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Census 91: Data Quality
Undercount**

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**CENSUS OF POPULATION AND HOUSING, 6 AUGUST 1991
CENSUS 91: DATA QUALITY — UNDERCOUNT**

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INQUIRIES

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MAIN FINDINGS

This publication provides details of the population and dwelling characteristics of the undercount in the 1991 Census of Population and Housing held on 6 August 1991 and the method used for measuring the extent of undercounting.

Person Undercount

The 1991 Census missed 1.8 per cent of persons who should have been counted. The extent of undercounting in the 1991 Census was slightly lower than in the 1986 Census (1.9%).

The extent of undercounting varied for different population groups. The groups identified as having the highest rates of undercounting included:

- persons in the Northern Territory — undercounted by 4.1 per cent. Western Australia had the next highest rate of undercounting (2.1%).
- persons not at their usual address on census night 1991 (14.1%). This compares with an undercount rate of 1.2 per cent for those at home on census night.
- persons living outside metropolitan areas (2.2%), compared with an undercount rate of 1.7 per cent for persons living in Australia's capital cities.
- persons aged 20–24 years (3.6%).
- persons born in New Zealand (3.5%). In comparison, the rate of undercounting for persons born in Australia was 1.8 per cent, the United Kingdom and Ireland 1.6 per cent, Italy 1.3 per cent, the Netherlands 1.1 per cent, Greece 1.0 per cent and Germany 0.9 per cent.

Aboriginal and Torres Strait Islander people have also been identified as a group having a high rate of undercounting (greater than 5.0%) (see paragraph 2.3).

Dwelling and Household Undercount

The extent of dwelling and household undercounting varied between States and Capital City/Balance of State.

Balance of State areas in Australia recorded the highest rates of undercounting for dwellings (2.2% compared with 0.8% for Capital Cities).

The overall underenumeration of households was low, with undercount rates of 0.7 per cent for both Capital City and Balance of State.

South Australia's and Western Australia's Balance of State had the highest levels of dwelling and household undercount.

1. MEASURING UNDERCOUNT IN THE 1991 CENSUS

Introduction

- 1.1 While every attempt is made in the census to achieve a complete count of both dwellings and persons, it is inevitable that some will be missed and some will be counted more than once.
- 1.2 Persons and dwellings can be missed from the census count for a number of reasons. For example, where a dwelling is counted some of the occupants in the dwelling, such as visitors, may be missed. If a collector is unable to make contact with the residents of a dwelling, it may be misclassified as unoccupied, which also leads to the persons present not being included in the census. Where separate dwellings are difficult to identify — such as 'granny flats' — a complete dwelling and all its occupants may be missed. Conversely, someone away from home on census night could be counted more than once if they were inadvertently included on a census form at their home address as well as at the actual address where they were staying.
- 1.3 In Australia, more people and dwellings are missed from the census than are counted more than once. The net effect when both factors are taken into account is referred to in this information paper as undercounting. Undercounting can bias census counts because the characteristics of missed persons may be different from those of counted persons. In Australia, rates of undercounting vary significantly for different population groups depending on factors such as age, sex and geographic area.

Difference between census counts and estimated resident population

- 1.4 Table 1 shows how census counts are adjusted to derive estimates of the resident population. These estimates are made on a usual residence basis. Usual residence counts for a State/Territory are obtained from census counts at place of enumeration by:

- adding the number of usual residents of a State or Territory who were counted elsewhere in Australia;
- subtracting the number of persons who usually reside in other States/Territories; and
- subtracting the number of persons who usually reside overseas.

The Estimated Resident Population is then derived by:

- adjusting the usual residence census counts for undercounting; and
- adding the number of Australian residents who have been estimated to be temporarily overseas on census night.

TABLE 1. COMPONENTS OF ESTIMATED RESIDENT POPULATION: STATES, TERRITORIES AND AUSTRALIA, 6 AUGUST 1991 ('000 Persons)

	NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT	Aust.
Census Count (Place of enumeration)	5,732.1	4,244.3	2,977.9	1,400.6	1,586.8	452.8	175.9	280.1	16,850.5
+ Residents absent interstate	57.4	77.5	22.6	23.0	12.5	8.1	2.8	8.6	212.5
- Interstate visitors	49.7	22.4	86.9	11.2	15.5	3.9	16.3	6.5	212.5
- Overseas visitors	24.5	11.3	26.4	3.8	7.5	0.8	3.0	1.4	78.7
Census Count (Usual Residence)	5,715.3	4,288.0	2,887.1	1,408.6	1,576.3	456.3	159.3	280.9	16,771.9
+ Adjustment for undercount on a usual residence basis	109.2	78.8	52.1	22.3	33.2	7.7	4.8	4.1	312.3
+ Residents temporarily overseas	82.1	57.7	28.6	16.5	29.2	3.2	1.8	4.8	223.9
Estimated Resident Population	5,906.6	4,424.6	2,967.9	1,447.4	1,638.7	467.2	166.0	289.7	17,308.1

Why measure the undercount?

- 1.5 The census provides the basic information from which estimates are made of the resident population. Population estimates need to be as accurate as possible as they are required for the determination of the number of seats each State and Territory will have in the Federal House of Representatives and for the allocation of Commonwealth general revenue grants to States and Territories. Population estimates are also used extensively as indicators of population growth and distribution in a wide variety of demographic, social and economic studies. Because population estimates for each State/Territory and Local Government Area are based on census counts, it is important to determine the level of undercounting for each census so that appropriate adjustments can be made to the census counts.

- 1.6 It is also important to measure the undercount to evaluate the effectiveness of census collection procedures and to provide users of census data with an assessment of the completeness of the census. This allows areas to be identified in which improvements in future censuses can be made.

How undercount is measured — the Post Enumeration Survey

- 1.7 In Australia, the main method used to measure undercounting is the Post Enumeration Survey (PES), a sample survey of the population that begins three weeks after census night.
- 1.8 The aim of the PES is to obtain an independent measure of census coverage. Because of this, it is important to conduct the PES as independently of the census as possible and to ensure that the collection systems used in the PES and the census are operationally separate.
- 1.9 In the 1991 PES, a multi-stage area sample of about 40,000 private dwellings was selected (two-thirds of 1 per cent of all dwellings in Australia). The sampling fraction varied between States and Territories, with the smaller States and Territories having higher sampling fractions. More details about the reliability of PES estimates are given in the Technical Note at the end of this information paper.
- 1.10 While the scope of the 1991 PES was similar to that of the census some persons, dwellings and areas were excluded. All persons who should have been counted in the census were included in the scope of the PES except those who were in non-private dwellings at the time of the PES, lived in sparsely settled and remote areas, had gone overseas or died since census night.
- 1.11 Non-private dwellings such as hotels and motels, hospitals and other institutions were not included in the PES. The vast majority of residents in non-private dwellings would have been short-term residents and would have a chance of being included in the PES at their place of usual residence where information on such persons would be obtained. Consequently a relatively small number of long-term residents of non-private dwellings were out-of-scope of the PES.
- 1.12 For practical reasons, dwellings in very sparsely settled areas (that is, Statistical Local Areas with less than 0.57 dwellings per square kilometre) were not included in the PES. The PES was also not conducted in remote areas, where special census procedures were used to contact and count Aboriginal and Torres Strait Islander people. In order to conduct the PES in these areas the same contacts and procedures adopted for the census would be relied upon and therefore underenumeration could not be accurately and independently measured.

Collection procedures in the Post Enumeration Survey

- 1.13 Interviewing for the 1991 PES was conducted during the period 26 August to 9 September 1991, after census fieldwork was completed on 16 August. At least one responsible adult member of each household was interviewed. The total number of persons included in the PES was about 100,000.
- 1.14 To ensure operational independence, the PES used a separate collection system from that used in the census. Separate recruitment procedures were used for PES interviewers and census staff were not aware which areas would be included in the PES.
- 1.15 In some cases, census forms for households visited by PES interviewers had not been lodged when the interviewers made contact. This was possible because people had preferred to post in their census forms or the census collector had been unable to collect them. Although people in this group were not told by the PES interviewer to post their census form in, some people still may have been prompted to do this where they would not have otherwise done so. To overcome this potential bias, any census form returned by mail after PES interviewing commenced was considered a late return and was treated differently to other forms in the PES estimation procedures.

Matching and searching procedures in the 1991 Post Enumeration Survey

- 1.16 Matching and searching in the 1991 PES attempted to identify whether dwellings and persons included in the PES were missed, counted once or the number of times counted if counted more than once.
- 1.17 The first procedure involved the clerical comparison of PES household forms to their corresponding census forms. Census forms were located by comparing the address on the front of the PES form with all addresses given in the record book of the census collector who was responsible for the collection district (CD) in which the PES household was located. Once the correct record book number was identified and the corresponding census form(s) located, a matching code, indicating the type of census household which was found to match the PES enumeration address, was determined. The next task was to match at the person level. This involved

an examination of common variables, such as name, between the PES form and the census form. This enabled match codes to be generated for each individual on the PES form.

- 1.18 The second stage of processing involved matching to addresses specified by respondents as possible addresses of inclusion in the census, other than the PES address. A search form was generated for every address reported in the PES for each person in the household. Provision was made for the first time in the 1991 PES to search the whole CD for this address. While in most cases it was possible to identify a clear match on name, there were cases of spelling errors and insufficient details on address which made the person-matching procedure less straight forward. In these cases, a judgement on whether or not a person was matched was made on information such as age, sex, marital status, birthplace and relationship to other members in the census household.
- 1.19 Where a match was made, the number of times a person was counted in the census was coded. A person may have been counted more than once, for example, if that person was away from their place of usual residence on census night and was recorded both at the place of actual location on census night and the place of usual residence. If matches were not made, persons and dwellings were coded as not counted in the census, except where matching failed because of a lack of adequate information. In these cases, the decision to record a respondent as matched or not matched was determined by imputing a probability, based on a regression model, of having been counted.
- 1.20 Once processing was completed, all records of names and addresses of persons and households in the PES were destroyed. No names and addresses of persons or households were stored on computer files.

Estimation procedures and reliability of the estimates in the Post Enumeration Survey

- 1.21 From the PES, the ratio of the number of persons who should have been included in the census to the number of persons who were estimated to have been included can be calculated. The ratio is the net adjustment factor which accounts for persons both missed and counted more than once in the census. This adjustment factor is weighted and then applied to the actual census count to produce an estimate of the population. The PES based estimates of the population are then analysed against other data of the Australian population according to age, sex and State/Territory. Some adjustments are made to PES estimates where these comparisons indicate that the results are anomalous. In 1991, adjustments were made to PES estimates for males aged 60–64 years and females aged 35–39, 40–44, 65–69 and 75 years and over. The undercount number is the net difference between the actual census count and the PES estimate after these adjustments, while the rate of undercounting is this net difference expressed as a percentage of the adjusted PES estimate.
- 1.22 Since PES estimates are based on information obtained from occupants of a sample of dwellings, they may differ from the figures that would have been produced if the information had been obtained from occupants of all dwellings. One measure of the likely difference is given by the standard error, which indicates the extent to which an estimate might have varied by chance because only a sample of dwellings was included in the survey (see Technical Note for further details). It should be noted that some estimates have such high standard errors as to warrant caution in their use.
- 1.23 The imprecision due to sampling variability, which is measured by the standard error, should not be confused with inaccuracies that may occur because of imperfections in reporting by respondents, errors made in collection of data, and errors made in processing the data. Inaccuracies of this kind are referred to as non-sampling errors and they may occur in any enumeration, whether it be a full count or a sample. Every effort is made in both the census and PES to reduce non-sampling error to a minimum by careful design of forms, training and supervision of collectors and interviewers and efficient operating procedures.
- 1.24 Types of non-sampling error affecting census counts themselves are detailed in the Explanatory Notes. The following paragraphs discuss sources of non-sampling error arising from the way the PES is run and the way estimates are derived from the survey.
- 1.25 One weakness in the PES method is its dependence on matching as a means of deciding whether or not a given dwelling or person has been counted in the census. The difficulties associated with the matching process means there is a risk of failing to match persons who are actually included in the census. The consequence of such failures to match properly would be an overstatement of the number of persons missed in the census.
- 1.26 While every attempt is made to achieve operational independence, because of the similarity of the PES method and the census method, in that they both involve approaches to households, errors may be correlated. For example, dwellings missed by the census collector are more likely to be missed by the PES interviewer than other dwellings. As another example, people who avoid being included in the census are also likely to avoid being included in the PES. While it is not likely that either method could obtain perfect coverage, it is

generally accepted that the coverage of the PES is more complete. This is because it is possible to use more tightly controlled collection procedures, and more highly trained and experienced field staff in an operation the size of the PES, than in the census.

- 1.27 On the other hand, the operational independence will result in differences. For example, for the same household, the person who completes the census form and the person who is interviewed in the PES may be different and may give different answers to the same question. As another example, even in households where the same person completes the census form and is interviewed in the PES, that person may give a different response to a particular question. A major factor in such a response could be the presence of interviewers in the PES. Inconsistencies in response can have significant consequences when analysing the characteristics of persons who are undercounted (see paragraphs 2.1 to 2.3).

History of Post Enumeration Surveys

- 1.28 The PES has been undertaken in Australia for each census from 1966. From 1966 until 1976, the PES had three components. It evaluated coverage of persons (that is, the extent of the undercount of individuals), coverage of dwellings (where a separate sample of dwellings was used to compare dwellings listed by PES interviewers with those compiled by census collectors) and the accuracy of responses to particular census questions.
- 1.29 From 1981 on, the PES has been designed solely to obtain a measure of census coverage incorporating information on the undercount of persons and some information on dwellings.

2. CHARACTERISTICS OF PERSONS UNDERCOUNTED IN THE 1991 CENSUS

Introduction

- 2.1 This chapter presents in detail PES results on the characteristics of persons undercounted in the 1991 Census. The analysis is based on answers provided by respondents in the PES. These answers are not always consistent with answers obtained to the same questions in the census. Such inconsistency, if extensive enough, has the potential to undermine the value of PES results as measures of undercounting for particular groups of the population, but this has not generally been the case with the 1991 PES.
- 2.2 Inconsistencies between 1991 PES and census answers were greatest for questions on age and for some response categories to the questions on marital status and Aboriginal and Torres Strait Islander origin. Most of the discrepancies between census and PES age were minor, with the result that quite valid conclusions can still be drawn. For marital status, inconsistencies between PES and census responses were significant for the categories of 'separated' and 'divorced' and hence, these categories of marital status are omitted from the undercount table (see Table 7). One possible reason for discrepancies in responses to the marital status question is that some respondents are more sensitive towards disclosing registered marital status in an interview situation than they are in responding to the question on a self-enumerated form.
- 2.3 The extent of inconsistencies in responses to the Aboriginal/Torres Strait Islander origin question between the PES and the Census were great enough to limit the value of PES results as a measure of Aboriginal and Torres Strait Islander person undercounting in the census. All that can be concluded from the 1991 PES is that persons identified as Aboriginal in the survey have an undercount rate significantly higher (over 5.0%) than other persons (less than 2.0%). More details on the coverage of Aboriginal and Torres Strait Islander people in the 1991 Census are available in the publication *Experimental Estimates of the Aboriginal and Torres Strait Islander Population, 1986-1991* (3230.0).

Australia, States and Territories

- 2.4 The 1991 Census counted 16,850,500 persons. Using the results of the PES, the population of Australia, by place of enumeration, was estimated to be 17,167,200. Thus, after taking into account those persons in the census who were counted more than once and those not counted at all, it was estimated that 316,700 persons were missed at the 1991 Census, an undercount of 1.8 per cent. The census count by place of usual residence (which excludes overseas visitors) was 16,771,900 and the PES gave an estimate on the same basis of 17,084,200, an undercount of 312,300 persons, or 1.8 per cent. Because the PES figures are based on a sample, they are subject to sampling variation. Taking sampling variation into account, there is a 95 per cent chance that the undercount rate lies in the range 1.6 per cent to 2.0 per cent.
- 2.5 Table 2 and Figure 1 set out the rates of undercounting for the 1991 Census by place of enumeration, with comparative rates from 1986 and 1981. Table 3 sets out the rates of undercounting for the 1991 Census on a usual residence basis, with comparative rates from 1986 and 1981. It should be noted that the method of compiling the 1991 PES estimates was slightly different to previous years. This change resulted in an increase of around 0.1 per cent in the national undercount rate compared with the method used in 1986. Despite this change of method, the extent of undercounting in the 1991 Census was slightly lower than 1986 and 1981 rates.
- 2.6 Since the introduction of the PES in 1966, there have been consistent State and Territory differentials in undercount rates, with the Northern Territory having the highest rates and the Australian Capital Territory and Tasmania the lowest. In 1991 a similar pattern emerged, although the undercount for Tasmania showed an apparent increase on previous censuses. New South Wales experienced an increase in its undercount rate from 1.5 per cent in 1986 to 1.9 per cent in 1991. Notable reductions in the undercount rate were experienced in the Northern Territory (9.1% in 1986 to 4.1% in 1991) and Queensland (2.7% in 1986 to 2.0% in 1991).

TABLE 2. CENSUS UNDERCOUNT : STATES, TERRITORIES AND AUSTRALIA: 1981, 1986 AND 1991 CENSUSES
(Place of Enumeration Basis)

State/ Territory	1981 Census			1986 Census			1991 Census		
	Undercount Number	Rate		Undercount Number	Rate		Undercount Number	Rate	
		%	SE		%	SE		%	SE
New South Wales	102,600	2.0	0.1	83,500	1.5	0.1	108,300	1.9	0.1
Victoria	52,400	1.4	0.1	63,700	1.6	0.2	74,500	1.7	0.1
Queensland	70,400	3.0	0.1	70,400	2.7	0.4	60,400	2.0	0.1
South Australia	21,900	1.7	0.1	21,000	1.5	0.2	20,400	1.4	0.1
Western Australia	21,700	1.7	0.1	33,200	2.3	0.2	34,600	2.1	0.2
Tasmania	3,200	0.8	0.1	5,700	1.3	0.4	8,000	1.7	0.1
Northern Territory	6,100	4.7	0.4	15,500	9.1	2.0	7,500	4.1	0.7
Australian Capital Territory	2,000	0.9	0.3	4,900	1.9	1.1	3,100	1.1	0.3
Australia	280,400	1.9	0.1	297,900	1.9	0.1	316,700	1.8	0.1

(a) Throughout this publication, SE refers to standard error.

**FIGURE 1. CENSUS UNDERCOUNT RATES,
STATES, TERRITORIES AND AUSTRALIA:
1981, 1986 AND 1991 CENSUSES**

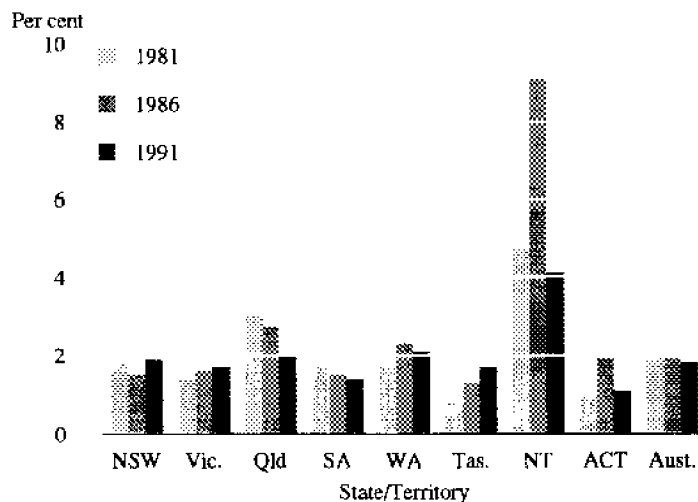


TABLE 3. CENSUS UNDERCOUNT : STATES, TERRITORIES AND AUSTRALIA: 1981, 1986 AND 1991 CENSUSES
(Place of Usual Residence Basis)

State/ Territory	1981 Census			1986 Census			1991 Census		
	Undercount Number	Rate		Undercount Number	Rate		Undercount Number	Rate	
		%	SE		%	SE		%	SE
New South Wales	92,300	1.8	0.1	81,200	1.5	0.2	109,200	1.9	0.1
Victoria	58,000	1.5	0.1	71,900	1.8	0.2	78,800	1.8	0.1
Queensland	69,100	3.0	0.2	62,700	2.4	0.2	52,100	1.8	0.1
South Australia	21,300	1.6	0.1	21,400	1.6	0.3	22,300	1.6	0.1
Western Australia	20,800	1.6	0.1	32,100	2.2	0.3	33,200	2.1	0.2
Tasmania	4,100	1.0	0.3	5,000	1.1	0.3	7,700	1.7	0.2
Northern Territory	5,100	4.2	1.3	8,300	5.5	1.4	4,800	2.9	0.7
Australian Capital Territory	3,000	1.4	0.5	4,000	1.6	0.8	4,100	1.4	0.2
Australia	273,700	1.9	0.1	286,600	1.8	0.1	312,300	1.8	0.1

Undercount by Resident/Visitor status

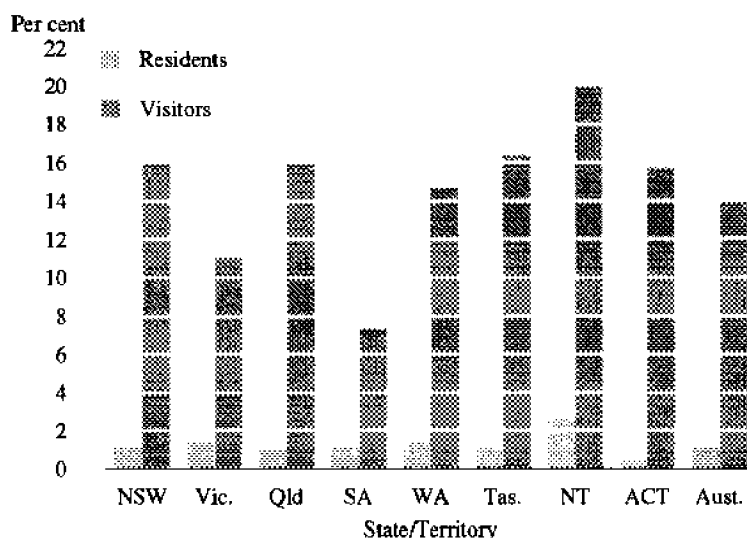
- 2.7 The undercount rates were affected to a large extent by the numbers of people from each State who were not at their usual residence on census night 1991. Overall, the net rate of undercounting for visitors (that is, those away from their usual residence on census night) of 14.1 per cent, was significantly higher than the rate for those at home (1.2%) on census night 1991 (Table 4 and Figure 2).
- 2.8 Persons who were not at their usual residence on census night may have been camping out, visiting friends or relatives in another private dwelling, or staying for short periods of time in non-private dwellings such as motels, guest houses or hospitals. They may have been missed from the census if they mistakenly believed they had been counted elsewhere, or did not obtain, receive or complete a census form because, for example, they were travelling around census time.
- 2.9 The high rates of undercounting among visitors across all States and Territories indicates the difficulties in enumerating a mobile, hard-to-contact population.

TABLE 4. 1991 CENSUS UNDERCOUNT RATES BY RESIDENT/VISITOR STATUS, STATES, TERRITORIES AND AUSTRALIA
(Place of Enumeration Basis)

State/ Territory	Resident		Visitor(a)		Total	
	Rate (%)	SE	Rate (%)	SE	Rate (%)	SE
New South Wales	1.2	0.2	15.9	2.7	1.9	0.1
Victoria	1.4	0.2	11.0	3.4	1.7	0.1
Queensland	1.0	0.2	15.9	2.9	2.0	0.1
South Australia	1.2	0.3	7.3	4.6	1.4	0.2
Western Australia	1.4	0.4	14.7	4.5	2.1	0.2
Tasmania	1.1	0.5	16.4	9.0	1.7	0.3
Northern Territory	2.6	1.2	20.1	10.8	4.1	0.6
Australian Capital Territory	0.5	0.4	15.7	11.1	1.1	0.3
Australia	1.2	0.1	14.1	1.5	1.8	0.1

(a) A visitor is defined as someone who was not at their place of usual residence on census night 1991.

FIGURE 2. CENSUS UNDERCOUNT RATES BY RESIDENT/VISITOR STATUS, STATES, TERRITORIES AND AUSTRALIA: 1991 CENSUS



Capital City and Balance of State

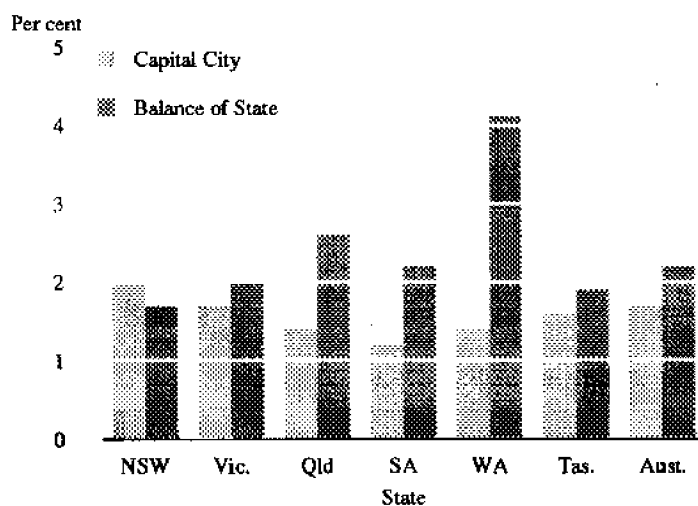
- 2.10 An examination of regional differences in undercounting contrasts Capital City and Balance of State areas. Capital Cities are the Capital City Statistical Divisions for each State. Balance of State areas comprise all Statistical Divisions outside the Capital City boundaries.
- 2.11 The rates of undercounting by Capital City/Balance of State for each State are given in Table 5 and Figure 3. With the exception of New South Wales, rates of undercounting in Balance of State areas were higher in every State than those in Capital Cities. As in 1986 the undercount for Western Australia's Balance of State (4.1%) was considerably larger than for any other State, the next highest being Queensland's Balance of State (2.6%).

TABLE 5. 1991 CENSUS UNDERCOUNT BY CAPITAL CITY AND BALANCE OF STATE, STATES, TERRITORIES AND AUSTRALIA
(Place of Enumeration Basis)

State/ Territory	Capital City			Balance of State			Total		
	Undercount Number	Rate		Undercount Number	Rate		Undercount Number	Rate	
		%	SE		%	SE		%	SE
New South Wales	70,700	2.0	0.2	37,600	1.7	0.2	108,300	1.9	0.1
Victoria	49,600	1.7	0.2	24,800	2.0	0.3	74,500	1.7	0.1
Queensland	18,200	1.4	0.1	42,100	2.6	0.2	60,400	2.0	0.1
South Australia	12,100	1.2	0.1	8,300	2.2	0.4	20,400	1.4	0.2
Western Australia	16,400	1.4	0.2	18,200	4.1	0.5	34,600	2.1	0.2
Tasmania	2,900	1.6	0.2	5,100	1.9	0.2	8,000	1.7	0.3
Northern Territory(a)	..	..	..	..	..	..	7,500	4.1	0.6
Australian Capital Territory(a)	..	..	..	..	..	..	3,100	1.1	0.3
Australia	169,900	1.7	0.1	136,200	2.2	0.1	316,700	1.8	0.1

(a) High sampling error precludes reliable estimates of undercounting for Capital City/Balance of State.

FIGURE 3. CENSUS UNDERCOUNT RATES BY CAPITAL CITY
AND BALANCE OF STATE, STATES AND AUSTRALIA:
1991 CENSUS



Age, Sex and Marital Status

- 2.12 Census undercounting varied considerably in 1991 between age and sex groups within the population. Table 6 and Figure 4 give rates of undercounting by age and sex. The undercount for males was higher than for females, with the greatest difference in rates occurring in the 25-34 age group. Overall, undercounting was higher than average for both males and females in the 15-34 age categories, a trend consistent with past rates of undercounting. In 1991, the 15-34 age category constituted about half of the total number of people who were not counted in the 1991 Census. Undercounting was lowest for children aged between 10 and 14 years.
- 2.13 Table 7 sets out the rates of undercounting by marital status and sex. Results for the separated and divorced categories of marital status are omitted from this table because of the problem of inconsistency between PES and census responses referred to at the beginning of this chapter. Discrepancies in responses for the other categories of marital status, married, widowed and never married, were only of a minor nature. The inconsistency affects the accuracy of PES results as measures of undercounting of specific groups *as described in the census* and this should be borne in mind when using the data. However, it does not prevent conclusions being drawn about the underenumeration rates of different marital status groups *as described in the PES*.
- 2.14 It can be seen in Table 7 that undercounting was lowest for those persons who were married (1.3%) or widowed (1.7%).

TABLE 6. 1991 CENSUS UNDERCOUNT BY AGE AND SEX, AUSTRALIA
(Place of Enumeration)

Age (years)	Males			Females			Persons		
	Undercount Number	Rate		Undercount Number	Rate		Undercount Number	Rate	
		%	SE		%	SE		%	SE
0-4	10,600	1.6	0.3	9,200	1.5	0.3	19,800	1.6	0.2
5-9	9,600	1.5	0.3	7,900	1.3	0.2	17,500	1.4	0.2
10-14	7,300	1.1	0.3	5,800	1.0	0.2	13,000	1.1	0.2
15-19	20,000	2.9	0.3	14,700	2.2	0.3	34,700	2.5	0.2
20-24	29,800	4.2	0.4	20,800	3.0	0.4	50,600	3.6	0.3
25-29	28,400	4.1	0.4	18,500	2.7	0.3	46,900	3.4	0.3
30-34	18,100	2.6	0.3	8,700	1.2	0.2	26,800	1.9	0.2
35-39	12,200	1.9	0.3	5,500	0.8	0.2	17,700	1.3	0.2
40-44	12,000	1.8	0.3	6,000	0.9	0.2	18,000	1.4	0.2
45-49	7,400	1.4	0.3	5,900	1.2	0.3	13,300	1.3	0.2
50-54	7,100	1.7	0.3	4,300	1.0	0.3	11,400	1.4	0.2
55-59	5,500	1.5	0.3	4,800	1.3	0.3	10,300	1.4	0.2
60-64	5,900	1.6	0.2	5,000	1.4	0.3	10,900	1.5	0.2
65-69	4,400	1.4	0.4	4,800	1.4	0.2	9,200	1.4	0.2
70-74	3,400	1.5	0.4	3,900	1.4	0.4	7,400	1.4	0.3
75+	3,600	1.3	0.5	5,600	1.2	0.3	9,200	1.2	0.3
All ages	185,200	2.2	0.1	131,500	1.5	0.1	316,700	1.8	0.1

FIGURE 4. CENSUS UNDERCOUNT RATES BY AGE AND SEX,
AUSTRALIA: 1991 CENSUS

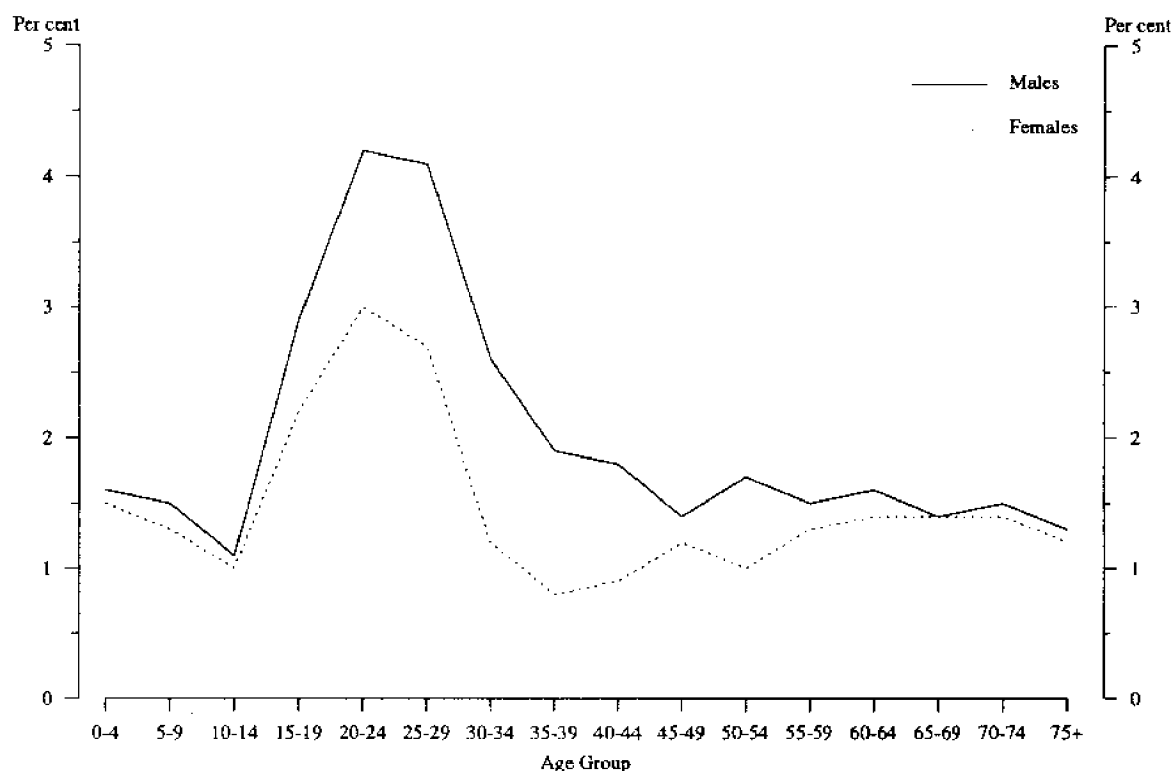


TABLE 7. 1991 CENSUS UNDERCOUNT BY MARITAL STATUS, AUSTRALIA
(Place of Enumeration)

Marital Status	Males			Females			Persons		
	Undercount Number	Rate		Undercount Number	Rate		Undercount Number	Rate	
		%	SE		%	SE		%	SE
Never Married	68,300	3.1	0.1	43,200	2.5	0.1	111,500	2.8	0.1
Married	56,400	1.5	0.1	41,700	1.1	0.1	98,100	1.3	0.1
Separated		(a)			(a)			(a)	
Divorced		(a)			(a)			(a)	
Widowed	4,700	2.8	0.6	10,100	1.5	0.2	14,800	1.7	0.2
Total	157,700	2.4	0.1	108,600	1.6	0.1	266,300	2.0	0.1

(a) The rates are not considered to be a reliable measure of census undercounting – see paragraphs 2.2 and 2.13.

Country of Birth

2.15 As can be seen in Table 8, undercounting varied considerably according to individual country of birth. The pattern of undercount by birthplace group shows a similar pattern to that of previous censuses, with New Zealand born persons considerably higher than any other group (3.5%).

2.16 To a certain extent the undercount rates reflect the age structures of these birthplace groups. The populations of the older source countries, such as Italy and Greece, have older age structures and lower undercount rates. New Zealand born residents, on the other hand, have a relatively young median age (32.1 years in 1991) and reflect the higher undercount of the 20–29 age groups.

TABLE 8. 1991 CENSUS UNDERCOUNT BY BIRTHPLACE AND SEX, AUSTRALIA
(Place of Enumeration)

<i>Birthplace</i>	<i>Males</i>			<i>Females</i>			<i>Persons</i>		
	<i>Undercount Number</i>	<i>Rate</i>		<i>Undercount Number</i>	<i>Rate</i>		<i>Undercount Number</i>	<i>Rate</i>	
		<i>%</i>	<i>SE</i>		<i>%</i>	<i>SE</i>		<i>%</i>	<i>SE</i>
Australia	138,700	2.2	0.1	88,400	1.4	0.1	227,100	1.8	0.1
U.K. & Ireland	11,400	1.9	0.3	7,400	1.3	0.3	18,900	1.6	0.2
Italy	1,400	1.0	0.3	1,800	1.5	0.6	3,300	1.3	0.3
Greece	500	0.8	0.6	800	1.2	0.6	1,300	1.0	0.4
Former Yugoslav Republics		(a)			(a)		1,200	0.7	0.4
Netherlands	500	0.9	0.7	500	1.2	0.9	1,000	1.1	0.6
Germany	500	1.0	0.7	500	0.9	0.7	1,100	0.9	0.5
New Zealand	6,900	4.7	0.9	3,100	2.2	0.6	10,000	3.5	0.6
Viet Nam		(a)			(a)			(a)	
Other Europe	4,300	2.2	0.5	1,300	0.8	0.3	5,600	1.5	0.3
Other Asia	6,200	2.3	0.5	6,600	2.2	0.5	12,800	2.2	0.4
Other	6,200	2.4	0.5	4,900	2.0	0.5	11,100	2.2	0.4
Total(b)	185,200	2.2	0.1	131,500	1.5	0.1	316,700	1.8	0.1

(a) High sampling error precludes reliable estimates. (b) Includes Not Stated.

3. DWELLING AND HOUSEHOLD UNDERCOUNT IN THE 1991 CENSUS

Introduction

- 3.1 A dwelling is defined as a building or structure, such as a house, or part of a building, such as a flat, which is inhabitable. The 1991 PES did not include non-private dwellings or caravan parks, while PES dwellings identified as 'Dwelling under Construction', 'Dwelling Converted to Non-Dwelling', 'Derelict Dwelling' or 'Dwelling Demolished' were excluded from the calculation of missed dwellings.
- 3.2 The PES measures the net undercount of dwellings. This would have been marginally greater if the PES measured dwellings in the same way as the census. In the census, a separate census form should be completed for each household in multiple household dwellings which in turn should lead to an overstatement of the census count of dwellings (a dwelling record is created for each household). However, in practice multiple households often use the same census form and hence the dwelling is generally only counted once.
- 3.3 A household is defined as a group of people who live and eat together. While the people themselves must consider whether or not they live together, lodgers, since they receive accommodation only, are considered to be a separate household. Boarders, who receive accommodation and meals, are not considered to be a separate household.
- 3.4 In compiling estimates of the percentage of missed households, a missed household was defined as one in which all members were missed by the census. Differences in the number of households counted in the census and the PES can occur when a group of people within a dwelling change their living arrangements or change their interpretation of a household between the time of the census and the PES. For example, while there should be one census form and PES questionnaire for each household, a group of people may have two census forms and only one PES questionnaire, or vice versa.

Dwelling Undercount

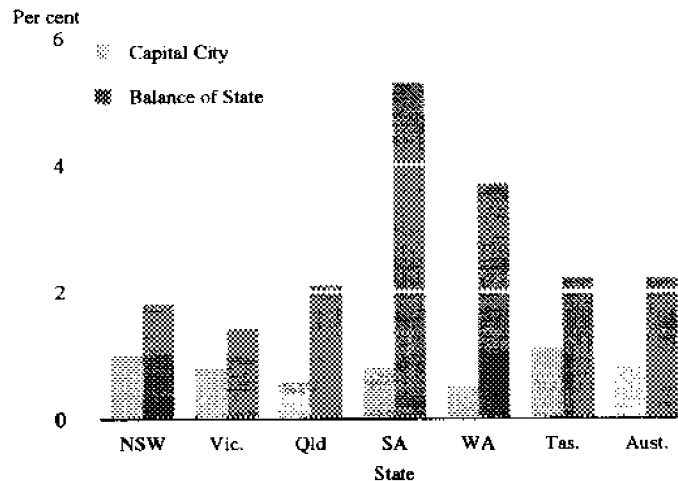
- 3.5 The rates of dwelling undercount by Capital City/Balance of State are given in Table 9 and Figure 5. At the State/Territory level, the Northern Territory (2.5%) and South Australia (2.1%) had the highest rates of dwelling undercount. Dwelling undercount rates were consistently low for all Capital City Statistical Divisions. All Capital Cities, with the exception of Hobart, had dwelling underenumeration rates equal to or less than 1.0 per cent.
- 3.6 An analysis of the number of missed dwellings broken down by Capital City/Balance of State shows that nearly three times as many dwellings were missed outside Capital Cities than within Capital City Statistical Divisions. There were significant differences in rates between Balance of State areas, with South Australia's and Western Australia's Balance of State having the highest percentages of dwellings missed (5.3% and 3.7% respectively). A high proportion of these missed dwellings were unoccupied. New South Wales' and Victoria's Balance of State rates were both well below the national average.

TABLE 9. 1991 CENSUS DWELLING UNDERCOUNT RATES BY CAPITAL CITY/BALANCE OF STATE, AUSTRALIA

State/ Territory	Capital City		Balance of State		Total	
	Rate (%)	SE	Rate (%)	SE	Rate (%)	SE
New South Wales	1.0	0.2	1.8	0.3	1.3	0.1
Victoria	0.8	0.2	1.4	0.3	1.0	0.2
Queensland	0.6	0.1	2.1	0.1	1.5	0.1
South Australia	0.8	0.1	5.3	0.4	2.1	0.1
Western Australia	0.5	0.1	3.7	0.4	1.4	0.2
Tasmania	1.1	0.4	2.2	0.4	1.8	0.2
Northern Territory(a)	..	..	..	..	2.5	0.5
Australian Capital Territory(a)	..	..	..	..	0.8	0.2
Australia	0.8	0.1	2.2	0.1	1.3	0.1

(a) High sampling error precludes reliable estimates of undercounting for Capital City/Balance of State.

FIGURE 5. DWELLING UNDERCOUNT RATES BY CAPITAL CITY AND BALANCE OF STATE, STATES AND AUSTRALIA: 1991 CENSUS



Household Undercount

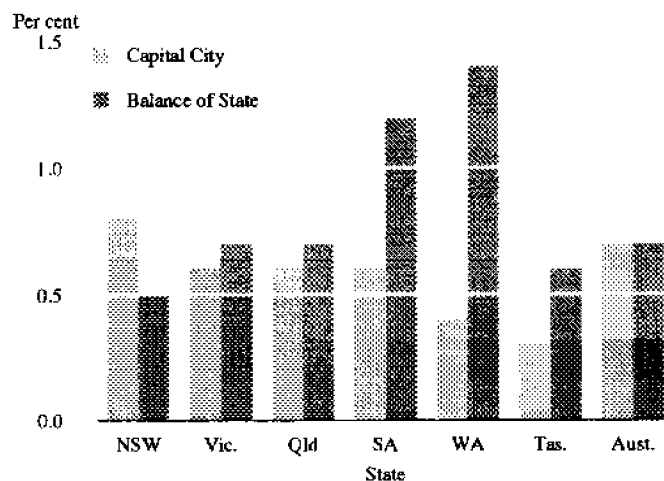
3.7 Table 10 and Figure 6 show that levels of undercounting by households were low, with the undercount rate for Australia being 0.7 per cent. As for dwelling undercount rates, consistently low levels of household undercounting were recorded for Capital City Statistical Divisions (less than 0.9 %). While New South Wales, Victoria and Queensland showed no significant differences in household undercounts between Capital City and Balance of State, there were significant differences between these rates in South Australia and Western Australia. South Australia and Western Australia had the highest levels of household undercounting (1.2 % and 1.4 % respectively), while New South Wales had the lowest rate (0.5 %).

TABLE 10. 1991 CENSUS HOUSEHOLD UNDERCOUNT RATES BY CAPITAL CITY/BALANCE OF STATE, AUSTRALIA

State/ Territory	Capital City		Balance of State		Total	
	Rate (%)	SE	Rate (%)	SE	Rate (%)	SE
New South Wales	0.8	0.1	0.5	0.1	0.7	0.1
Victoria	0.6	0.0	0.7	0.1	0.7	0.0
Queensland	0.6	0.1	0.7	0.1	0.7	0.1
South Australia	0.6	0.1	1.2	0.2	0.7	0.1
Western Australia	0.4	0.1	1.4	0.2	0.7	0.1
Tasmania	0.3	0.1	0.6	0.2	0.5	0.1
Northern Territory(a)	..	..	..	..	1.5	0.2
Australian Capital Territory(a)	..	..	..	..	0.4	0.3
Australia	0.7	0.0	0.7	0.1	0.7	0.0

(a) High sampling error precludes reliable estimates of undercounting for Capital City/Balance of State.

FIGURE 6. HOUSEHOLD UNDERCOUNT RATES BY CAPITAL CITY AND BALANCE OF STATE, STATES AND AUSTRALIA: 1991 CENSUS



EXPLANATORY NOTES

1. Scope and coverage of the 1991 Census

The 1991 Census of Population and Housing aimed at counting every person who spent census night, 6 August 1991, in Australia, including persons on vessels in or between Australian ports, or on board long-distance trains, buses or aircraft. All private dwellings were to be counted, whether occupied or unoccupied. Occupied non-private dwellings, such as hospitals, prisons, hotels, etc., were also to be included. People were counted where they were on census night, which may not have been where they usually live. Place of usual residence was asked of each person, and answers, where they differed from enumeration address, were coded to Statistical Local Area (SLA) level. Visitors to Australia were to be enumerated regardless of how long ago they had arrived or how long they planned to stay. Australian residents out of the country on census night were to be excluded from the count. Overseas diplomatic personnel and their families were out of the scope of the census, as were diplomatic residences.

2. Definitions

Census count — Place of enumeration

Includes people counted where they were on census night. Overseas visitors are included, Australians overseas are excluded and no adjustment is made for census undercounting.

Census count — Place of usual residence

Includes people counted according to their stated place of usual residence. Overseas visitors and Australians overseas are excluded and no adjustment is made for census undercounting.

Estimated Resident Population (ERP)

The ERP at census date is formed by adding estimates of Australians overseas and the census undercount to the census count at place of usual residence.

Dwellings

For the 1991 Census, dwellings are classified into four basic groups: occupied private dwellings, unoccupied private dwellings, occupied non-private dwellings and unoccupied non-private dwellings.

- (a) An *occupied private dwelling* is defined as the premises occupied by a household on census night. A private dwelling is normally a house, flat, part of a house or even a room; but can also be a house attached to, or rooms above, shops or offices, a boat, a tent, a houseboat, or a caravan situated on a residential allotment.
- (b) An *unoccupied private dwelling* is a structure built specifically for living purposes which is habitable, but unoccupied at the time of the census. Vacant houses, holiday homes, huts, cabins (other than seasonal workers' quarters) and houseboats are counted as unoccupied dwellings. Also included are newly completed dwellings not yet occupied, dwellings which are vacant because they are due for demolition or repair, dwellings to let, and dwellings where all members of the household were absent on census night. Unoccupied caravans etc. in caravan parks and boats in marinas are not counted in the census.
- (c) *Non-private dwellings (NPDs)* are residential dwellings with accommodation which are not included in the dwelling categories listed above, and are classified according to their function. These dwellings include hotels, motels, guest houses, gaols, religious and charitable institutions, defence establishments, hospitals and other communal dwellings. Where this type of accommodation includes self-contained units (as provided by hotels, motels, homes for the elderly and guest houses), the units are enumerated as part of the non-private dwelling (NPD), not as separate households. Complexes such as retirement villages, which have a combination of self-contained units, hostel and/or nursing home accommodation, are enumerated as NPDs.
- (d) *Unoccupied non-private dwellings* are houses under construction, derelict houses, vacant tents, or converted garages and are not included in any census count.

Household

For census purposes, a household is either a person living alone, or a group of people living together as a single domestic unit with common eating arrangements. It is possible for more than one household to live in one house or structure. For example, a lodger who lives with a family and provides all his or her own food is not a member of the family's household but constitutes a separate household and, therefore, completes a separate household form. A household resides in a private dwelling (including caravans etc. in caravan parks).

3. Data quality

Statistical collections such as the census are subject to a number of sources of error. While some errors defy detection and correction procedures, the ABS takes action to minimise the number of errors in overall census results.

Main sources of error in the census are:

- (e) *Undercounting*. Despite efforts to obtain full coverage of persons and dwellings (other than those associated with overseas diplomatic missions), some undercounting still occurs. A measure of the extent of undercounting is obtained from a survey of households undertaken shortly after the census. This is the Post Enumeration Survey (PES), discussed in detail in this publication. Undercounting of persons in the 1991 Census was estimated to be 1.8 per cent for Australia as a whole on a place of enumeration basis.
- (f) *Respondent error*. Computer editing procedures are used to detect obvious errors made by individuals in completing the form (for example, a six year old person who was married). However, such procedures cannot detect all respondent errors and some remain in final output.
- (g) *Processing error*. Errors created during the processing of the census are minimised through training and supervision of staff and by means of a quality control system involving sample checking at different stages of the data capture and coding operations and taking corrective action where necessary.
- (h) *Introduced random adjustments*. Adjustments are made to small cells in tables to allow the maximum of detailed census data to be released, while protecting the confidentiality of information about individual persons. For this reason, and since possible respondent and processing errors have greatest relative impact on small cells, no reliance should be placed on cells of three or less.

For further information on sources of error in the census, refer to the appropriate entries in the 1991 Census Dictionary (2901.0). Sources of error in the PES are described in Chapter 1.

4. Review of Northern Territory Population Estimates

A review of the method of estimating State and Territory populations in 1994 has identified that there has been underestimation of the Northern Territory population as at census date 1991 of 1,045 persons. While population estimates since June 1991 have been adjusted to incorporate this underestimation, all data in this paper exclude this adjustment. Further information is available on request.

5. Related ABS Papers

ABS Census of Population and Housing, 30 June 1986, *Census 86: Data Quality — Undercount* (2607.0), Canberra, 1990.

Current publications produced by the ABS are listed in the *Catalogue of Publications, Australia* (1101.0). The ABS also issues, on Tuesdays and Fridays, a *Publications Advice* (1105.0) which lists publications to be released in the next few days. The Catalogue and Publications Advice are available from any ABS office.

6. Undercount Numbers

In this publication undercount numbers have been rounded to the nearest hundred. Where figures have been rounded, discrepancies may occur between sums of component items and totals.

7. Symbols

- .. not applicable
- nil or rounded to zero

TECHNICAL NOTE

SAMPLING ERRORS ASSOCIATED WITH STATISTICS PRODUCED FROM THE POST ENUMERATION SURVEY (PES)

Reliability of PES Estimates

Statistics produced from the PES are subject to sampling error. Since only a sample of dwellings is included in the PES, estimates derived from the survey may differ from figures which would have been obtained if all dwellings had been included. One measure of the likely difference is given by the standard error which indicates the extent to which an estimate might have varied by chance because only a sample was included.

The particular sample selected for the PES was only one of a number of possible samples. Each possible sample would yield different estimates. The standard error measures the variation of all the possible sample estimates around the figures which would have been obtained if all dwellings had been included.

Given an estimate and the standard error on that estimate, there are about two chances in three that the sample estimate will differ by less than one standard error from the figure that would have been obtained if all dwellings had been included, and about nineteen chances in twenty that the difference will be less than two standard errors. If the standard error is greater than 50 per cent of the estimate, the lower bound of the range in which the true figure is expected to be should be taken as zero.

The following example illustrates the use of the concept of standard error.

If an estimate of 1.3% has a standard error of 0.1 percentage points there are two chances in three that the figure that would have been obtained if all dwellings had been included in the sample is in the range 1.3 per cent \pm (1 \times 0.1%) or 1.2 per cent to 1.4 per cent, and nineteen chances in twenty that the figure is in the range 1.3 per cent \pm (2 \times 0.1%) or 1.1 per cent to 1.5 per cent.

For ease of use, the standard errors corresponding to the estimated underenumeration rates are given next to the rates in the tables throughout this information paper.

Sampling errors on estimates of differences

The sampling error on the difference between two estimates can be derived from their standard errors. For the difference between two estimates x and y produced from the PES the standard error of the difference may be approximated by the following formula:

$$\text{Standard error } (x-y) = \sqrt{(\text{standard error } (x))^2 + (\text{standard error } (y))^2}$$

This approximation will be exact for differences between estimates in different States, for Capital City versus Balance of State, or for differences between estimates from different censuses. However, for estimates within the same region there will tend to be a negative correlation between the rates so that the approximation will tend to underestimate the true standard error.

For example, if the estimates of the rate of undercounting for residents at home on census night for two States are 1.3 per cent and 2.2 per cent respectively, with standard errors of 0.1 per cent and 0.2 per cent, using the formula above, the standard error on the difference 0.9 per cent is

$$\sqrt{(0.1\%)^2 + (0.2\%)^2} = 0.22\%$$

Therefore there are nineteen chances in twenty that the difference between the rates of undercounting for usual residents at home on census night between these two States is within the range $0.9 \pm (2 \times 0.22)$ or 0.46 to 1.34 percentage points.



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