



Supporting Information

Supplementary methods and results

**This appendix was part of the submitted manuscript and has been peer reviewed.
It is posted as supplied by the authors.**

Appendix to: Zhu L, Hayen A, Blanch B, et al. First implantable cardiac defibrillator insertions in New South Wales, 2005–2020: an analysis of linked administrative data. *Med J Aust* 2024; doi: 10.5694/mja2.52246.

Table 1. Australian Classification of Health Interventions (ACHI) procedure codes for implantable cardioverter–defibrillators procedures

Insertion	38393-00 Insertion of cardiac defibrillator generator 38524-00 Insertion of automatic defibrillator generator
Adjustment	38524-02 Adjustment of automatic defibrillator generator 90203-06 Adjustment of cardiac defibrillator generator
Replacement	38393-01 Replacement of cardiac defibrillator generator 38524-03 Replacement of automatic defibrillator generator
Removal	38524-01 Removal of automatic defibrillator generator 90203-07 Removal of cardiac defibrillator generator

Table 2. International Statistical Classification of Diseases and Related Health Problems, tenth revision, Australian modification (ICD-10-AM) codes

Diagnosis	ICD-10-AM codes*
Hypertension	G93.2, I10, I15.0, I15.1, I15.2, I15.8, I15.9, I27.0, K76.6, O10.0, O10.4, O10.9, O13, O16, P29.2, R03.0
Stroke	G46.3, G46.4, I60.0, I60.1, I60.2, I60.3, I60.4, I60.5, I60.6, I60.7, I60.8, I60.9, I61.0, I61.1, I61.2, I61.3, I61.4, I61.5, I61.6, I61.8, I61.9, I69.0, I69.1, I63.0, I63.1, I63.2, I63.3, I63.4, I63.5, I63.6, I63.8, I63.9, I64, I66.0, I66.1, I66.2, I66.3, I66.4, I66.8, I66.9, I69.3, I69.4, I69.8
Acute myocardial infarction	I21.0, I21.1, I21.2, I21.3, I21.4, I21.9, I23.0, I23.1, I23.2, I23.3, I23.4, I23.5, I23.6, I23.8
Heart failure	I11.0, I13.0, I13.2, I50, I50.0, I50.1, I50.9
Diabetes	E11.9, E11.72, E08.0, E08.1, E08.2, E08.9, E08.0, E08.1, E08.2, E08, E09, E10, E11, E13
Smoking	Z72.0, Z86.43
Cardiac arrest	I46.0, I46.1, I46.2, I46.9
Ventricular fibrillation and flutter	I49, I49.0, I49.01, I49.02
Ventricular tachycardia	I47.2
Atrial fibrillation and flutter	I48, I48.0, I48.01, I48.02, I48.3, I48.4, I48.9
Supraventricular tachycardia	I47.1

* ICD-10-AM single-digit codes include all two-digit level codes.

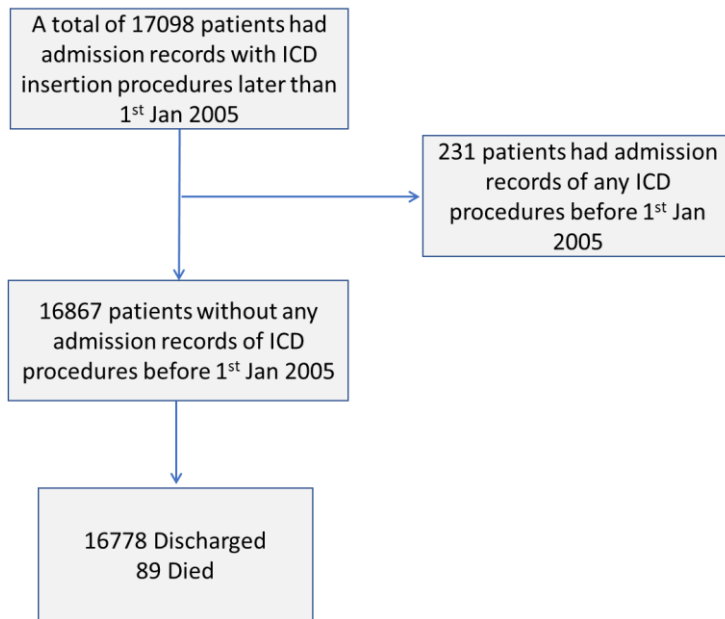
Table 3. International Statistical Classification of Diseases and Related Health Problems, ninth or tenth revision, Australian modification (ICD-9/10-AM) codes and Systematized Nomenclature of Medicine – Clinical Terms codes (SNOMED-CT; 2016) (1)

Category	ICD-9 codes*	ICD-10 codes*	SNOMED-CT codes
Cardiac arrhythmias: atrial fibrillation	427.31	I48, I48.0, I48.01, I48.02, I48.3, I48.4, I48.9	49436004; 5370000; 314208002
Cardiac arrhythmias: cardiac arrest	427.5	I46.0; I46.1; I46.2; I46.9	410429000
Cardiac arrhythmias: unspecified/ related	780.2; 785.1; 780.4; 427.9	I44.1; I44.7; I49.3; I49.4; I49.8; I49.9; R00.0; R00.1	271594007; 80313002; 404640003; 386705008; 44808001; 48867003; 309585006; 6285003;
Cardiac arrhythmias: supraventricular tachycardia		I47.1	6456007
Cardiac arrhythmias: ventricular fibrillation		I49, I49.0, I49.01, I49.02	71908006
Cardiac arrhythmias: ventricular tachycardia	427.1	I47.2	25569003
Cardiomyopathy	425.4	I25.5; I42.0; I42.9; I42.1; I42.2; I42.6; I42.7; I42.8; I43.0	85898001
Cerebrovascular diseases	430-438	G45.9; I62.0; I63.2; I66.0; I63.4; I63.5; I63.8; I60.6; I61.2; I63.1; I63.3; I64; I67.1; I67.2; I67.8	266257000; 230690007; 95453001
Chest pain	786.5; 786.59	R07.3; R07.4	29857009; 102589003; 102588006; 161972006; 102587001; 426396005; 274664007
Device: inappropriate shocks			234239006
Device complication/disorder	996.01; 996.79; 996.09;	Z45.0; Z45.8; T82.1; T82.8; T82.7; T82.81; T82.5; T82.89; T82.79; T82.9; T81.8; T85.6; T81.1; T81.7; T81.89; T82.59; T82.6; T82.83; T82.84; T82.86; T84.7; T88.8; I97.9	213035005; 441769002; 13036008; 90354008; 234228008; 271983002
Device surgery related	998.8; 998.5	Z48.8; T81.41; T81.2; T81.3	128053003; 213262007; 91302008; 59282003; 110265006; 213299007; 385486001; 88797001; 7520000; 18949003; 35688006; 76844004; 58126003; 416462003; 417713005; 225552003; 239164002; 22247000; 262526004; 225553008; 226007004
Heart failure	428; 428.1; 428.9	I50.0; I50.1; I50.9	42343007; 84114007
Heart failure-related symptom		R06.0	267036007; 40541001; 19242006; 360371003; 60845006

Category	ICD-9 codes*	ICD-10 codes*	SNOMED-CT codes
Ischaemic heart disease	411.1; 410.9;	I25.11; I20.0; I21.4; I20.9; I21.9; I21.3; I20.1; I21.0; I25.12; I25.8; I21.2; I51.3; I21.1; I22.0; I23.8; I24.8; I24.9; I25.10; I25.13; I25.9	394659003; 401314000; 401303003; 57054005
Other cardiovascular disease		I70.21; I71.4; I97.1; I74.2; I74.8; I70.1; I71.01; I72.4; I74.3; K31.81; K31.82	45007003; 28651003; 373945007; 38341003; 35304003; 56265001; 89138009

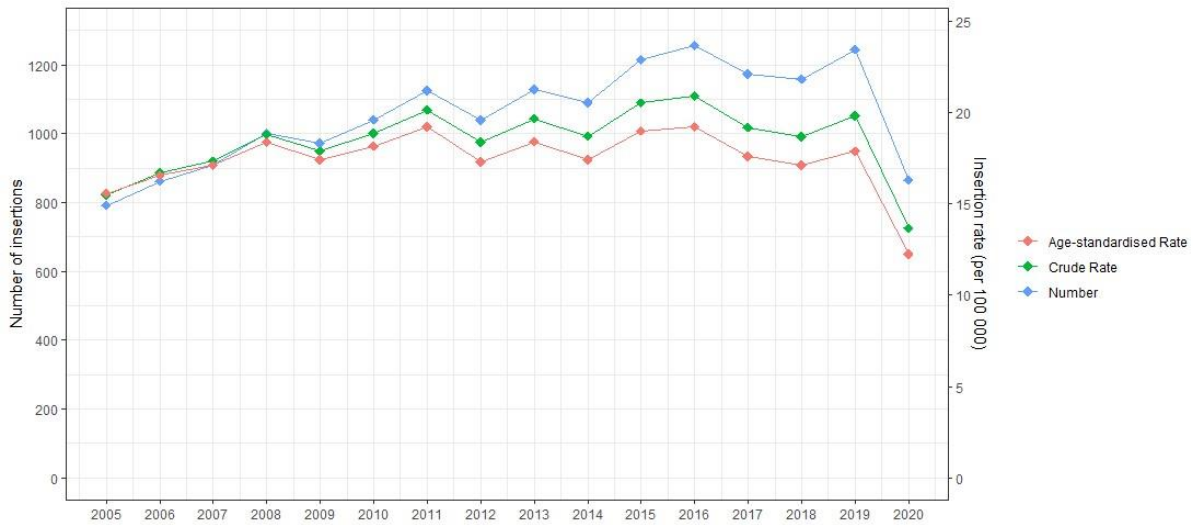
* ICD-9/10-AM single-digit codes include all two-digit level codes.

Figure 1. Selection of people who received first implantable cardioverter–defibrillators in New South Wales during 2005–2020 for our analysis



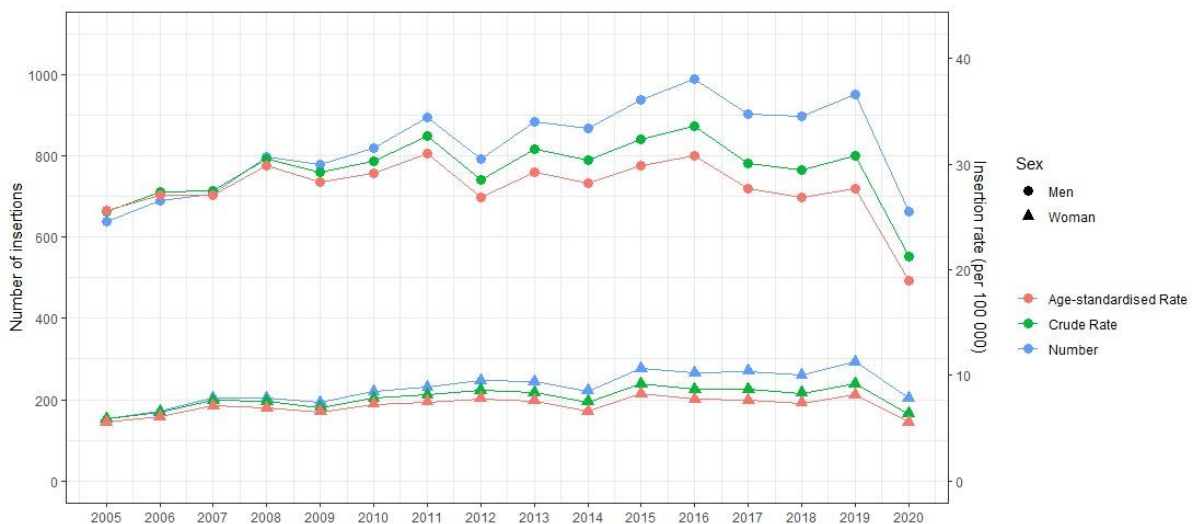
ICD = implantable cardioverter–defibrillator.

Figure 2. Numbers, crude rates, and age-standardised rates of first insertions of implantable cardioverter–defibrillators, New South Wales, 2005–2020*



* The denominators for the rates are the number of New South Wales residents for each year (Australian Bureau of Statistics) (2). Age-standardised rates were based on the 2001 Australian standardised population (3).

Figure 3. Numbers, crude rates, and age-standardised rates of first insertions of implantable cardioverter–defibrillators, New South Wales, 2005–2020, by sex*



* The denominators for the rates are the number of New South Wales residents for each year (Australian Bureau of Statistics) (2). Age-standardised rates were based on the 2001 Australian standardised population (3).

Table 4. Cumulative numbers of people who visited emergency departments after first insertions of implantable cardioverter–defibrillators, New South Wales, 2005–2020*

Diagnosis[†]	30 days	90 days	365 days
All causes	2003 (11.9%)	3750 (22.4%)	9127 (54.4%)
Cardiac arrhythmias[‡]	285 (1.7%)	573 (3.4%)	1236 (7.4%)
Cardiac arrest	11 (0.1%)	18 (0.1%)	47 (0.3%)
Ventricular fibrillation	5 (0.1%)	9 (0.1%)	18 (0.1%)
Ventricular tachycardia	69 (0.4%)	142 (0.8%)	298 (1.8%)
Atrial fibrillation	55 (0.3%)	100 (0.6%)	239 (1.4%)
Supraventricular tachycardia	5 (0.1%)	12 (0.1%)	32 (0.2%)
Cardiac arrhythmias-related symptom	125 (0.7%)	259 (1.5%)	506 (3.0%)
Not specified	15 (0.1%)	33 (0.2%)	96 (0.6%)
Cardiomyopathy	17 (0.1%)	39 (0.2%)	94 (0.6%)
Cerebrovascular diseases	20 (0.1%)	45 (0.3%)	134 (0.8%)
Chest pain	232 (1.4%)	442 (2.6%)	1008 (6.1%)
Dead on arrival at hospital	4 (< 0.1%)	8 (0.1%)	18 (0.1%)
Device-related[§]	163 (1.0%)	246 (1.5%)	434 (2.6%)
Device inappropriate shocks	9 (0.1%)	17 (0.1%)	46 (0.3%)
Device complication/disorder	154 (1.0%)	229 (1.4%)	388 (2.3%)
Heart failure	241 (1.4%)	504 (3.0%)	1108 (6.6%)
Heart failure diagnosis	191 (1.1%)	430 (2.6%)	982 (5.8%)
Heart failure-related symptom	50 (0.1%)	74 (0.1%)	126 (0.8%)
Ischaemic heart disease	43 (0.3%)	94 (0.6%)	292 (1.7%)
Other cardiovascular disease	46 (0.3%)	75 (0.4%)	165 (1.0%)

* Denominator: 16,778 people discharged from hospital alive after first insertion of implantable cardioverter–defibrillator.

† Multiple diagnoses possible, but each specific diagnosis category (bolded) counted only once per person.

‡ We used a hierarchical approach to counting specific types of cardiac arrhythmia such that only one was counted per person: cardiac arrest, ventricular fibrillation, ventricular tachycardia, atrial fibrillation, supraventricular tachycardia, not specified.

§ We used a hierarchical approach to counting type of device-related re-admissions such that only one was counted per person: device-related complication/disorder, device surgery-related.

Table 5. Re-admissions to hospital of men who received first implantable cardioverter–defibrillators in New South Wales during 2005–2020, by age group*

Cause for re-admission [†]	30 days		90 days		365 days	
	Under 65 years	65 years or older	Under 65 years	65 years or older	Under 65 years	65 years or older
Number of people	5311	7903	5311	7903	5311	7903
All causes	794 (5.0%)	1435 (18.2%)	1475 (27.8%)	2669 (33.8%)	2601 (49.0%)	4780 (60.5%)
Device[‡]	211 (4.0%)	294 (3.7%)	414 (8.4%)	589 (7.5%)	662 (12.5%)	932 (11.8%)
Device complication/disorder	194 (3.7%)	267 (3.4%)	387 (7.3%)	551 (7.0%)	612 (11.5%)	853 (10.8%)
Device surgery-related	17 (0.3%)	27 (0.3%)	27 (0.5%)	38 (0.5%)	50 (0.9%)	79 (1.0%)
Heart failure	91 (1.7%)	243 (3.1%)	206 (3.7%)	464 (5.9%)	421 (7.9%)	967 (12.2%)
Cardiac arrhythmias[§]	125 (2.4%)	197 (2.5%)	274 (5.2%)	446 (5.6%)	583 (11.0%)	942 (11.9%)
Cardiac arrest	2 (0.1%)	7 (0.1%)	4 (0.1%)	11 (0.2%)	16 (0.3%)	18 (0.2%)
Ventricular fibrillation	8 (0.2%)	4 (0.1%)	10 (0.2%)	10 (0.1%)	28 (0.5%)	23 (0.3%)
Ventricular tachycardia	31 (0.6%)	63 (0.8%)	83 (1.6%)	129 (1.6%)	183 (3.4%)	284 (3.6%)
Atrial fibrillation	40 (0.8%)	77 (1.0%)	104 (2.0%)	193 (2.4%)	202 (3.8%)	372 (4.7%)
Supraventricular tachycardia	5 (0.1%)	4 (0.1%)	11 (0.2%)	10 (0.1%)	26 (0.5%)	25 (0.3%)
Not specified	39 (0.8%)	43 (0.6%)	62 (1.3%)	93 (1.5%)	128 (2.9%)	220 (3.6%)
Ischaemic heart disease	43 (0.8%)	95 (1.2%)	106 (2.0%)	192 (2.4%)	250 (4.7%)	445 (5.6%)
Chest pain	61 (1.1%)	51 (0.6%)	112 (2.1%)	104 (1.3%)	257 (4.8%)	270 (3.4%)
Cardiomyopathy	37 (0.7%)	22 (0.3%)	92 (1.7%)	48 (0.6%)	190 (3.6%)	128 (1.6%)
Septicaemia	14 (0.3%)	26 (0.3%)	23 (0.4%)	51 (0.6%)	51 (1.0%)	126 (1.6%)
Cerebrovascular diseases	7 (0.1%)	21 (0.2%)	14 (0.3%)	38 (0.5%)	32 (0.6%)	98 (1.2%)
Other cardiovascular disease	6 (0.1%)	11 (0.1%)	10 (0.2%)	25 (0.3%)	26 (0.5%)	79 (1.0%)

* Denominators: People in age group discharged from hospital alive after first insertion of implantable cardioverter-defibrillator.

† Multiple diagnoses possible, but each specific diagnosis counted only once per person.

‡ We used a hierarchical approach to counting device-related re-admissions admissions such that only one was counted per person: device-related complication/disorder, device surgery-related.

§ We used a hierarchical approach to counting specific types of cardiac arrhythmia such that only one was counted per person: cardiac arrest, ventricular fibrillation, ventricular tachycardia, atrial fibrillation, supraventricular tachycardia, not specified.

Table 6. Re-admissions to hospital of women who received first implantable cardioverter-defibrillators in New South Wales during 2005–2020, by age group*

Cause for re-admission [†]	30 days		90 days		365 days	
	Under 65 years	65 years or older	Under 65 years	65 years or older	Under 65 years	65 years or older
Denominator	1636	2017	1636	2017	1636	2017
All causes	264 (16.1%)	378 (18.7%)	514 (31.4%)	666 (33.0%)	844 (51.6%)	1208 (59.9%)
Device[‡]	67 (5.0%)	73 (3.6%)	175 (10.7%)	129 (6.4%)	247 (17.8%)	204 (10.1%)
Device complication/disorder	63 (3.9%)	64 (3.2%)	167 (10.2%)	119 (5.9%)	233 (14.2%)	184 (9.1%)
Device surgery-related	4 (0.2%)	9 (0.4%)	8 (0.4%)	10 (0.5%)	14 (0.8%)	20 (1.0%)
Heart failure	24 (1.5%)	55 (2.7%)	61 (3.7%)	127 (6.3%)	121 (7.4%)	271 (13.4%)
Cardiac arrhythmias[§]	45 (2.8%)	63 (3.1%)	86 (5.3%)	117 (5.8%)	187 (11.4%)	232 (11.5%)
Cardiac arrest	1 (0.1%)	0	1 (0.1%)	0	3 (0.2%)	3 (0.2%)
Ventricular fibrillation	4 (0.2%)	3 (0.2%)	7 (0.4%)	3 (0.2%)	18 (1.1%)	6 (0.3%)
Ventricular tachycardia	14 (0.9%)	15 (0.7%)	22 (1.4%)	25 (1.2%)	51 (3.1%)	46 (2.3%)
Atrial fibrillation	9 (0.6%)	30 (1.6%)	21 (1.3%)	59 (2.9%)	52 (3.1%)	111 (5.5%)
Supraventricular tachycardia	1 (0.1%)	1 (0.1%)	5 (0.3%)	1 (0.1%)	15 (0.9%)	3 (0.2%)
Not specified	17 (1.0%)	14 (0.8%)	30 (1.8%)	29 (1.4%)	48 (2.9%)	63 (3.1%)
Ischaemic heart disease	9 (0.6%)	14 (0.7%)	15 (0.9%)	32 (1.6%)	43 (2.6%)	78 (3.9%)
Chest pain	27 (1.7%)	20 (1.0%)	51 (3.1%)	33 (1.6%)	103 (6.3%)	84 (4.2%)
Cardiomyopathy	4 (0.2%)	11 (0.5%)	20 (1.2%)	25 (1.2%)	57 (3.5%)	48 (2.4%)
Septicaemia	6 (0.4%)	7 (0.3%)	13 (0.8%)	13 (0.6%)	24 (1.5%)	37 (1.8%)
Cerebrovascular diseases	2 (0.1%)	4 (0.2%)	3 (0.2%)	8 (0.4%)	10 (0.6%)	27 (1.3%)
Other cardiovascular disease	1 (0.1%)	0	2 (0.1%)	3 (0.1%)	4 (0.2%)	7 (0.3%)

* Denominators: People in age group discharged from hospital alive after first insertion of implantable cardioverter-defibrillator.

† Multiple diagnoses possible, but each specific diagnosis counted only once per person.

‡ We used a hierarchical approach to counting device-related re-admissions such that only one was counted per person: device-related complication/disorder, device surgery-related.

§ We used a hierarchical approach to counting specific types of cardiac arrhythmia such that only one was counted per person: cardiac arrest, ventricular fibrillation, ventricular tachycardia, atrial fibrillation, supraventricular tachycardia, not specified.

Table 7. Deaths of people who received first implantable cardioverter–defibrillators in New South Wales during 2005–2020, by sex*

Cause of death	Women	Men	Total
Denominator	3653	13,214	16,867
All causes	1039 (28.4%)	4585 (34.7%)	5624 (33.3%)
Cardiovascular disease	478 (13.1%)	2143 (16.2%)	2621 (15.5%)
Ischaemic heart disease	248 (6.8%)	1257 (9.5%)	1505 (8.9%)
Cardiomyopathy	99 (2.7%)	337 (2.6%)	436 (2.6%)
Heart failure	64 (1.8%)	292 (2.2%)	356 (2.1%)
Cerebrovascular diseases	36 (1.0%)	156 (1.2%)	192 (1.1%)
Cardiac arrhythmias	22 (0.6%)	75 (0.6%)	97 (0.6%)
Other cardiovascular disease	9 (0.2%)	26 (0.2%)	35 (0.2%)
Cancer	94 (2.6%)	492 (3.7%)	586 (3.5%)
Diabetes	40 (1.1%)	184 (1.4%)	224 (1.3%)
Kidney disease	26 (0.7%)	149 (1.1%)	175 (1.0%)
Chronic lower respiratory disease	34 (0.9%)	135 (1.0%)	169 (1.0%)
Dementia, including Alzheimer disease	24 (0.7%)	78 (0.6%)	102 (0.6%)
Septicaemia	24 (0.7%)	73 (0.6%)	97 (0.6%)
Influenza/pneumonia	16 (0.4%)	53 (0.4%)	69 (0.4%)
Accidental falls	6 (0.2%)	44 (0.3%)	50 (0.3%)
Cirrhosis and other diseases of liver	12 (0.3%)	36 (0.3%)	48 (0.3%)
Other	163 (4.5%)	734 (5.5%)	897 (5.32%)
Unknown	122 (3.3%)	464 (3.5%)	586 (3.5%)

* Denominator: 16,867 people who received first implantable cardioverter–defibrillators in New South Wales during 2005–2020.

References

- (1) National Clinical Terminology Service. Access SNOMED CT-AU. <https://www.healthterminologies.gov.au/access-clinical-terminology/access-snomed-ct-au> (viewed Jan 2024).
- (2) Australian Bureau of Statistics. National, state and territory population. Reference period March 2023. 14 Sept 2023. <https://www.abs.gov.au/statistics/people/population/national-state-and-territory-population/latest-release> (viewed Oct 2023).
- (3) Australian Bureau of Statistics. Which population to use for age standardisation? In: Australian demographic statistics, Mar 2013 (3101.0). 26 Sept 2013. <https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/3101.0Feature+Article1Mar%202013> (viewed Jan 2024).