centres within these broad regions:

- Auckland region had a net undercount of 2.1 percent
- Wellington region had a very small net undercount, at 0.7 percent
- Canterbury region had a net undercount of 2.9 percent.

The undercount for the rest of the North Island, excluding Auckland and Wellington regions, was 3.4 percent, compared with 1.3 percent for the rest of the South Island excluding Canterbury.



Source: Statistics New Zealand

Response rate

The response rate is the proportion of eligible households who responded to the PES interviewers. A responding household was one where there was at least one fully responding eligible person. The 2013 PES had a response rate of 87 percent, which was below the target rate of 90 percent, but is comparable with other household surveys conducted by Statistics NZ.

Census targets

The 2013 Census had established a set of indicators to measure the success of census enumeration and processing. Census did not meet either the coverage or the response rate targets. PES estimated that the national coverage rate of 97.6 percent was just below the target for coverage of 98.0 percent. The PES also found that the achieved census national response rate of 92.9 percent was below the target of 95.0 percent.

Reasons for census undercount and overcount

Reasons for undercount (people and dwellings being missed) in the census include newborn babies being overlooked, people shifting from one house to another around census time or deliberately avoiding the collector, occupied dwellings misclassified as unoccupied, and dwellings missed by collectors.

Situations where overcount can occur include children living in joint custody with both parents completing forms for the same child, or children attending boarding school, people with dual residences, unoccupied dwellings misclassified as occupied, and residents who are temporarily overseas on census night.

Census substitute records and PES

The methodology used for the 2013 PES enabled a partial investigation of the substitute records raised by the 2013 Census. Previous PESs assumed that the number of substitutes created was correct. This was recognised as a missed opportunity with implications for the interpretation of census coverage. So long as the number of substitute records remained relatively small in

census, this had been a less significant problem. However, a total of over 203,000 substitute records were raised in the 2013 Census.

This was more than in previous years. Of these, 135,000 were in private households where all members and the dwelling form were substitutes (referred to as 'an all-substitute dwelling'). For the first time, the 2013 PES measured the validity of this process in cases where the PES recorded a match to both a substitute record in an all-substitute dwelling and a record found elsewhere. This allowed us to identify and adjust for an incorrectly raised substitute form. The 2013 PES found that the 2013 Census raised approximately 15,000 too many substitute records of this type.

Undercount estimates for ethnic groups were not adjusted in this way because we do not impute ethnicity in census.

[Understanding substitution and imputation in the 2013 Census](#) has more information about substitutes and imputation of key variables.

Non-response to 2013 Census was 7.1 percent

The combination of net undercount, estimated by PES, and substitute records, counted in census, give a more complete measure of non-response to census. In 2013, the non-response to census was 7.1 percent of the PES estimated resident population on census night. In 2006, the non-response to census was 5.2 percent. In 2001, it was 5.0 percent. While the undercount has remained between 2.0 percent and 2.5 percent over this time, the number of substitute records has increased, resulting in higher non-response.

PES helps form the base for post-censal population estimates and projections

The 2013 Census counts will not be revised in light of the 2013 PES results. However, the 2013 PES results are a key part of the 2013-base estimated resident population (ERP). The ERP 2013-base uses the 2013 Census and PES results, together with adjustments for residents temporarily overseas on census night and components of change (births, deaths, and migration) between census date and 30 June 2013. The ERP 2013-base is the starting point for deriving population estimates and projections, until a new base is derived after the next census.

The 2013-base estimated resident population will be released on 14 August 2014. At this time the population estimates for June 2013 to March 2014 quarters, currently based on the 2006 Census, will be superseded by 2013-base estimates. Population projections using the new 2013 base will follow from November 2014.

For more detailed data from the Post-enumeration Survey see the Excel tables in the 'Downloads' box.

Definitions

About the Post-enumeration Survey

The 2013 Post-enumeration Survey (PES) was the fourth to be undertaken in New Zealand. The first was in 1996. The 2013 PES, like its predecessors, was a sample survey of individuals in private dwellings.

The main objective of the 2013 PES was to measure the level of national coverage (undercount and overcount) in the 2013 Census.

Other definitions

Coverage: measures of the proportion of the population actually counted of the population that should have been counted. Coverage is usually expressed as a percentage of the estimated population that was counted.

Net undercount: is the gross undercount minus the gross overcount. The census net undercount is a measure of the difference between the number of people counted by census and the number estimated as eligible to be counted. That is, a measure of the difference between people missed by census and those counted more than once.

Overcount: the number of people counted more than once. This can happen if someone is away from home on census night and completes their own form at the same time as someone else completes a form on their behalf.

Response rate: the survey response rate is the proportion of eligible households who responded to the PES interviewer. A responding household was one where there was at least one fully responding eligible person.

Substitute record: substitute individual records are individual census records created where there is sufficient evidence that a person exists, but we have not received an individual census form for them.

Undercount: the number of people that were not been counted, when they should have been.

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Related information

[Census](#) has links to reports and further information.

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About the PES

The 2013 Post-enumeration Survey (PES) was the fourth to be undertaken in New Zealand. The first was in 1996. The 2013 PES, like its predecessors, was a sample survey of individuals in private dwellings. The survey was carried out between 9 April and 10 May 2013 and included just over 14,900 dwellings and nearly 32,700 individuals.

The main objective of the 2013 PES was to measure the level of national coverage (undercount and overcount) in the 2013 Census. Counting more than 4 million people throughout New Zealand is a major undertaking, and inevitably some people are missed or counted more than once by the census.

Many countries conduct surveys to estimate the number of people who were not enumerated or were overcounted by their censuses. Experience from previous PESs in New Zealand, access to new information and international developments, and advances in methodology help us improve the accuracy and robustness of these surveys.

A post-enumeration survey is one way of examining the effectiveness of the census data collection and any implications for quality of census output. Results from the 2006 PES contributed to 2013 Census development, and similarly the 2013 PES will help us develop collection strategies for future censuses.

The environment for collecting data is becoming more difficult. The New Zealand population has become more diverse in terms of ethnicity, living arrangements, and lifestyles, and people are becoming more difficult to contact. We have continued to develop and enhance initiatives to encourage people to participate in census. These included public communication campaigns via advertising and community liaison, and developing the option (first provided in 2006) for people to complete their forms online. Thirty-four percent of people completed their forms online in 2013. Results from the 2013 PES provide assurance that through initiatives such as these, the census can be carried out effectively and efficiently in an increasingly complex environment.

A PES provides the census coverage information required to calculate a reliable population base for deriving post-censal population estimates and projections. The 2013 Census usually resident population counts will be used with the estimated net undercount (undercount less overcount), as part of the adjustments necessary to derive the estimated resident population of New Zealand at

30 June 2013. This forms the base population for estimating changes in the resident population until the next census and for the 2013-based population projections.

This first release provides an overview of the results and the methods used by the survey. A full report on the results and supporting information on the 2013 PES will be released in August 2014.

Objectives

The Post-enumeration Survey (PES) measures the level of coverage (overcount and undercount) for both people and private dwellings in the census. Coverage measures are the key performance indicators for the 2013 Census of Population and Dwellings.

The PES produces estimates of net undercount (ie, gross undercount minus gross overcount) for the following key population groups:

- total population
- sex (male, female)
- age (0–14 years, 15–29 years, 30–44 years, 45–64 years, and 65+ years)
- ethnicity (European, Māori, Pacific, Asian and 'other', which combines both remaining two high level groupings of ethnicities: Middle Eastern/Latin American/African (=MELAA) and Other)
- geographical area (in two groups: (1) northern North Island (ie, Northland, Auckland, Waikato, Bay of Plenty regional council areas), southern North Island, South Island, and (2) Auckland region, Wellington region, rest of North Island, Canterbury region, rest of South Island).

The survey period was chosen to avoid census collectors and PES interviewers being in the field at the same time, yet remaining close enough to census date (5 March 2013) to assist accurate respondent recall.

Source of data

The 2013 PES was based on a stratified, multi-stage sample of approximately 15,000 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. 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.

Sample design

The sampling process was complex. The geographical framework of New Zealand consists of 46,637 meshblocks. A meshblock in an urban area is usually a 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 sampling purposes, these meshblocks are aggregated into 21,813 primary sampling units

(PSUs). To improve the sampling efficiency, we put these units into 127 groups (or strata) based on region, urban/rural mix, ethnic population, and other socioeconomic variables (income, employment status, population aged 65 years and over).

We randomly selected PSUs across the 127 strata, with oversampling in strata containing people who were deemed more difficult to count in census. The 2013 PES sample was made up of 1,299 PSUs, with a total of almost 15,000 dwellings (or about 0.9 percent of total permanent private dwellings in New Zealand).

Survey form and interview

The 2013 PES visited almost 15,000 households in areas throughout New Zealand, from 9 April to 10 May 2013. Our field interviewers asked each respondent demographic questions (date of birth or age, ethnicity, sex) and questions about their usual address and their address on census night. Interviewing usually took between 10 and 15 minutes per household. Respondent information was recorded on a paper questionnaire.

This information is used to locate a census record for each respondent to determine whether or not they were counted (or double-counted) in the census. The PES does not evaluate the quality of census responses. Under the Statistics Act 1975, respondents must provide the information requested for the PES.

Methodology

We matched respondents in the PES to census forms by comparing the information given by PES respondents with the information given on census forms. We estimate measures of undercount and overcount from the results obtained in the matching procedure.

Two major changes from the 2006 PES are the increased sample size (15,000 dwellings, up from 11,000) and the introduction of automatic matching of records to supplement clerical matching between PES and census. The net undercount estimates produced from the PES are subject to both sampling and non-sampling errors. The enhanced sample size aimed to reduce the sampling error of coverage estimates. Introducing automatic matching significantly improved the quality of matching.

In 2013, a new automatic matching procedure used data integration software to electronically link PES records to census records. Previous matching was done manually only. This reduced dependence on the quality of address information and meant we could cast our net wider in searching for PES respondents in census.

Matching was done to determine if a PES respondent was counted in the census at the address at which they were interviewed in the PES, or at each address where a census form may have been completed for them. If an address given on the census form was different from the PES address, we performed a search to find the address.

The estimation methodology for the 2013 PES includes several improvements over that used in 2006, 2001, and 1996. The main change was to include a dwelling weighting step to adjust for dwelling-level non-response in the PES. This enables us to take into account the extra information we have about census attributes of dwellings found in the census.

Estimation and adjustment

Each person in the sample has a selection weight that reflects their probability of selection into the sample. We adjust these selection weights to compensate for non-response in the PES and to reduce bias that may result from sample imbalance. If 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. We combine the information collected from the PES sample using these adjusted weights to provide an estimated undercount for the whole population.

Substitute records

Substitute individual records are individual census records we create if there is sufficient evidence that a person exists but we have no corresponding individual form.

[Understanding substitution and imputation in the 2013 Census](#) has more information about substitutes and imputation of key variables.

Sampling error

Net undercount estimates produced from the PES are subject to sampling error. Since only a sample of dwellings was included in the PES, our estimates 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, we can only provide reliable estimates of undercount for broad groups of the population. Some estimates have high sampling errors, so be cautious when using these. In general, the sampling errors associated with subnational estimates (eg breakdowns by area or ethnic group) are larger than for the national estimate. When comparing undercount estimates, keep both sampling error and non-sampling error in mind.

Non-sampling error

Non-sampling errors in surveys typically arise from a number 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 is an additional source of non-sampling error encountered by this survey.

The requirement for independence between census and the PES – where people are randomly missed by census or the PES – may not always be met and can therefore contribute to non-sampling error. Lack of independence can occur when a person missed in the 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 undercoverage are likely to be lower than the true undercount.

Matching impact study

A matching impact study (MIS) was done on a subsample of 2,000 PES dwellings. This study evaluated the new method of predominantly automated electronic matching against the manual-only method that had been used in 2006 to measure the effect of the change in method.

The MIS verified that the 2013 PES results improved the quality of matching. The overall impact is a reduction in the net census undercount from the new method because we could find more people who gave vague or inaccurate census-night addresses in the PES. In the MIS, the national net undercount rate was estimated to be 3.9 percent (+/- 0.6 percent) using the 2006 method, compared with 2.4 percent (+/- 0.5 percent) using the new method.

More information

[See more information about Post-enumeration Survey](#)

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Correction

1 July 2014

When we published this release on 27 May 2014, the data quality section had an error.

Under the 'Matching impact study' subheading the text originally said:

"In the MIS, the national net undercount rate was estimated to be 3.9 percent (+/- 0.5 percent) using the 2006 method, compared with 2.4 percent (+/- 0.5 percent) using the new method."

On 1 July 2014 we corrected the 2006 sampling error percentage, so it now says:

"In the MIS, the national net undercount rate was estimated to be 3.9 percent (+/- 0.6 percent) using the 2006 method, compared with 2.4 percent (+/- 0.5 percent) using the new method."

We apologise for any inconvenience caused.

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Tables

The following tables are available in Excel format from the 'Downloads' box. If you have problems viewing the files, see [opening files and PDFs](#).

1. Summary of coverage statistics, 2013
2. Population counts, undercounts, and coverage rates, 1996–2013