



CENSUS OF POPULATION AND HOUSING – DETAILS OF UNDERCOUNT AUSTRALIA

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INQUIRIES

For further information about these and related statistics, contact the National Information and Referral Service on 1300 135 070 or David Blair on Canberra (02) 6252 6516.

NOTES

ABOUT THIS PUBLICATION This publication presents estimates of net undercount for the 2006 Census, as well as information on how the estimates were calculated. This issue presents additional data and information to that included in the earlier publication *Census of Population and Housing — Undercount* (cat. no. 2940.0) released on 5 June 2007. The additional data includes undercount estimates for Indigenous status and country of birth.

NOTES ABOUT THE ESTIMATES Information in this publication has been obtained from the 2006 Census Post Enumeration Survey (PES). The PES was conducted in September 2006, soon after the Census. People from approximately 33,000 households across Australia were asked about everyone present or usually resident in the household. In addition to obtaining basic demographic information, questions were asked about each person's usual residence, their location on Census night, and any other addresses where they might have been counted in the Census.

The results of the PES are used to determine how many people were missed in the Census and how many were counted more than once.

The estimated net undercount from the PES is used to augment the Census counts for the purpose of deriving population estimates for Australia and the states and territories.

ROUNDING As estimates have been rounded, discrepancies may occur between sums of the component items and totals.



ABBREVIATIONS

- ABS Australian Bureau of Statistics
- CD collection district
- ERP estimated resident population
- FMC field match code
- ICF Indigenous Community Frame
- MSS Match and Search System
- PD private dwelling
- PES Census Post Enumeration Survey
- PMC person match code
- QA quality assurance
- SE standard error

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OVERVIEW

BACKGROUND

Tuesday, 8 August 2006 was Census night in Australia. Every person present in Australia on Census night, excluding foreign diplomats and their families, should have been included on a Census form at the place where they stayed.

Whenever a Census is undertaken, questions about the completeness and accuracy of the Census count invariably arise. In such a large and complex exercise, it is inevitable that some people will be missed and some will be included more than once (or included when they shouldn't be). In Australia, the Census Post Enumeration Survey (PES) is used to determine how many people were missed in the Census and how many were counted more than once. The PES is a household survey conducted by the Australian Bureau of Statistics (ABS) shortly after the Census. The survey provides an independent check on Census coverage and also identifies the key demographic characteristics of the population that have been missed or overcounted in the Census.

WHAT IS UNDERCOUNT?

In the 2006 Census, some people were missed (undercount) and some were counted more than once (overcount). As is usually the case, in 2006 more people were missed than overcounted.

The PES interview process determines whether each person in the PES sample should have been counted in the Census, and the category in which they should have been counted (such as age, sex, Indigenous status, region of usual residence). The match and search process determines how many times each person in the PES sample was actually counted in the Census, and in which categories.

PES output processing and estimation combines and weights results from the match and search process to produce an estimate of the number of people who should have been counted in the Census. Net undercount is estimated as the difference between this estimate and the actual Census count (including imputed people for non-responding dwellings).

The net undercount for a category of person is obtained by taking the PES estimate of the number of people in the category who should have been counted and subtracting the Census count of the number of people (in the category). Net undercount for a category of person is the net result of undercount, overcount, differences in classification between the PES and Census (e.g. age, sex, Indigenous status), and imputation error in the Census.

Rates of net undercount vary significantly for different population groups depending on factors such as age, sex, ethnicity (including Indigenous status) and geographic location.

Estimation

PES estimation involves assigning a 'weight' to each selected PES dwelling and then to each person for whom a PES response was obtained.

Dwelling weighting for the 2006 PES comprised two stages. For private dwellings selected in the PES that were found in the Census, the first stage of weighting adjusted the PES selection weight (the inverse of the probability of a dwelling being selected in the PES sample) such that the adjusted weights added up to the Census private dwelling count within categories based on geography and dwelling characteristics. A first-stage weight adjustment was also applied to private dwellings selected in PES that were missed in the Census. For dwellings in discrete Indigenous communities, a similar first-stage

OVERVIEW *continued*

Estimation continued

weight adjustment was applied based on dwelling counts for communities within each state and territory.

The second stage of dwelling weighting applied a non-response adjustment so that the responding PES dwellings represented other dwellings from which no response was obtained.

The initial stage of person weighting adjusted the dwelling weights to ensure that the PES estimates of people counted (in the Census) in private dwellings and discrete Indigenous community dwellings (other than late-return or non-responding dwellings) in a set of benchmark categories matched the actual Census counts for these categories. The weight adjustment applied to a person did not depend on whether they responded in the Census, but only on characteristics of the person as reported in the PES.

As a final step in weight adjustment, the initial person weights were adjusted so that the PES estimates also represented people in non-private dwellings, such as hotels, hospitals and jails, which were not covered by the PES. The person weighting step in PES processing calculates weights for all PES records, including those relating to late-return or non-responding dwellings.

The PES estimate of the number of people who should have been counted in the 2006 Census was 20,402,459 people. The actual 2006 Census count for Australia was 19,852,973 people. The difference (549,486 people) is the net undercount for Australia.

Further information on Census late-return or non-responding dwellings can be found in the Appendix of this publication.

USE OF NET UNDERCOUNT IN ESTIMATED RESIDENT POPULATION (ERP)

After each Census, the ABS uses the new information obtained to rebase the estimated resident population (ERP) of Australia and the states and territories. A crucial step in rebasing ERP using the 2006 Census counts is the application of the net undercount estimates from the PES. For more information on the calculation of rebased ERP for 30 June 2006 based on results from the 2006 Census and PES, see *Australian Demographic Statistics, December quarter 2006* (cat. no. 3101.0), released on 5 June 2007.

ESTIMATES OF NET UNDERCOUNT

INTRODUCTION

This section presents estimates of net undercount of people in the 2006 Census. Additional tables are included for Indigenous status and Country of birth which were not included in the first release publication, *Census of Population and Housing – Undercount* (cat. no. 2940.0), released on 5 June 2007.

As estimates of undercount are based on a sample survey they are subject to sampling error (whereby estimates derived from the survey may differ from figures which would have been obtained if all dwellings had been included in the survey). The estimates of undercount are also subject to non-sampling errors which occurs in all collections, whether censuses or surveys. For further information on sampling and non-sampling error see the Technical Note.

Census counts

Census counts include persons whose Census form was partially completed. During Census processing, values for age, sex, marital status, and state/territory of usual residence are imputed if they were left blank on the Census form. Values for all other variables left blank (e.g. Indigenous status, country of birth) are set to not-stated or not applicable, depending on the (possibly imputed) age of the person.

Census counts also include imputed person records for non-responding dwellings. These records have values imputed for age, sex, marital status, and place (CD, SLA and State/territory) of usual residence. Values for all other variables (e.g. Indigenous status, country of birth) are set to not-stated or not applicable, depending on the imputed value for age.

Therefore, care should be taken when interpreting undercount estimates for Indigenous status and country of birth. For example, there were 1,133,294 persons (5.7% of the Census count) whose Indigenous status was not stated in the Census. These persons do not contribute to either the Indigenous or non-Indigenous Census count, although they do contribute to total Census counts by age, sex, marital status, and state/territory of usual residence.

Undercount adjustment factor

The PES population estimate is an estimate (based on PES and Census data) of the number of people who should have been counted in the Census. The *undercount adjustment factor* is the ratio of the PES population estimate to the actual Census count. This factor can be applied to the Census count for a category to indicate how many people should have been counted in the Census for that category. The following tables present estimates of net undercount and undercount adjustment factors, along with their standard errors.

The undercount adjustment factor should not be used to derive an alternative measure of ERP. For example, ERP includes usual residents of Australia who are temporarily overseas. For information on the calculation of ERP, see the ABS publication *Australian Demographic Statistics, December quarter 2006* (cat.no. 3101.0), released on 5 June 2007.

Rounding

The undercount adjustment factors have been rounded for presentation in the following tables. Discrepancies may occur when the rounded factor is applied to the Census counts.

Estimates of net undercount have been calculated on a place of usual residence basis.

ESTIMATES OF NET UNDERCOUNT *continued*

2.1 NET UNDERCOUNT(a)

	PES population estimate(b)		Census Count	Net undercount	Undercount adjustment factor	
	no.	SE			no.	no.	no.	SE
Australia	20 402 459	39 908	19 852 973	549 486	1.028	0.002
State/territory of usual residence						
NSW	6 706 755	25 679	6 549 177	157 578	1.024	0.004
Vic.	5 046 018	21 009	4 932 422	113 596	1.023	0.004
Qld	4 052 943	18 181	3 904 534	148 409	1.038	0.005
SA	1 550 618	6 709	1 514 337	36 281	1.024	0.004
WA	2 023 237	11 754	1 959 087	64 150	1.033	0.006
Tas.	486 014	2 984	476 479	9 535	1.020	0.006
NT	208 809	3 300	192 900	15 909	1.082	0.017
ACT	328 064	3 189	324 037	4 027	1.012	0.010
Sex						
Male	10 127 510	24 120	9 797 986	329 524	1.034	0.002
Female	10 274 949	21 994	10 054 987	219 962	1.022	0.002
Registered marital status						
Never married(c)	9 654 876	31 088	9 214 713	440 163	1.048	0.003
Widowed, divorced or separated	2 771 501	14 227	2 738 612	32 889	1.012	0.005
Married	7 976 082	19 063	7 899 648	76 434	1.010	0.002
Age group (years)						
0-4	1 304 190	8 576	1 260 249	43 941	1.035	0.007
5-9	1 340 445	8 429	1 308 660	31 785	1.024	0.006
10-14	1 397 186	8 438	1 367 751	29 435	1.022	0.006
15-19	1 406 291	8 389	1 356 785	49 506	1.036	0.006
20-24	1 445 135	12 687	1 347 212	97 923	1.073	0.009
25-29	1 371 108	11 372	1 276 783	94 325	1.074	0.009
30-34	1 456 766	10 200	1 399 320	57 446	1.041	0.007
35-39	1 504 666	9 475	1 465 984	38 682	1.026	0.006
40-44	1 508 440	9 135	1 471 446	36 994	1.025	0.006
45-49	1 472 217	8 490	1 446 539	25 678	1.018	0.006
50-54	1 337 035	7 934	1 315 601	21 434	1.016	0.006
55+	4 858 979	11 012	4 836 643	22 336	1.005	0.002
Indigenous status						
Indigenous	513 977	13 309	454 799	59 178	1.130	0.029
Non-Indigenous	19 888 482	39 636	18 264 880	1 623 602	1.089	0.002
Not stated(d)	..	..	1 133 294	..	..	..
Country of birth						
Australia	15 461 752	32 613	14 071 468	1 390 284	1.099	0.002
New Zealand	435 088	6 924	389 439	45 649	1.117	0.018
England	910 636	7 149	856 891	53 745	1.063	0.008
Scotland	140 435	3 085	130 196	10 239	1.079	0.024
Italy	220 489	3 349	199 121	21 368	1.107	0.017
Greece	123 662	3 388	109 987	13 675	1.124	0.031
Vietnam	180 999	5 269	159 846	21 153	1.132	0.033
Philippines	137 295	4 256	120 536	16 759	1.139	0.035
China	254 276	7 694	206 581	47 695	1.231	0.037
India	180 250	7 127	147 102	33 148	1.225	0.048
Other overseas	2 357 577	15 707	2 095 667	261 910	1.125	0.008
Not stated(d)	..	..	1 366 139	..	..	..

.. not applicable

(a) Estimates are based on a sample survey, and hence are subject to sampling error, indicated by the SEs provided. See the Technical Note for further information.

(b) PES estimate of the number of people who should have been counted in the Census.

(c) Includes those who are living with a de facto partner and have never been in a registered marriage.

(d) People whose Census form was either not received or partially completed.

ESTIMATES OF NET UNDERCOUNT *continued*

INDIGENOUS STATUS

The net undercount for Indigenous Australians in the 2006 Census was 59,178 people. Table 2.2 shows the undercount estimates for Indigenous persons in the 2006 Census by state/territory of usual residence. Of the 19,852,973 people counted in the Census, 1,133,294 (5.7% of the Census count) had their Indigenous status not-stated.

2.2 NET UNDERCOUNT(a), Indigenous persons by State/territory of usual residence

	<u>Net undercount(b)</u>		<u>Net undercount rate(b)</u>		<u>Undercount adjustment factor</u>	
	no.	SE	%	SE	no.	SE
NSW	8 883	9 134	6.0	5.8	1.064	0.066
Vic.	-74	3 126	-0.2	10.4	0.998	0.104
Qld	18 263	6 087	12.5	3.7	1.143	0.048
SA	137	2 678	0.5	10.4	1.005	0.105
WA	18 594	5 605	24.1	5.5	1.317	0.095
Tas.	851	1 363	4.8	7.4	1.051	0.081
NT	12 739	2 341	19.2	2.9	1.237	0.044
ACT	-214	498	-5.8	14.4	0.945	0.129
Aust.	59 178	13 309	11.5	2.3	1.130	0.029

(a) Estimates are based on a sample survey, and hence are subject to sampling error, indicated by the SEs provided. See the Technical Note for further information.

(b) A negative value indicates a net overcount.

Estimates of the Indigenous population of Australia, states and territories were published in *Population Distribution, Aboriginal and Torres Strait Islander Australians* (cat. no. 4705.0), released on 15 August 2007.

COUNTRY OF BIRTH

As Census forms are completed by householders, those who have come to Australia from other countries and whose first language is not English could find completing this a more difficult task than other Australians. An Ethnic Enumeration Strategy has been used for several Censuses to promote an understanding of the Census among migrants to Australia and to provide assistance in a range of languages.

Table 2.3 shows the undercount estimates by Country of birth. The countries displayed were the highest ranked (in terms of population) according to the 2006 Census. There were 1,366,139 people (6.9% of the Census count) whose country of birth was not stated in the Census.

ESTIMATES OF NET UNDERCOUNT *continued*

COUNTRY OF BIRTH

continued

2.3 NET UNDERCOUNT(a), Country of birth by Sex

	PES population estimate		Census count	Net undercount	Undercount adjustment factor	
	no.	SE			no.	no.	no.	SE
Males						
Australia	7 679 491	19 847	6 930 979	748 512	1.108	0.003
New Zealand	227 495	4 767	196 432	31 063	1.158	0.024
England	462 178	4 928	429 454	32 724	1.076	0.011
Scotland	70 454	2 118	64 791	5 663	1.087	0.033
Italy	113 697	2 005	103 026	10 671	1.104	0.019
Greece	59 936	2 052	54 513	5 423	1.099	0.038
Vietnam	84 984	3 180	75 289	9 695	1.129	0.042
Philippines	47 612	2 229	42 687	4 925	1.115	0.052
China	117 316	4 324	93 277	24 039	1.258	0.046
India	105 711	6 024	81 188	24 523	1.302	0.074
Other overseas	1 158 638	9 567	1 022 317	136 321	1.133	0.009
Not stated(b)	—	—	704 033	—	—	—
Total	10 127 510	24 120	9 797 986	329 524	1.034	0.002
Females						
Australia	7 782 261	18 785	7 140 489	641 772	1.090	0.003
New Zealand	207 593	3 915	193 007	14 586	1.076	0.020
England	448 458	4 699	427 437	21 021	1.049	0.011
Scotland	69 982	1 985	65 405	4 577	1.070	0.030
Italy	106 792	2 127	96 095	10 697	1.111	0.022
Greece	63 726	2 202	55 474	8 252	1.149	0.040
Vietnam	96 015	3 274	84 557	11 458	1.136	0.039
Philippines	89 683	2 890	77 849	11 834	1.152	0.037
China	136 961	4 602	113 304	23 657	1.209	0.041
India	74 539	2 188	65 914	8 625	1.131	0.033
Other overseas	1 198 939	9 987	1 073 350	125 589	1.117	0.009
Not stated(b)	—	—	662 106	—	—	—
Total	10 274 949	21 994	10 054 987	219 962	1.022	0.002
Persons						
Australia	15 461 752	32 613	14 071 468	1 390 284	1.099	0.002
New Zealand	435 088	6 924	389 439	45 649	1.117	0.018
England	910 636	7 149	856 891	53 745	1.063	0.008
Scotland	140 435	3 085	130 196	10 239	1.079	0.024
Italy	220 489	3 349	199 121	21 368	1.107	0.017
Greece	123 662	3 388	109 987	13 675	1.124	0.031
Vietnam	180 999	5 269	159 846	21 153	1.132	0.033
Philippines	137 295	4 256	120 536	16 759	1.139	0.035
China	254 276	7 694	206 581	47 695	1.231	0.037
India	180 250	7 127	147 102	33 148	1.225	0.048
Other overseas	2 357 577	15 707	2 095 667	261 910	1.125	0.007
Not stated(b)	—	—	1 366 139	—	—	—
Total	20 402 459	39 908	19 852 973	549 486	1.028	0.002

— nil or rounded to zero (including null cells)

(a) Estimates are based on a sample survey, and hence are subject to sampling error, indicated by the SEs provided. See the Technical Note for further information.

(b) People whose Census form was either not received or partially completed.

Of the overseas countries listed in Table 2.3, England had the highest net undercount (53,745). However, England had the lowest undercount adjustment factor (1.063) i.e. it had the lowest proportional net undercount. China and India had the highest undercount adjustment factors of the overseas countries, with 1.231 and 1.225 respectively.

COMPONENTS OF NET UNDERCOUNT

COMPONENTS OF NET UNDERCOUNT

The net undercount for a category of person is obtained by taking the PES estimate of the number of people in the category who should have been counted in the Census and subtracting the Census count of the number of people in that category. The Census count includes imputed persons in non-responding dwellings, except for those categories (such as Indigenous) where Census assigns 'not-stated' for all imputed persons. Net undercount for a category of person is the net result of undercount and overcount, differences in classification between the PES and Census (e.g. age, sex, and Indigenous status), and imputation error in the Census. This section provides additional information on these components.

Contact and non-contact sector

For the purposes of PES estimation, Census records are divided into a 'contact' sector (dwellings for which a Census form was received before the commencement of PES enumeration) and a 'non-contact' sector (where no Census form was received or a Census form was received after the commencement of PES enumeration – that is a 'late return'). The non-responding dwellings constitute the majority of the Census non-contact sector.

Further information on the 'contact' and 'non-contact' sectors can be found in the Appendix.

Tables 3.1 and 3.2 below show estimates of key components of net undercount.

3.1 COMPONENTS OF NET UNDERCOUNT (a), State/territory of usual residence

	NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT	Aust.
	no.	no.	no.	no.	no.	no.	no.	no.	no.
Persons not counted in contact sector	259 863	171 971	180 993	52 411	89 530	17 505	18 948	8 746	799 967
Net difference in classification in contact sector	-6 846	2 313	4 198	1 182	89	-847	190	-278	—
Persons with Census category not-stated	—	—	—	—	—	—	—	—	—
Undercount in non-contact sector	-95 439	-60 687	-36 782	-17 312	-25 468	-7 124	-3 228	-4 440	-250 481
Net undercount	157 578	113 596	148 409	36 281	64 150	9 535	15 909	4 027	549 486

— nil or rounded to zero (including null cells)

(a) A negative value indicates a net overcount.

DESCRIPTION OF COMPONENTS

Components of net undercount are described below:

Persons not counted in contact sector

For a given category of person (as reported in the PES), this is the difference between the number of times people in that category should have been counted in the Census and the number of times people in that (PES) category actually were counted (irrespective of their Census category).

Net difference in classification in contact sector

Occasionally the answers obtained for a person in the PES interview are not consistent with the answers obtained for the equivalent questions in the Census. In addition, in some cases a value imputed (e.g. for age, sex, or state/territory of usual residence) in the Census for a missing response is different from the PES response. The net difference in classification gives, for persons actually counted in the Census contact sector, excluding those with category value not-stated, the estimated number of people in the given

COMPONENTS OF NET UNDERCOUNT *continued*

DESCRIPTION OF COMPONENTS *continued*

category (as reported in PES) who were counted in the Census minus the estimated number counted in that category in Census.

Persons (in contact sector) with Census category not-stated

The Census contact sector contains some dwellings which were responding in the Census but returned a partially completed Census form. For Census purposes, values for age, sex, state of usual residence and marital status are imputed during Census processing where these items have been left blank. Missing values for other items remain 'not-stated' in the final version of Census counts (including Indigenous status and country of birth).

Persons in the contact sector with Census category value 'not-stated' contribute to net undercount estimates for the category in which they should have been counted, as reported in the PES.

Undercount in non-contact sector

Non-responding dwellings in the Census are given imputed person records (using 'hot-deck' imputation) during Census processing, based on information provided by the Census collector about the dwelling and its residents. Inevitably, the imputed values, at the dwelling and person level, differ from the true, but unknown, values. Values for age, sex, state of usual residence and marital status are imputed at the person level, however other items, such as Indigenous status and country of birth, remain not-stated in the final version of Census counts.

An estimate of the undercount in the non-contact sector for a category of person is obtained by calculating the difference between the PES estimate of the number of people who should have been counted in the non-contact sector in that category (as reported in PES) and the Census count of people in the non-contact sector for the category (including imputed person records within the category).

For categories of persons classified by age, sex, marital status and state/territory of usual residence, this component of net undercount largely represents an estimate of imputation error in the Census. For Indigenous status and country of birth categories, this component largely represents an estimate of persons who should have been counted in non-responding dwellings.

COMPONENTS OF NET UNDERCOUNT *continued*

3.2 COMPONENTS OF NET UNDERCOUNT(a)(b), Contact and non-contact sector

	Undercount in contact sector										
	Persons not counted in contact sector			Net difference in classification		Persons with Census category not-stated		Undercount in non-contact sector		Net undercount	
	no.	no.	no.	no.	SE	no.	SE	no.	SE		
Australia	799 967	—	—	799 967	25 118	-250 481	28 842	549 486	39 908		
State/territory of usual residence											
NSW	259 863	-6 846	—	253 017	16 122	-95 439	17 992	157 578	25 679		
Vic.	171 971	2 313	—	174 284	12 845	-60 687	15 851	113 596	21 009		
Qld	180 993	4 198	—	185 191	12 544	-36 782	12 146	148 409	18 181		
SA	52 411	1 182	—	53 593	4 319	-17 312	4 928	36 281	6 709		
WA	89 530	89	—	89 619	7 615	-25 468	8 740	64 150	11 754		
Tas.	17 505	-847	—	16 659	2 552	-7 124	1 473	9 535	2 984		
NT	18 948	190	—	19 137	2 609	-3 228	1 874	15 909	3 300		
ACT	8 746	-278	—	8 468	2 681	-4 440	1 683	4 027	3 189		
Sex											
Male	455 725	8 929	—	464 654	16 531	-135 130	16 383	329 524	24 120		
Female	344 242	-8 929	—	335 313	14 882	-115 351	14 868	219 962	21 994		
Age group (years)											
0-4	57 855	-10 214	—	47 641	6 766	-3 700	4 927	43 941	8 576		
5-9	40 115	-5 055	—	35 061	6 353	-3 275	5 309	31 785	8 429		
10-14	41 536	-192	—	41 345	7 000	-11 909	4 677	29 435	8 438		
15-19	67 852	3 581	—	71 434	7 355	-21 927	3 691	49 506	8 389		
20-24	113 742	-3 206	—	110 536	10 046	-12 614	6 466	97 923	12 687		
25-29	90 752	7 998	—	98 750	8 914	-4 425	6 640	94 325	11 372		
30-34	61 448	-691	—	60 757	7 664	-3 311	6 069	57 446	10 200		
35-39	58 763	-6 731	—	52 032	7 679	-13 349	5 014	38 682	9 475		
40-44	58 992	-659	—	58 333	7 558	-21 339	4 541	36 994	9 135		
45-49	45 985	3 539	—	49 524	7 272	-23 846	4 105	25 678	8 490		
50-54	41 089	421	—	41 510	6 792	-20 076	3 828	21 434	7 934		
55+	121 836	11 209	—	133 045	9 258	-110 709	5 642	22 336	11 012		
Registered marital status											
Never married (c)	497 475	16 441	—	513 916	21 845	-73 752	20 011	440 163	31 088		
Widowed, divorced or separated	111 611	-30 704	—	80 907	12 703	-48 018	5 440	32 889	14 227		
Married	190 882	14 263	—	205 145	14 985	-128 711	11 515	76 434	19 063		
Indigenous status(d)											
Indigenous	54 056	-30 797	7 989	31 248	11 310	27 930	5 792	59 178	13 309		
Non-Indigenous	745 911	30 797	367 343	1 144 051	25 622	479 551	28 257	1 623 602	39 636		
Country of birth(d)											
Australia	574 748	20 819	445 800	1 041 367	22 481	348 917	22 219	1 390 284	32 613		
New Zealand	27 485	-10 081	11 773	29 177	5 496	16 472	3 754	45 649	6 924		
England	31 652	-31 132	33 756	34 276	6 248	19 469	3 230	53 745	7 149		
Scotland	3 235	-848	5 425	7 812	2 842	2 427	1 024	10 239	3 085		
Italy	4 468	4 174	10 060	18 702	3 080	2 666	1 217	21 368	3 349		
Greece	4 936	1 891	5 163	11 990	3 229	1 685	1 147	13 675	3 388		
Vietnam	5 552	2 391	5 747	13 690	4 075	7 463	3 149	21 153	5 269		
Philippines	7 282	3 694	3 913	14 889	4 054	1 870	1 030	16 759	4 256		
China	25 912	3 897	6 609	36 418	5 920	11 277	3 887	47 695	7 694		
India	12 924	161	4 612	17 697	5 021	15 451	4 349	33 148	7 127		
Other overseas	101 771	5 034	73 658	180 463	12 318	81 447	8 956	261 910	15 707		

— nil or rounded to zero (including null cells)

(a) Estimates are based on a sample survey, and hence are subject to sampling error, indicated by the SEs provided. See the Technical Note for further information.

(b) A negative value indicates a net overcount.

(c) Includes those who are living with a de facto partner and have never been in a registered marriage.

(d) Net undercount is based on Census counts for a category. In the Census, Indigenous status and Country of birth were set to not-stated where the response was blank and where imputed person records were created for non-responding dwellings. Hence components of undercount for Indigenous status and Country of birth do not sum to the Australia total.

COMPONENTS OF NET UNDERCOUNT *continued*

Undercount for Indigenous people

The contact sector of the Census failed to count an estimated 54,056 Indigenous people. In addition, from people who identified as Indigenous in the PES it has been estimated that a further 7,989 Indigenous people had their Indigenous status not-stated in the contact sector of the Census. However, these figures are offset by the difference between the number of people recorded as Indigenous in the PES but non-Indigenous in the Census, and the number of people recorded as Indigenous in the Census but non-Indigenous in the PES (estimated as 30,797 people).

This gives an estimated net undercount of Indigenous people in the contact sector of 31,248. Added to this is the estimated number of Indigenous people (27,930) who should have been counted as Indigenous in the non-contact sector but were not (since Census did not impute an Indigenous status in non-responding dwellings).

Correcting for Census imputation error in the non-contact sector

The use of PES to estimate the number of people who should have been counted in the Census non-contact sector allows the sampling error in this sector to be measured and included in the published standard errors (SE). This is the major reason that SEs for the 2006 PES exceed those of previous PESs. The increased SEs represent the uncertainty associated with estimating the contribution of the non-contact sector. This is considered a much better outcome than the alternative of including an unmeasured and potentially major bias arising from unadjusted inaccuracies in the Census imputation process. The ability to measure the non-contact sector is one of the key improvements made in the 2006 PES.

The majority of Census non-contact sector records are imputed records (just under 90%), with the remainder made up of late returns. The Census count of late returns is considered an accurate measure as special procedures were implemented for Census forms received after the start of PES field work to be flagged as such (and no unbiased estimate of late returns is possible from the PES).

By subtracting the Census count of late returns from the PES estimate of people who should have been counted in the non-contact sector, a PES estimate (and corresponding standard error) of the number of people who should have been imputed in the Census can be calculated. The Census imputation error is the difference between this PES estimate and the actual Census count of imputed people.

PEOPLE AND DWELLINGS MISSED

PEOPLE MISSED IN THE CENSUS

In order to estimate net undercount, the PES determines for each person the number of times they were counted in the Census and whether they should have been counted in the Census. In the majority of cases, people should have been, and were, counted in the Census once. Inevitably, a small proportion of people are missed in the Census. Some of these are correctly not included in the Census, such as those overseas on Census night. The PES identified people who should have been counted in the Census but were not matched to any Census form. These people, with sampling weights applied, give an estimate of the Census gross undercount. This section presents a more detailed analysis of the data available on the people and dwellings missed in the Census.

In the PES, people are asked a number of questions about where they usually live and addresses where they might have been counted in the Census, including:

- if they or the person answering on their behalf thought they were counted on a Census form (and if so where) and
- where they were on Census night (i.e. their 'Census night address').

For processing purposes, it was recorded whether the Census night address was the address at which the respondent was enumerated in the PES (i.e. the 'PES address'), or at a different address supplied during the interview, called a 'search address'.

The Census form (where it existed) corresponding to the PES address was checked to determine if the person was counted at that address. Search addresses were then checked to determine if the person was counted elsewhere in the Census. A key difference in the quality of this information is that exact address information was available for PES addresses, while search addresses relied on details provided by respondents.

If the quality of the address information provided for a search address was insufficient to conduct a search for the dwelling during the match and search processing, the address was flagged as 'vague'. A modelling technique was used to assign a match status to these PES records.

Based on results from the PES match and search process, there were a total of 7,689 PES respondents who were not counted in the Census. This represents 8.9% of the total number of people responding to the PES. Of these 7,689 respondents, 6,276 people actually should have been counted in the Census but were not (that is undercounted people). The remainder (1,413 people) were PES respondents who should not have been counted in the Census, e.g. diplomats, people who were overseas on Census night, and babies born after Census night.

Table 4.1 includes information on whether PES respondents were counted in the Census and whether they thought they were included on a Census form, cross-classified by characteristics of their Census night address. The data in this table are unweighted, and hence do not correspond to estimates included in other parts of this publication.

PEOPLE AND DWELLINGS MISSED *continued*

PEOPLE MISSED IN THE
CENSUS *continued*

4.1 PES RESPONDING PERSONS, Whether counted in the Census and Whether thought they were included on a Census form

	Whether thought they were included on a Census form(a)			Total(b)
	Yes - counted at PES address	Yes - counted at another address	No - not counted in Census(c)	
Counted in Census(d)				
Census night address				
PES address	73 953	151	481	74 585
Search address				
Dwelling found	204	3 345	136	3 685
Dwelling missed	78	47	28	153
Vague address	23	14	7	44
Overseas	62	2	20	84
Total(e)	74 320	3 559	672	78 559
Undercounted persons				
Census night address				
PES address	3 507	33	876	4 416
Search address				
Dwelling found	44	317	144	505
Dwelling missed	88	546	306	940
Vague address	52	209	154	415
Overseas	—	—	—	—
Total(e)	3 691	1 105	1 480	6 276
All persons(f)				
Census night address				
PES address	77 495	184	1 365	79 044
Search address				
Dwelling found	248	3 670	282	4 200
Dwelling missed	167	598	337	1 102
Vague address	75	224	167	466
Overseas	379	20	923	1 322
Total(e)	78 364	4 696	3 074	86 248

— nil or rounded to zero (including null cells)

(a) As reported in the PES.

(b) Includes people who did not report (or were not asked) whether they thought they had been included in the Census.

(c) Includes people who did not know whether they were included on a Census form.

(d) Includes people who should not have been counted in the Census.

(e) Includes people who did not provide a Census night address (e.g. because of scope exclusions).

(f) Includes people who were not counted and should not have been counted in the Census.

The majority of people are expected to be counted at the dwelling where they stayed on Census night. The Census night address was the same as the person's PES address for 70.4% of undercounted people, compared to 94.9% for people counted in the Census.

PEOPLE AND DWELLINGS MISSED *continued*

PEOPLE MISSED IN THE CENSUS *continued*

Of undercounted people, 23.6% thought they had not been included on a Census form, with 76.4% believing they were included on a Census form. Most of these people (77.0%) thought they had been counted at their PES address. There were 415 people who were unable to be found during PES match and search processing because information provided for their Census night address was too vague. Of the people who were counted in the Census, less than one percent (0.9%) thought they were not counted in the Census. In addition, just over one in five people (21.9%) who thought they had not been counted in the Census had in fact been counted.

DWELLINGS MISSED IN THE CENSUS

For a variety of reasons, not all dwellings receive a Census form. This is because not all dwellings are habitable, or the Census collector did not identify them, or in the case of a diplomatic dwelling did not contain people within the scope of the Census. Census field procedures require that all dwellings, apart from the types listed below, are recorded, irrespective of a received (or returned) Census form. Hence all dwellings in Australia (less the following exclusions) should be counted in the Census.

Census dwelling counts do not include:

- Dwellings under construction
- Derelict dwellings
- Vacant tents
- Unoccupied converted garages
- Unoccupied caravans; and
- Unoccupied dwellings within marinas/manufactured home estates.

There were an estimated 248,796 dwellings missed by the Census, or 2.9% of all dwellings. Table 4.2 shows the PES estimates of the number of dwellings counted and missed, by Census response type.

4.2 PES ESTIMATE OF COUNTED AND MISSED DWELLINGS(a), Census response type by State/territory

Counted in Census

	Occupied		Unoccupied		Non-contact sector		Total(b)		Missing		Total	
	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
NSW	2 332 445	83.4	246 505	8.8	129 316	4.6	2 708 266	96.9	87 737	3.1	2 796 003	100.0
Vic.	1 779 110	84.0	208 339	9.8	83 751	4.0	2 071 200	97.7	47 920	2.3	2 119 120	100.0
Qld	1 422 738	83.4	143 643	8.4	73 152	4.3	1 646 527	96.6	58 611	3.4	1 705 138	100.0
SA	584 696	84.2	66 828	9.6	19 843	2.9	674 632	97.2	19 735	2.8	694 367	100.0
WA	704 374	81.9	84 998	9.9	42 545	4.9	837 342	97.3	22 901	2.7	860 243	100.0
Tas.	182 302	82.0	26 502	11.9	5 748	2.6	214 552	96.5	7 827	3.5	222 379	100.0
NT	50 295	66.1	4 700	6.2	6 140	8.1	73 404	96.5	2 639	3.5	76 043	100.0
ACT	117 132	88.4	8 397	6.3	5 596	4.2	131 125	98.9	1 426	1.1	132 551	100.0
Aust.	7 173 092	83.4	789 912	9.2	366 091	4.3	8 357 048	97.1	248 796	2.9	8 605 844	100.0

(a) Excludes sample loss i.e. dwellings converted to non-dwellings; derelict dwellings; demolished dwellings; dwellings under construction.

(b) Includes a total of 27,953 dwellings that were counted in the ICF.

MATCH AND SEARCH PROCESSING

DETERMINING A MATCH

The first step in match and search processing was to attempt to 'match' every dwelling selected in the PES to the equivalent dwelling in the Census. Person matching was then carried out for all people in matched PES dwellings. In the majority of cases the same people were recorded in the same dwelling during both the PES and Census enumeration.

The second step was to 'search' for PES respondents at any alternative address provided during the PES interview: that is, their search addresses.

Field match codes (FMC)

To determine if a PES person matched to a Census person, a comparison was made of responses to key variables common to both the PES and Census forms. A field match code (FMC) was recorded to indicate the strength of the match against each of the following fields:

- Name
- Sex
- Date of birth
- Age
- Marital status
- Indigenous status
- Country of birth
- Relationship in household.

Person match codes (PMC)

The Match and Search System incorporated an algorithm which combined field match codes to produce a final person match code (PMC). Fields such as name, sex, and age were given greater importance in determining the PMC. Other variables, such as marital status, Indigenous status, country of birth and relationship in household were considered less important in determining a PMC but still played a vital part in informing the decision of whether a match existed.

PES address and search address

Match and search processing was done in the same manner for both PES addresses and search addresses. However, PES addresses usually had more accurate address details, as standard ABS survey procedures include checks at PES addresses, while search addresses rely on information supplied during the interview.

Information included in this section relates to both PES addresses and search addresses.

Table 5.1 shows the broad categories for final person match code by person match status (i.e. matched or not matched) by Private Dwelling (PD) and Indigenous Community Frame (ICF) samples. The table excludes a small number of records that, due to system limitations, were reviewed after the conclusion of match and search processing. The total 90,426 addresses include the PES addresses for 86,101 PES responding people, and 4,325 search addresses.

MATCH AND SEARCH PROCESSING *continued*

5.1 CONFIDENCE OF MATCH DECISIONS, Person match codes by Sample type—Persons

<i>Person match details</i> (a)	PD Sample		ICF Sample		Total	
	no.	%	no.	%	no.	%
Matched						
Definite match on name, age and sex	73 591	94.9	830	78.4	74 421	94.7
Name match plus either age or sex	792	1.0	115	10.9	907	1.2
Partial name match plus age or sex	2 769	3.6	91	8.6	2 860	3.6
Partial name or other variables indicate a match	413	0.5	23	2.2	436	0.6
<i>Total matched</i>	<i>77 565</i>	<i>100.0</i>	<i>1 059</i>	<i>100.0</i>	<i>78 624</i>	<i>100.0</i>
Not matched						
Dwelling found with some similarities with person record	29	0.3	—	—	29	0.2
Dwelling found but no corresponding person on Census form	5 381	48.6	688	93.0	6 069	51.4
Dwelling found but no Census form	5 019	45.4	47	6.4	5 066	42.9
Dwelling not found	633	5.7	5	0.7	638	5.4
<i>Total not matched</i>	<i>11 062</i>	<i>100.0</i>	<i>740</i>	<i>100.0</i>	<i>11 802</i>	<i>100.0</i>
Persons processed	88 627	100.0	1 799	100.0	90 426	100.0

— nil or rounded to zero (including null cells)

(a) There were 22 PMCs available during match and search processing. The PMCs have been grouped by similar characteristics for presentation in this table.

PES address and search address continued

The majority of person matches (94.7%) were very strong matches due to the name, sex and age of the PES and Census person matching. Decisions leading to a person non-match were mostly cases where the dwelling was located but there was no equivalent person to match to (51.4%), or where the dwelling was located but there was no Census form processed for that dwelling (42.9%), that is the dwelling was non-responding to the Census.

QUALITY ASSURANCE AND ADJUDICATION PROCESSING

To ensure the accuracy of PES results, Quality Assurance (QA) procedures were used in match and search processing, whereby all PES records were processed a second time by a different operator. Each workload was presented for processing in a way that prevented the identification of the workload as either an 'original' or QA workload.

All discrepancies, at either the dwelling or person level, found between the original and QA processing were automatically flagged for adjudication. A processing supervisor reviewed the discrepancies between the original and QA coding and decided which was correct. If both the original and QA coding were considered to be incorrect, the record was reprocessed by the supervisor.

MATCH AND SEARCH PROCESSING *continued*

QUALITY ASSURANCE AND
ADJUDICATION
PROCESSING *continued*

Table 5.2 shows a comparison of the match and non-match results between the original and QA processes.

5.2 MATCHING RESULTS, Original and Quality Assurance—Persons

<i>Original process</i>	QA process					
	Matched		Not matched		Total	
	no.	%	no.	%	no.	%
Matched	77 170	98.9	857	1.1	78 027	100.0
Not matched	759	6.1	11 640	93.9	12 399	100.0
Total	77 929	86.2	12 497	13.8	90 426	100.0

Of the 78,027 records classed as a match during original processing, 98.9% were also found to be a match during the second (QA) process. For records not matched in the original coding process, 93.9% were not matched during QA processing.

ADJUDICATION RESULTS

Records were flagged for adjudication when there was a discrepancy with the matched Census records, or between PMCs recorded, for both the original and QA processes. This included records that were matched in both processes e.g. one process recorded a definite name match and the other a partial name match.

Table 5.3 shows the result of adjudication processing.

5.3 ADJUDICATION PROCESSING, Person match status by Sample type—Responding PES persons

<i>Adjudication processing of persons</i>	PD sample				ICF sample				Total			
	Matched	Not matched	Total		Matched	Not matched	Total		Matched	Not matched	Total	
	no.	no.	no.	%	no.	no.	no.	%	no.	no.	no.	%
Adjudication not required	74 193	10 432	84 625	95.5	789	695	1 484	82.5	74 982	11 127	86 109	95.2
Adjudication required	3 372	630	4 002	4.5	270	45	315	17.5	3 642	675	4 317	4.8
Original chosen	1 755	315	2 070	2.3	99	14	113	6.3	1 854	329	2 183	2.4
QA chosen	1 593	309	1 902	2.1	169	31	200	11.1	1 762	340	2 102	2.3
Adjudication coded	24	6	30	—	2	—	2	0.1	26	6	32	—
Total	77 565	11 062	88 627	100.0	1 059	740	1 799	100.0	78 624	11 802	90 426	100.0

— nil or rounded to zero (including null cells)

Adjudication was required for less than 5% of PES records (4.8% of cases for PES addresses, and 3.3% for search addresses).

In 95.2% of cases, original and QA processing produced exactly the same result and adjudication was not required. Of the 4.8% of cases where adjudication was required, original and QA records were chosen in almost equal proportions (50.6% and 48.7% respectively). In a small number of cases (32 records), both original and QA results were

MATCH AND SEARCH PROCESSING *continued*

ADJUDICATION RESULTS *continued*

rejected and reprocessed by the PES supervisor. Those records that did not require adjudication resulted in a match slightly more often than those where adjudication was required, in 87.1% and 84.4% of cases respectively.

The proportion of records requiring adjudication was higher for the ICF sample (17.5%) than the PD sample (4.5%). This reflects the slightly more complex procedures required for processing the ICF component.

Further information on the Match and Search procedures can be found in *Information Paper: Measuring Net Undercount in the 2006 Population Census* (cat. no. 2940.0.55.001) released on 7 May 2007.

DIFFERENCES IN CLASSIFICATION BETWEEN PES AND CENSUS

Occasionally the answers obtained for a person in the PES interview are not consistent with the answers obtained for the equivalent questions in the Census or the imputed Census value where no answer was provided. This is more prevalent for Indigenous status and Country of birth, as there are no responses for these items in a number of Census records and there is no imputation for them.

Tables 5.4 and 5.5 below contain unweighted PES counts of the classification of Indigenous status and Country of birth for both PES and Census. The tables are counts of all responding people in the PES. For the small number of people (139) found on more than one Census form, only the first match has been included in the table.

5.4 DIFFERENCE IN CLASSIFICATION, Indigenous status—Responding PES persons

<i>Census response</i>	PES response					
	Indigenous		Non-Indigenous		Total	
	no.	%	no.	%	no.	%
Matched	2 730	81.4	76 907	92.8	79 637	92.3
Indigenous	2 576	76.8	283	0.3	2 859	3.3
Non-Indigenous	116	3.5	75 406	91.0	75 522	87.6
Not stated	38	1.1	1 218	1.5	1 256	1.5
Not matched	624	18.6	5 987	7.2	6 611	7.7
Total	3 354	100.0	82 894	100.0	86 248	100.0

MATCH AND SEARCH PROCESSING *continued*

DIFFERENCES IN
CLASSIFICATION
BETWEEN PES AND
CENSUS *continued*

5.5 DIFFERENCE IN CLASSIFICATION, Country of birth—Responding PES persons

Census response	PES response					
	Australia		Overseas		Total	
	no.	%	no.	%	no.	%
Matched	61 572	93.0	18 065	90.0	79 637	92.3
Australia	59 702	90.2	209	1.0	59 911	69.5
Overseas	239	0.4	17 352	86.5	17 591	20.4
Not stated	1 631	2.5	504	2.5	2 135	2.5
Not matched	4 606	7.0	2 005	10.0	6 611	7.7
Total	66 178	100.0	20 070	100.0	86 248	100.0

For Indigenous status and Country of birth, nearly all person matches between PES respondents and their corresponding Census records showed the same response. For example, 94.4% (2,576) of matched people who reported as Indigenous in the PES (2,730), were also counted as Indigenous in the Census, and 96.1% (17,352) of matched people who reported as overseas born in the PES (18,065), were also counted as overseas born in the Census.

EXPLANATORY NOTES

SCOPE OF THE 2006 CENSUS

1 The 2006 Census of Population and Housing was held on 8 August 2006. The objective of the Census was to measure the number and key characteristics of people in Australia on Census night, and the dwellings in which they live.

2 The Census attempts to count every person who spent Census night in Australia. This includes Australian residents in Antarctica and people in the territories of Jervis Bay, Cocos (Keeling) Islands and Christmas Island. The other Australian External Territories, Norfolk Island and minor islands such as Heard and McDonald Islands, are outside the scope of the Australian Census. Australian residents out of the country on Census night are also out of scope of the Census. The only people who spend Census night in Australia but are excluded from the Census are foreign diplomats and their families. People were counted where they stayed on Census night. This means that the Census was conducted on an 'actual location' or 'place of enumeration' basis.

3 Visitors to Australia are counted regardless of how long they have been in the country or how long they plan to stay. People outside Australia who are not required to undertake migration formalities, such as those on oil and gas rigs off the Australian coast, are included. People visiting Australia on Census night are included in the Census counts on a place of enumeration basis but not those on a place of usual residence basis.

4 All private dwellings, except diplomatic dwellings, are included in the Census, whether occupied or unoccupied. Caravans in caravan parks, manufactured homes in manufactured home estates and houseboats in marinas are counted only if occupied. Occupied non-private dwellings, such as hospitals, prisons, hotels, etc., are also included.

5 Details about the 2006 Census content, collection operations, confidentiality and privacy protection, processing and evaluation activities are contained in *2006 Census Nature and Content* (cat no. 2008.0).

SCOPE AND COVERAGE OF THE 2006 PES

6 The scope of the Census is every person present in Australia on Census night (with the exception of foreign diplomats and their families). Ideally the PES would sample from all people who were or should have been counted in the Census – thus this set of people constitute the theoretical scope of the PES. For practical reasons there are a number of areas, dwellings and people excluded or not able to be covered by the PES. Of the people present in Australia at the time of the PES, the following are not included:

- people in non-private dwellings such as hotels, motels, hospitals and other institutions
- homeless people (as the sample selected in the PES is based on the selection of dwellings)
- foreign diplomats and their families
- overseas visitors who were not in Australia on 8 August 2006 (Census night)
- babies born after 8 August 2006
- people in Cocos (Keeling) Islands, Christmas Island, Australian Antarctic Territory, and Jervis Bay Territory.

7 The PES also does not obtain information about people who died between Census and the PES. However, it does obtain information about Australian residents who are overseas during the PES enumeration period and who departed some time in August, provided that they usually live with people remaining in Australia (in private dwellings).

8 The 2006 PES included remote areas and discrete Indigenous communities for the first time. Previous PESs have excluded these areas from the coverage of the survey due to operational reasons – mainly the additional cost and the need to use the same local contacts as Census, which was considered likely to compromise the independence of the PES. Inclusion of these communities in 2006 ensures that the geographic coverage of the PES is more complete than it has been in the past. In practice, the PES is used to

EXPLANATORY NOTES *continued*

SCOPE AND COVERAGE OF THE 2006 PES *continued*

produce estimates for the full Census scope, even though its actual coverage is somewhat less.

9 The PES interview process determines whether each person in the sample should have been counted in the Census, and a few of the categories in which they should have been counted (such as age, sex, Indigenous status, country of birth, region of usual residence, etc). The match and search process involves comparing dwellings and people enumerated in the PES with dwellings and people counted in the Census. The objective is to determine how many times each person in the PES sample was actually counted in the Census. PES output processing and estimation then combines and weights results from the match and search process to produce an estimate of the number of people who should have been counted in the Census.

PES ESTIMATION

10 Following the 2001 PES, a review of the PES estimation method was commissioned to develop an estimator for the PES that adjusts adequately for non-response and non-coverage in PES, and for miscounting in the Census.

11 The 2006 PES introduced a number of methodological improvements that allow more aspects of the Census to be appropriately measured. A side-effect of these changes is that the sampling error on the overall population estimates has increased, with previously unmeasured potential errors now being measured by the survey and included in adjustments.

12 Broadly speaking, PES estimation involves assigning a 'weight' to each selected PES dwelling and then to each person for whom a PES response was obtained. The PES estimate of the number of people who should have been counted in the Census is obtained as a weighted sum of the number of people in the PES sample who should have been counted in the Census.

13 Further details of PES estimation are in Appendix 3 of *Census of Population and Housing — Undercount* (cat. no. 2940.0) released on 5 June 2007. Technical details of the PES estimator were reported in *Research Paper: An estimating equation approach to Census coverage adjustment* (cat. no. 1351.0.55.019) released on 7 May 2007. Further descriptions of PES estimation can also be found in *Information Paper: Measuring Net Undercount in the 2006 Population Census, Australia* (cat. no. 2940.0.55.001) released on 7 May 2007.

CENSUS COUNTS *Not-stated values*

14 For Census purposes, age, sex, marital status and state of usual residence are imputed during Census processing where these items have been left blank, including where a whole person record has been imputed. Missing values for any other items remain 'not-stated' in the final version of Census counts.

Usual residence

15 The Australian Census counts people where they actually were on Census night, rather than where they usually live. There is, however, a need for data based on place of usual residence, and Census counts are available on this basis.

16 For usual residents of Australia, 'place of usual residence' for the 2006 Census is defined as the address at which a person has lived or intends to live for six months or more in 2006. While for most people their usual residence was the same as their actual location on Census night, some people spent Census night at a place other than where they usually lived. Thus, their 'place of enumeration' and their 'place of usual residence' were different.

17 Usual residents of Australia who are temporarily overseas on Census night are not included in Census counts on either a place of usual residence or place of enumeration basis. However, these people are accounted for in the estimated resident population of Australia (ERP). For information on the calculation of ERP, see the ABS publication

EXPLANATORY NOTES *continued*

Usual residence continued

Australian Demographic Statistics, December quarter 2006 (cat. no. 3101.0), released on 5 June 2007.

CORRECTION FOR CENSUS
IMPUTATION ERROR IN THE
NON-CONTACT SECTOR

18 Estimates presented in this publication are on a place of usual residence basis.

19 The standard error (SE) on the PES estimate of the population in the non-contact sector has been calculated, and used in comparing the accuracy of the PES estimate with that of the unadjusted Census count for this sector. Analysis showed that the overall population estimates are considerably more accurate if the PES estimates are used for this sector rather than using the Census counts (which in this sector were mostly imputed). See Appendix for further information.

20 Net undercount estimates presented in this publication incorporate the PES estimates for the population in the non-contact sector.

APPENDIX LATE RETURNS AND NON-RESPONDING DWELLINGS

NON-CONTACT SECTOR

Late returns

For some people who have not returned a Census form, contact from the ABS following selection in the PES acts as a reminder and possible motivator to return a completed Census form. These late returns, if not identified, would result in the PES sample having a higher proportion of Census response than the overall population. To protect against this, all Census forms received after the start of PES field work are deemed 'late' and treated differently in PES estimation.

To deal with this situation, PES estimation conceptually uses the Census on an 'at start of PES' basis. Census forms that were returned by mail or the Internet after a specified date (referred to as 'late returns') are included in the 'non-contact sector' of the Census.

Non-responding dwellings

The non-contact sector also contains dwellings which were non-responding in the Census – that is, dwellings where the Census never obtained a return, and which could not be established as having been unoccupied on Census night. These non-response dwellings are given imputed person records (using 'hot-deck' imputation) during Census processing, based in many cases on information provided by the Census collector about the dwelling and its residents. These records have values imputed for Age, Sex, Marital status, and place (CD, SLA and State/territory) of usual residence. Values for all other variables (e.g. Indigenous status, Labour force status) are set to not-stated or not applicable, depending on the imputed value for age.

Inevitably, the imputed values, at the dwelling and aggregate level, differ from the true, but unknown, values. The imputed records constitute the majority of the Census non-contact sector records; late returns (as defined above) are only a small component of the overall Census non-contact sector. Given that late returns prompted by PES would otherwise have been classed as non-response in the Census, the PES sample is representative of the whole non-contact sector, even though late returns cannot be separately identified from non-responses in a manner comparable to the Census.

Estimating the number of people in the Census non-contact sector

In previous Censuses, only the Census contact sector was corrected for under- and over-count by using the PES estimates. Effectively, late returns and imputed records (the Census non-contact sector for PES purposes) were treated as being reported accurately. While this assumption is imperfect, this was considered the most feasible way to calculate accurate net undercount estimates at the level of detail needed for producing estimated resident population counts in Australia.

For the 2006 PES, the person weighting step in PES processing calculates weights for all PES records, including those that correspond to the Census non-contact sector. Hence the PES can provide an estimate of the total population in Census late-return and non-responding dwellings on Census night. This is a change from previous PESs, in which people selected in non-contact sector dwellings were excluded from matching and from estimation. The inclusion of these people in the 2006 PES is made possible by the development of appropriate methods for representing them in estimation.

PES estimates of the population in the non-contact sector have relatively high sampling errors because of the small sample size (there are relatively few non-contact dwellings selected by chance in the PES sample); and also because person counts for this sector are not available to use as a weighting 'benchmark'. This lack of Census person counts also means that, while the dwelling weights used for the non-contact sector are estimated from the sector itself, the adjustments applied to provide final person weights depend strongly on information observed in the contact sector. This is a potential source of non-sampling error, as is any bias arising from peculiarities of the PES non-respondents in this sector. Both these sources of non-sampling error are expected to be small compared to the sampling error of the PES population estimate for the non-contact sector.

APPENDIX LATE RETURNS AND NON-RESPONDING DWELLINGS

continued

Estimating the number of people in the Census non-contact sector continued

Using PES to estimate the population in the Census non-contact sector leads to a rise in the standard error of the overall population estimate. On the other hand, the alternative, where this sector is not measured by PES but is treated as accurately represented by the Census figures, can have a bias associated with Census imputation for non-response.

The standard error of the PES estimate of the population in the non-contact sector was used to compare the accuracy of the PES estimate with that of the unadjusted Census count for this sector. Analysis showed that the overall population estimates are considerably more accurate if the PES estimates are used for this sector rather than using the Census counts (which in this sector were mostly imputed).

As a result, net undercount for the 2006 Census incorporates the PES estimate of the number of people who should have been counted in the non-contact sector.

CENSUS LATE RETURNS AND IMPUTED RECORDS

In the 2006 Census, there were 880,770 persons in the non-contact sector, i.e. people from late-return dwellings or imputed person records for non-responding dwellings. The vast majority (just under 90%) of the non-contact sector is imputed person records. The non-contact sector comprised 4.4% of the final 2006 Census count.

Table A1.1 provides Census data by state/territory for 1996, 2001 and 2006. Care should be taken when comparing data for 2006 to previous years because of the following differences:

- Data for the 2006 Census include people from late-return dwellings and imputed persons; data for the 1996 and 2001 Censuses refer only to imputed persons.
- Data for 2006 refers to state/territory on a usual residence basis; data for 1996 and 2001 is on a state/territory of enumeration basis.
- In 2006, data for Australia excluded 'Other Territories' i.e. Christmas Island, Cocos (Keeling) Islands and Jervis Bay Territory. In 1996 and 2001, data for Australia included 'Other Territories'.

Although the data are not entirely comparable, the table does show a significant increase in the number of Census imputed person records in 2006 compared with the previous two Censuses, and hence the number of non-responding dwellings to the Census.

A1.1 CENSUS LATE RETURNS AND IMPUTED DWELLINGS, State/territory(a)—Person records

	1996(b)			2001(b)			2006(c)		
	Persons	Imputed persons	% Imputed	Persons	Imputed persons	% Imputed	Persons(d)	Non-contact sector persons(e)	% non-contact sector
	no.	no.	%	no.	no.	%	no.	no.	%
NSW	6 038 696	88 961	1.5	6 371 745	173 878	2.7	6 549 177	309 261	4.7
Vic.	4 373 520	57 388	1.3	4 644 950	97 618	2.1	4 932 422	203 639	4.1
Qld	3 368 850	44 033	1.3	3 655 139	63 340	1.7	3 904 534	172 384	4.4
SA	1 427 936	14 487	1.0	1 467 261	17 959	1.2	1 514 337	47 958	3.2
WA	1 726 095	24 909	1.4	1 851 252	36 551	2.0	1 959 087	104 431	5.3
Tas.	459 659	5 007	1.1	456 652	5 983	1.3	476 479	14 476	3.0
NT	195 101	7 383	3.8	210 664	7 869	3.7	192 900	15 778	8.2
ACT	299 243	3 954	1.3	311 947	6 608	2.1	324 037	12 843	4.0
Aust.	17 892 423	246 192	1.4	18 972 350	409 823	2.2	19 852 973	880 770	4.4

(a) For 1996 and 2001 State/territory refers to place of enumeration. For 2006 State/territory refers to place of usual residence.

(b) Aust. includes 'Other Territories', i.e. Christmas Island, Cocos (Keeling) Islands and Jervis Bay Territory.

(c) Aust. excludes 'Other Territories'.

(d) Excludes 2,317 people whose State/territory of usual residence was recorded as 'Other Territories' in the Census.

(e) Comprises persons from late-return dwellings and persons imputed for non-responding dwellings.

TECHNICAL NOTE SAMPLING AND NON-SAMPLING ERROR

SAMPLING ERRORS ASSOCIATED WITH ESTIMATES PRODUCED FROM THE PES

1 As estimates of undercount are based on a sample survey they 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 in the survey. One measure of the likely difference is given by the standard error (SE) which indicates the extent to which an estimate might have varied by chance because only a sample was included.

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

3 Given an estimate and the SE on that estimate, there are about two chances in three that the sample estimate will differ by less than one SE from the figure that would have been obtained if all dwellings had been included in the survey, and about nineteen chances in twenty that the difference will be less than two SEs.

4 The following example illustrates the use of the concept of SE. If an estimate of 1.3% has a SE 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 $1.3\% \pm (1 \times 0.1\%)$ or 1.2% to 1.4%, and nineteen chances in twenty that the figure is in the range $1.3\% \pm (2 \times 0.1\%)$, that is, between 1.1% and 1.5%.

5 For ease of use, the SEs corresponding to the net undercount rates or undercount adjustment factors are given next to the rates in the tables throughout this publication.

Sampling errors on estimates of differences

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

$$SE(x - y) = \sqrt{[SE(x)]^2 + [SE(y)]^2}$$

7 This approximation will be exact for differences between estimates in different states 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 SE.

8 For example, if the estimates of the rate of net undercount for usual residents in NSW and ACT are 2.4% and 1.2%, with SEs of 0.4 and 1.0 percentage points respectively, using the formula above the SE on the difference (1.2 percentage points) is:

$$\sqrt{(0.4)^2 + (1.0)^2} = 1.08 \text{ percentage points}$$

9 Therefore there are nineteen chances in twenty that the difference between the rates of undercount for usual residents between these two regions is within the range $1.2 \pm (2 \times 1.08)$ or -0.96 to 3.36 percentage points.

Non sampling error

10 The estimates of undercount are also subject to non-sampling errors which occur in all collections, whether censuses or surveys. Examples of this kind of error include imperfections in reporting by respondents, errors made in collection of data, and errors made in processing the data. Every effort is made in 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 by using effective operating procedures. Types of non-sampling error arising from the way the PES is conducted and the way estimates are derived from the survey are discussed below.

Non sampling error continued

11 A potential weakness in the PES method is its dependence on matching as a means of deciding whether or not a given person or dwelling in the PES has been counted in the Census. The difficulties associated with the matching process mean that there is a risk of failing to match people who are actually included in the Census. The effect of not matching when there should have been a match would be to overstate net undercount in the Census.

12 While the Census and PES are conducted independently of each other, they are very similar in many respects. Thus, some weaknesses in the Census may also be shared by the PES leading to an understatement of net undercount. For example, dwellings missed by a Census collector are often difficult to find and so could possibly be missed by a PES interviewer as well. Also, people who avoid being included in the Census may also avoid being included in the PES. The use of benchmarks in estimation is designed to control the effect of this 'correlation bias'.

GLOSSARY

Benchmark category	A category of dwelling or person for which the PES estimate of the Census count is forced to reproduce the actual Census count.
Census collection district (CD)	A Census collection district (CD) is the basic geographic unit of collection in the Census. A CD is generally a Census workload area that one collector can cover, delivering and collecting forms in a specified period. On average there are about 200 dwellings per CD; however, there may be more in some urban CDs, and in rural areas a CD may contain fewer dwellings yet cover an extensive area.
Census count	The number of people who were counted in the Census for a category. The Census count includes imputed persons for non-responding dwellings. However, some categories (such as Indigenous status and Country of birth) do not include any imputed persons, as Census assigns a not-stated category to all the imputed person records.
Census imputation error	The difference between the PES estimate and the actual Census count of imputed people.
Contact sector	The Census contact sector comprises all Census dwellings, excluding late return and non-responding dwellings.
Coverage	Survey coverage refers to the population units which have a chance of being selected in the survey sample. For the quality of the survey estimates, it is desirable that the survey coverage matches as closely as possible the survey scope. Coverage rules are generally applied in all household surveys to ensure that each person is associated with only one dwelling, and hence has only one chance of selection.
Discrete Indigenous community	A discrete Indigenous community is defined as a geographic location, bounded by physical or legal boundaries, and inhabited or intended to be inhabited predominantly by Indigenous people, with housing or infrastructure that is either owned or managed on a community basis.
Dwelling	<p>A dwelling is a building or structure in which people may live. This can be a building, such as a house; part of a building, such as a flat; or it can be a caravan or tent, humpy or a park bench. Houses under construction, derelict houses, vacant tents, or unoccupied converted garages, are not counted as dwellings in the Census. There are private and non-private dwellings.</p> <p>A private dwelling is normally a house, flat, part of a house, or even a room. Private dwellings can be either occupied or unoccupied. The following accommodation types are also classed as private dwellings: a house attached to, or room above, shops or offices; an occupied caravan or unit in a caravan park or on a residential allotment; an occupied boat in a marina; an occupied dwelling in a manufactured home estate; a self contained unit in a retirement village; a houseboat; or a tent if it is standing on its own block of land.</p> <p>Non-private dwellings are those dwellings not included above which provide a communal or transitory type of accommodation. These dwellings include hotels, motels, guest houses, prisons, religious and charitable institutions, defence establishments, hospitals and other communal dwellings. Only occupied non-private dwellings are included in the Census.</p>
Estimated Resident Population (ERP)	Estimated Resident Population (ERP) is the official measure of the population of Australia based on the concept of residence. It refers to all people, regardless of nationality or citizenship, who usually live in Australia, with the exception of foreign diplomatic personnel and their families. It includes usual residents who are overseas for less than 12 months. It excludes overseas visitors who are in Australia for less than 12 months.
Gross overcount	The number of people in the Census who should not have been counted, either because they had already been counted or because they were overseas and should not have been counted at all. If a person was counted in the Census three times, for example, they

GLOSSARY *continued*

would contribute two counts to the gross overcount (assuming they should have been counted in the Census).

Gross undercount	The number of people who should have been counted in the Census but were not.
Hot-deck imputation	An imputation process whereby a donor record is located and relevant responses copied from the donor record to a non-responding record. The donor record will have similar characteristics to the non-responding record and must also have the required variable(s) stated. In addition, the donor record will be located geographically as close as possible to the location of the record to be imputed.
Indigenous Community Frame (ICF)	<p>The Indigenous Community Frame (ICF) is a listing of all discrete Indigenous communities from which the sample of communities was selected for the 2006 PES. The selection unit on the ICF is a community set. A set usually comprises a main community, a number of out-stations and the non-community dwellings within the CDs associated with the main community. If a community set is selected then a selection of the dwellings in the main community, all the dwellings in some outstations, and a selection of the non-community dwellings will be enumerated in the survey.</p> <p>Once a community set has been selected the main community dwellings and outstations that will be enumerated are determined by the community skip and a random start. For instance, suppose a selected community set has 25 dwellings, 8 outstations and a skip of 5. The random start assigned is 3. The dwellings selected for enumeration are 3, 8, 13, 18, and 23, and all of outstations 3 and 8. The non-community dwellings will be enumerated with a skip of 5.</p>
Imputation	A statistical process for predicting values where no response was provided to a question and a response could not be derived.
Late return	A Census form which was returned after the start of PES enumeration.
Net undercount	The difference between the PES estimate of the number of people who should have been counted in the Census and the actual Census count (including imputations). The estimated net undercount for a category of person is the net result of undercount, overcount, differences in classification between the PES and Census (e.g. age, sex, Indigenous status) and imputation error in the Census.
Non-contact sector	The Census non-contact sector comprises late-return and imputed dwellings.
Non-private dwelling	An establishment which provides a communal type of accommodation, such as a hotel, motel, hospital or other institution. Non-private dwellings were not included in the 2006 PES sample.
Non-sampling error	Non-sampling error arises from inaccuracies in collecting, recording and processing the data. Every effort is made to minimise non-sampling error by the careful design of questionnaires, intensive training and supervision of interviewers, and efficient data processing procedures. Non-sampling error also arises because information cannot be obtained from all people selected in the survey.
Other territories	The Other territories comprise Jervis Bay Territory and the external territories of Christmas Island and Cocos (Keeling) Islands.
Outstation (or homeland)	A discrete Indigenous community that has a population of less than 50 people AND is administered by, or linked to, an organisation such as a Resource Agency or larger parent discrete Indigenous community for the provision and maintenance of services.
PES address	The address at which the respondent was enumerated in the PES.
PES population estimate	An estimate (based on PES and Census data) of the number of people who should have been counted in the Census.
Place of enumeration Census count	People are counted according to where they were on Census Night. Overseas visitors are included and Australians overseas are excluded from the counts. No adjustment is made for Census undercount.

GLOSSARY *continued*

Place of usual residence	People are counted according to their stated place of usual residence in Australia.
Census count	Overseas visitors are excluded, as are Australians residents who are temporarily overseas.
Private dwelling	A private dwelling is a residential structure which is self-contained, owned or rented by the occupants, and intended solely for residential use. A private dwelling may be a flat, part of a house, or even a room, but can also be a house attached to, or rooms above shops or offices.
Remote areas	<p>Within the Australian Standard Geographical Classification (ASGC), the Remoteness classification comprises five categories, each of which identifies a (non-contiguous) region in Australia having a particular degree of remoteness. The categories range from 'highly accessible' to 'very remote'.</p> <p>The degree of remoteness of each Collection District (CD) was determined using the Accessibility/Remoteness Index of Australia (ARIA). CDs have then been grouped into the appropriate category of Remoteness to form non-contiguous areas within each State.</p> <p>For more information, refer to <i>Statistical Geography Volume 1: Australian Standard Geographical Classification (ASGC) 2001</i> (cat. no. 1216.0) and <i>ABS Views on Remoteness</i> (cat. no. 1244.0).</p>
Sampling error	Sampling error occurs because a sample, rather than the entire population, is surveyed. One measure of the likely difference resulting from not including all dwellings in the survey is given by the standard error. There are about two chances in three that a sample estimate will differ by less than one standard error from the figure that would have been obtained if all dwellings had been included in the survey, and about nineteen chances in twenty that the difference will be less than two standard errors.
Search address	An address (other than the PES address) where a person was reported to be staying on Census night or where a person may have been included on a Census form. PES processing attempts to locate a Census form for each search address, in order to determine the number of times (if any) a person enumerated in the PES was included on a Census form.
Scope	Within household surveys in the ABS, survey scope is considered to be the population about which inferences are desired: that is, when the results are published, the population to which they refer.
Standard error	A measure of the likely difference between the true value and the estimate. For more details see the Technical Note.
Undercount adjustment factor	The undercount adjustment factor is the ratio of the PES population estimate to the Census count. This factor can be applied to the Census counts to indicate how many people should have been counted in the Census for that category.
Undercount in non-contact sector	The difference between the PES estimate of the number of people who should have been counted in the non-contact sector for a category of person and the Census count in the non-contact sector for the category (including imputed records).
Undercounted people	People who should have been counted in the Census but were not. Note: some PES respondents who were missed in the Census are not considered undercounted people e.g. people overseas on Census night.
Unoccupied dwelling (in Census)	A structure built specifically for living purposes which is habitable but the Census Collector was certain was unoccupied on Census night.
Usual residence	The usual residence for a resident of Australia is defined for the purpose of the Census as being the place where they have lived or where they intend to live for 6 months or more in 2006.

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